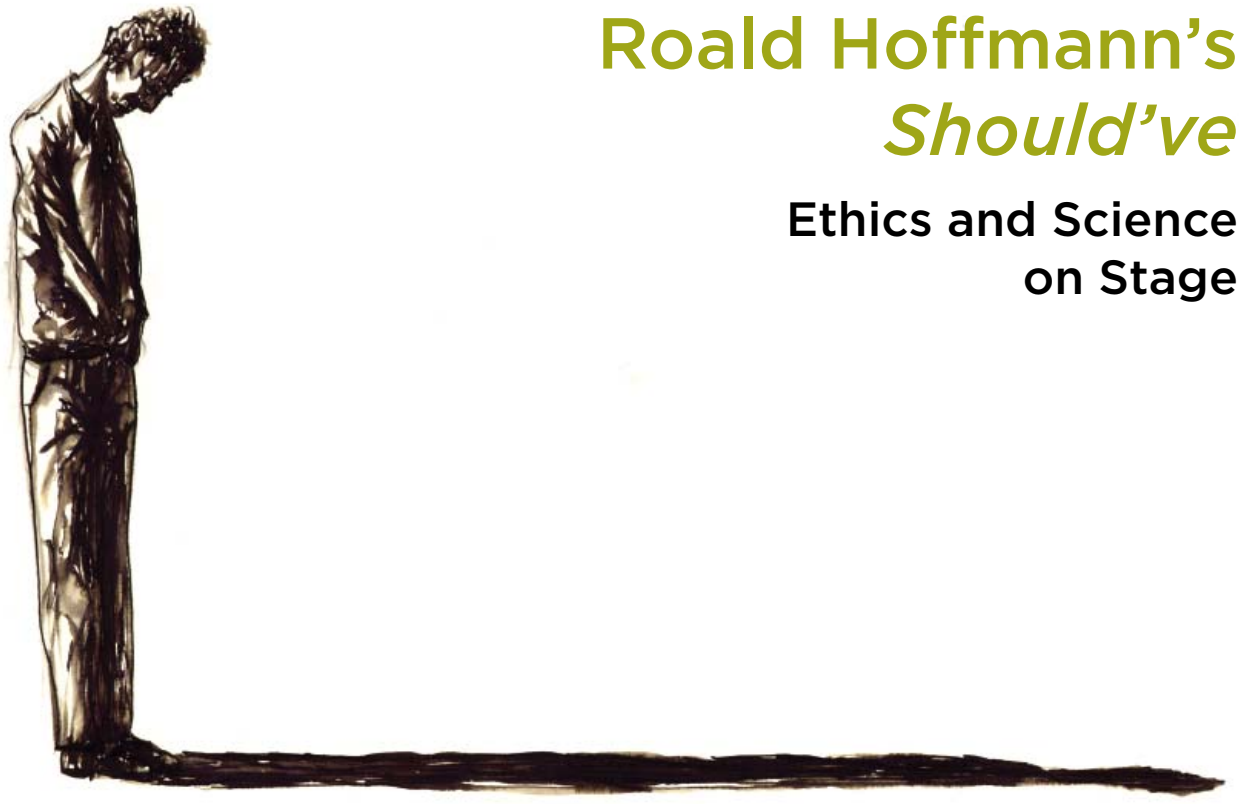
The News Magazine of the
International Union of Pure and
Applied Chemistry (IUPAC)

CHEMISTRY International

May-June 2007
Volume 29 No. 3



Roald Hoffmann's *Should've*

Ethics and Science on Stage

The Chemical Industry and Sustainable Development

Assuring Quality of Analytical Measurement Results: The IUPAC Role

CHEMISTRY International

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

www.iupac.org/publications/ci

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Printed by:
Cadmus Professional Communications,
Easton, MD, USA

Subscriptions
Six issues of *Chemistry International* (ISSN 0193-6484) will be published bimonthly in 2007 (one volume per annum) in January, March, May, July, September, and November. The 2007 subscription rate is USD 99.00 for organizations and USD 45.00 for individuals. Subscription orders may be placed directly with the IUPAC Secretariat. Affiliate Members receive *CI* as part of their Membership subscription, and Members of IUPAC bodies receive *CI* free of charge.

Periodicals postage paid at Durham, NC 27709-9990 and additional mailing offices. POSTMASTER: Send address changes to *Chemistry International*, IUPAC Secretariat, PO Box 13757, Research Triangle Park, NC 27709-3757, USA.

ISSN 0193-6484

From the Editor

On the back cover of most issues of *CI* you will find the Mission Statement of IUPAC. In less than 100 words, this statement provides a clear reminder to all members and volunteers involved with the organization of what we shall busy ourselves with: "IUPAC provides leadership, facilitation, and encouragement of chemistry and promotes the norms, values, standards, and ethics of science and the free exchange of scientific information." This may seem like quite a challenge, but everyone can find a niche in which he or she can contribute in some way toward achieving this objective.

IUPAC is also guided by six long-range goals (online at <www.iupac.org/news/archives/2002/strategic-plan.html>) that complement its mission. These goals include providing leadership, facilitating the advancement of research, assisting chemistry-related industry, fostering communication, contributing to the enhancement of chemistry education, and broadening the IUPAC national membership base.

Interestingly, lately I have observed more discussions among IUPAC members about these topics. The purpose of these conversations is not to question the Union's mission itself, but really to review how IUPAC can improve how it approaches some of these goals, and how its entire constituency can be best involved in accomplishing the mission. A new initiative—a series of round table discussions—will allow Council delegates at the General Assembly in Torino to debate and discuss some of the leading issues concerning IUPAC goals. Four round tables will be organized for no more than 40 participants for each topic, a format conducive to the easy exchanges of ideas.

Even if you are not a Council delegate, you might be interested in reviewing the proposed discussion topics. For this reason, the officers and Bureau members assigned to chair and moderate the discussions have outlined in detail some questions in advance of the event (see page 16). If you would like to comment, please do so by contacting your NAO (see list on the back cover or <www.iupac.org/organ/nao.html>) or by writing to the IUPAC officers directly. The more input, the more valuable the debates will be. As the officers concluded, "It is a relatively easy task to outline the questions, but much more difficult to provide practical answers. It is hoped that the round table discussions will lead to some really good suggestions and plans for future IUPAC activity."

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Cover: **Guilt** *by Martin Bolchover. Bolchover is a professional artist and illustrator who works in a wide range of styles, from traditional to digital media. His work has appeared in books, advertising, and exhibitions. For more see www.martinbolchover.com. See feature on page 4.*

Contents

CHEMISTRY International May-June 2007 Volume 29 No. 3

FOR WOMEN IN SCIENCE
L'ORÉAL

Stamps International, page 7

IUPAC Web Developments

by David StC. Black

For some years there has been a desire on the part of various groups of IUPAC members to improve the functionalities provided by the IUPAC website. Some groups felt that the IUPAC server was not able to act as a host for their specific applications because there was insufficient support. In particular, some division presidents and standing committee chairs have commented that IUPAC needs a website that is user friendly to all chemists and not just IUPAC-familiar people. There was also interest in having a web discussion board function, so that IUPAC members could access and review documents, and carry out online discussions. Certain other groups were concerned with major databases, which could not readily be handled by the existing site without some improvements. Such databases are central to IUPAC work, and it is vital that such carefully accumulated technical information is stored reliably, is readily accessible, and that new data can be easily entered.

In May 2006, after wide-ranging discussions, President Bryan Henry asked me to convene an ad hoc committee that would review the need for change, and make specific recommendations. Around this time, the host for the IUPAC website was moved from ibiblio in North Carolina to a dedicated IUPAC server located at the Fachinformationszentrum Chemie GmbH in Berlin (FIZ Chemie Berlin), following an offer by the manager, professor Dr. René Deplanque, who is a member of the Committee on Printed and Electronic Publications (CPEP). FIZ Chemie Berlin is Germany's Chemistry Information Centre, which provides information services related to the chemical sciences and chemical engineering to scientists in industry, academia, and government. It is funded by the German federal and state governments as a nonprofit information agency. Relocation of the IUPAC server to FIZ Chemie Berlin was achieved on 26 June 2006, and the support provided there now enables the modernization of the technology underpinning the website from HTML to XML.

The Ad Hoc Committee, established in August 2006, brought together a group with knowledge of, and interests in, the various aspects of website and database requirements. It included some members of CPEP. The terms of reference were "to recommend requirements to achieve a modernized interactive IUPAC website and an ability for IUPAC to provide large databases of value to chemists."

In considering what to do, the committee was asked to define and prioritize one or more options. An important issue in making decisions in this area is that the overall IUPAC budget is relatively fixed. However, the budget issue was something that could only be dealt with after a decision was made on what direction to take. So, the committee was asked to bear in mind only general financial constraints, but not to worry about the details. The committee's report would go to the Executive Director, who is in the best position to assess the financial and human resource implications.

The committee was not only given access to available comments on the website, but also given a detailed business plan for the future management of the Stability Constants Database, which is IUPAC's largest database, developed over some years by the Analytical Chemistry Division. This has been managed until now by Academic Software, but because of impending retirements, they wish to be relieved of that in the future. Thus, this was a good example for the committee to consider in detail, but it is not the only important IUPAC database to take into account. Division I also has an active involvement in other databases.

In dealing with databases, there are essentially two strategies. One is for IUPAC to establish in the Secretariat the expertise to do the complete management and delivery of databases. This would require significant costs, either for additional staff or contracts, and would necessitate diversion of funds from other areas. The alternative strategy is to form an alliance with an organization that already has all the expertise and capacity, and it was always obvious that FIZ Chemie Berlin might be such an organization. In my view, the second strategy was always going to be preferable. It indeed transpired that the main outcome of the committee's work was an extremely generous offer of further support from FIZ Chemie Berlin. After they did a careful analysis of the requirements, they gained approval from their board to cooperate with IUPAC in a strategic alliance that was seen

as being mutually beneficial. On 1 March 2007, René Deplanque and Bryan Henry signed a Memorandum of Understanding, which reads as follows:

"This Memorandum of Understanding between the International Union of Pure and Applied Chemistry and the Fachinformationszentrum für die Chemie Berlin covers cooperation to provide web-based services to IUPAC bodies and the worldwide chemistry community through the IUPAC website. The specific services currently contemplated are the following:

a. implementation of a content management system, which will enable the direct control of the content and the editing of the content by IUPAC
b. implementation of the TRAC systems for project control and guidance
c. a secure site and a billing system for the "stability constant database" and further IUPAC data collections, for example, "evaluated kinetic data" and "organic nomenclature"
d. the implementation of WIKIs as a web discussion board

Additional services will be part of this memorandum as agreed in writing by the parties.

FIZ Chemie Berlin will implement these services on the IUPAC website using its staff and at its own cost. Information necessary for the operation and maintenance of these services will be provided to IUPAC, which will be responsible for content generation, operation, and user service."

Collaboration has already begun, particularly in relation to the work being done in Prague by the group coordinated by Bohumir Valter, which includes Miloslav Nic and Bedrich Kosata. This group has provided very valuable and long-standing expertise and effort to transfer the Gold Book and *Pure and Applied Chemistry* to the web. There have also been on-going discussions about the Stability Constant Database.

The important thing is that a start has been made, and the collaborative process will be stepwise. We have by no means solved all the problems, and given the nature of web development, we shall never be able to do that. But we have entered into an exciting phase of development where IUPAC can confidently move forward, hand in hand with an expert organization, which is able to provide the best possible assistance and advice.

In once again expressing IUPAC's appreciation to FIZ Chemie Berlin, let us not forget the foresight of CPEP Chairman Leslie Glasser, in bringing René Deplanque into the IUPAC fold via CPEP.

IUPAC Secretary General David StC. Black <d.black@unsw.edu.au> has been involved in IUPAC since 1994 as a committee member of the Division of Organic and Biomolecular Chemistry, and served as Division vice president during 2002–2003. He has served as secretary general since 2004.

Roald Hoffmann's *Should've*

Ethics and Science on Stage

Ethics and social responsibility are not easy topics to address. However, the more the scientific community learns about nature and the world, the more these issues will take center stage. In fact, the stage is what Roald Hoffmann uses to explore the ethical dimensions of science in his latest play *Should've*. The play is a mystery, a savant mélange (what else would you expect from a chemist?) of people from different generations and backgrounds, who have to deal with issues of the past and the present, in science, art, and life. The performance begins with a suicide offstage, which stirs up the lives of everyone involved and leaves numerous unanswered questions. Throughout the story, various aspects of social responsibility are addressed, shedding light on conflicts and dilemma.

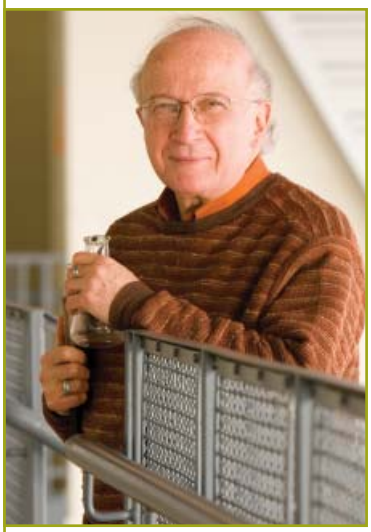


Photo credit: Creative Eye-mages Photography.

Roald Hoffmann

The chemistry of Hoffman's production is certain to catalyze discussion among those in attendance. A synopsis and full text of the drama are available on Hoffmann's website.*

CI invited **Liberato Cardellini** to interview **Roald Hoffmann** on the topic of scientific social responsibility. Cardellini, a member of the IUPAC Committee on Chemistry Education (CCE), conducted an earlier interview with Hoffmann titled "Looking for Connections."

The play will be staged in Torino on the opening night of the next IUPAC Congress on Sunday 5 August 2007 at 17:00. Following the initiative of CCE Chair Peter Mahaffy, a symposium titled "Beyond *Should've*: Ethical Issues in Science & Education" will take place during the Congress program as part of Session 10 (Advances in Chemical Education).

As a prelude to viewing the play, we recommend taking a short journey in "Hoffmann's Land between Chemistry, Poetry, and Philosophy."*

*www.roaldhoffmann.com

Liberato Cardellini (LC): Friedrich Wertheim, a chemist and the inventor of the saxotonin synthesis, killed himself. Are we responsible for the misuse of the molecules we make?

Roald Hoffmann (RH): Before I answer, let me make an obvious comment: A play with all characters reflecting the author's opinion is a worthless play. Or to put it another way: In Pirandello's *Six Characters in Search of an Author*,[1] which of the six characters reflects the way the playwright feels? So, the characters in the play differ in their response to your question.

But you are asking me for my personal opinion about the social responsibility of scientists. Here's what I think (from *The Same and Not the Same*[2]): There are no bad molecules, only evil human beings. Thalidomide seems as harmful as they come, in the first trimester of pregnancy. But it is useful in treating inflammation associated with leprosy. And there are recent studies claiming that thalidomide can inhibit the replication of HIV-1 (the virus that causes AIDS). Nitric oxide, NO, is an air pollutant but also an absolutely natural neurotransmitter. Ozone serves an essential (to us) function in the stratosphere, a thin layer of it absorbing much of the harmful ultraviolet radiation. At sea level the very same molecule is a bad actor in photochemical smog, the atmospheric pollution caused mainly by automotive exhausts. Ozone destroys automobile tires (weak vengeance), plant life, and our tissues.

Molecules are molecules. Chemists and engineers make new ones, transform old ones. Still others in the economic chain sell them, and we all want them and use them. Each of us has a role in the use and misuse of chemicals. Here is what I see as scientists' social responsibility to their fellow human beings. I see scientists as actors in a classical tragedy. They are sentenced by their nature to create. There is no way to avoid investigation of what is in or around us. There is no way to close one's eyes to creation or discovery. If you don't find that molecule, someone else will. At the same time I believe that scientists have absolute responsibility for thinking about the uses of their creation, even the abuses by others. And they must do everything possible to bring those dangers and abuses before the public. If not I, then who? At the risk of losing their livelihood, at the risk of humiliation, they must live with the consequences of their actions. It is this which makes them actors in a tragedy and not

comic heroes on a pedestal. It is this responsibility to humanity that makes them human.

LC: In one way or another, all the characters in your play *Should've* are guilty. If we judge the persecutor and the victim both to be guilty, are not we doing an injustice to the latter?

RH: I agree that it is fallacious to judge the perpetrator and the victim as both guilty. And that, incidentally, is the moral failing of Michael Frayn's *Copenhagen*, to build a case that [Niels] Bohr was as guilty, if not more so, than [Werner] Heisenberg. Guilty may not be the right word for the characters in my play. I think they all have failings that are revealed as the play unfolds. That's the way human beings are.

LC: More than Stefan (see box About the Play), Julia reflects your view. How much do you two have in common?

RH: There are differences, of course, of gender and profession. But Julia and I have in common that we look for and value the middle. (see **"This I Believe"** box, page 6). We tend to avoid struggles, she and I, but when we are pushed we will act.

LC: In the play you raise the question of the freedom of research. Is a code of conduct necessary here? Without ethical restraint, cannot the experiments performed on Block 41 in Birkenau and Block 10 in Auschwitz be repeated?

RH: Yes, I believe that an ethical code of research is necessary, for all scientists (and the play makes the point that artists too are prone to the romantic fallacy that all they do is good). Scientists are not born with ethics, nor is science ethically neutral. I think courses in ethics, or better still discussion groups, based on case studies, should be a part of the education of all scientists, and also that discussion should be continued throughout life, even for experienced scientists. I actually would argue a stronger case, one with which many of my colleagues would not agree, that there is some research that should not be performed.

Scientists are not born with ethics, nor is science ethically neutral.

LC: Your play concerns ethics and moral behavior, which calls for judgments to be made. How do you judge the behavior of the famous German Jewish chemist Fritz Haber, who is responsible for the development of chemical warfare agents? And, how, may I ask, does this judgment differ from that of the famous German Jewish physicist Albert Einstein who called for the development of the atom bomb?

RH: I think Haber was naïve, thinking that chemical weapons would be a catalyst for change, and his naïveté and arrogance led him—in this part of his life—to a terribly wrong decision. I believe in an ethics that comes out of dialogue between human beings, not prescriptive rules. So I think that Einstein's advocacy of atomic weapons, in his letter to Roosevelt, was justifiable as self-defense in the face of Nazi German aggression and immorality.

LC: Robert Oppenheimer said after the making of the atom bomb: "The physicists have known sin."[3] Have the chemists also known sin? Is your play a way of seeking atonement for the sins attributed to chemists?

About the Play

As *Should've* opens, Friedrich Wertheim, a German-born chemist, has taken his own life, blaming himself for putting an easy way to make a neurotoxin into the hands of terrorists. The circumstances and reasons for his death disturb profoundly the lives of three people—his daughter Katie (a scientist herself, a molecular biologist, but with very different ideas about the social responsibility of scientists), Katie's lover Stefan (a conceptual artist), and Wertheim's estranged second wife, Julia.

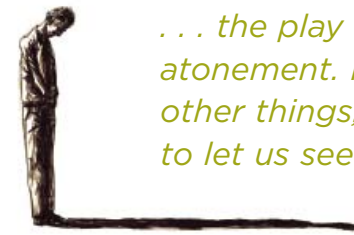
In 26 fast-moving scenes, these people's lives are fractured by the suicide. The motive for Wertheim's action isn't as simple as it seems; a story about his parents' survival in Nazi Germany emerges.

A play about the social responsibility of scientists and artists, *Should've* is also about three people trying to resist the transforming power of death. They are unable to do so, sundered as they are by the memories and a past that emerges from that death. And, eventually, the consequences shape a different bond among the three.

Produced by The King's University College, *Should've* is directed by Stephen Heatley of the University of British Columbia and designed by Daniel vanHeyst of The King's University College. Professional actors Robert Clinton, Maralyn Ryan, and Michele Brown are based in Edmonton. The performance will be performed on Sunday 5 August 2007 at 17:00 as part of the opening ceremony of the IUPAC Congress in Torino, Italy.

Roald Hoffman's *Should've*

RH: Chemists and physicists put tools of great good, and of potential destruction, into the hands of human beings. Who may abuse them, or, as in the case of the atom bomb, build it for good reason, and still become actors in a Greek tragedy. There are moments where this become clear; Oppenheimer saw such a moment. I think in chemistry we saw sin when Fritz Haber's soldiers opened up a chlorine tank on the western front. No, the play is not an atonement. It is, among other things, an attempt to let us see extremes (of Katie's view, of her father's), to see the good reasoning and perhaps the potential tragedy behind them. As I say it, I don't think that I succeed yet in showing that in



. . . the play is not an atonement. It is, among other things, an attempt to let us see extremes . . .

Katie's path; I have to work more at it. I would like people to come from the play with no answer as to what to do, but with the feeling that this—the social responsibility of scientists—is worth agonizing about.

This I Believe

by Roald Hoffmann

I believe the middle is tense, the middle is interesting. It may not be what the world wants, least of all what journalists (and that includes NPR journalists) want. "Is that hurricane the worst you've experienced?" Strong opinions, extremes make a good story. And... for the teller, the extreme is a haven. Where the water is calm, where your back is secure against a wall.

Why do I then like the nervous middle? Because I am the way I am, also perhaps because I'm a chemist.

The way I am: I was born in 1937 in southeast Poland, now in Ukraine. Our happy Jewish family was trapped in the destructive machinery of Nazi anti-Semitism. Most of us perished. In my case my father, three of four grandparents, and so on. My mother and I survived, hidden out the last 15 months of the war by a friendly Ukrainian schoolteacher, Mikola Dyuk. I just learned that the foreign minister of Poland, Adam Daniel Rotfeld, living under an assumed identity in the Greek Catholic monastery in that tiny village, went to school in exactly the house where I was hidden. I probably saw him playing outside.

Sad to say, most of the Ukrainian population in the region behaved badly in those terrible times. They helped the Nazis kill us. And yet, and yet, some saved us, at great risk to their lives.

I couldn't formulate it then, but I knew it, just knew it, from our experience—that people were not simply good or evil. The potential was there for both.

In time we came to America. I became a chemist. Chemistry is substances and their transformations, a science in the middle in many ways. Not quarks, not galaxies, molecules are intermediate. And poised along several polarities. One is of their harm and benefit, another is of being pure/impure, natural/unnatural, of being classical or quantum objects, capable of being taken apart, or put together.

Take morphine. Anyone who has had an operation knows what morphine is good for. And it is a deadly, addictive drug. Take ozone—up in the atmosphere, a layer of it protects us from harmful ultraviolet radiation (of our life-giving sun). At sea level, ozone is produced in photochemical smog, chews up tires and lungs. Not any other molecule, one and the same molecule.

A fundamental idea in chemistry is equilibrium, which doesn't mean lying there, quietly. Chemistry is about change, it's about A + B going to C + D. And going back. At equilibrium there's some A and B, some C and D. It just looks placid, that middle. But it's a dynamic middle, ripe with potential for change. Do you want to have the reaction go one way, or the other? We can perturb that equilibrium.

The middle is not static—my psychological middle, the chemical equilibrium. The middle has the potential, I have the potential, you have the chance of going one way or another.

I like that. Yes, I also want stability. But I believe that extreme positions—all reactants, all products, all people A bad, all people B good, no taxes at all, taxed to death—are impractical, unnatural, boring, the refuge of people who never want to change. The world is not simple, though God knows political ads (on every side) want to make it so. I like the tense middle, and am grateful for a world that offers me the potential for change.

www.roaldhoffmann.com

LC: "I'm nothing without my science," Katie says. Are scientists different from doctors or automobile mechanics? Why is it easy for us to believe (or to cherish false hopes) that science will give us immortality?

RH: Interesting question . . . When she said it, it was almost a statement of desperation; she (like many other addicts to science) defined herself and her worth as a human being in terms of her profession. But so many things make us up—our parents, our children, our friends, the good we have done (and the bad). The interesting thing is whether an unconscious desire to conquer immortality is the driving force to make great art or science, to leave something lasting behind . . .

Acknowledgments

Liberato Cardellini would like to thank Richard N. Zare of Stanford University for the advice and suggestions he gave for improving the questions for this interview and for assistance during the interview.

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1. L. Pirandello, *Six Characters in Search of an Author*. Translated by Stephen Mulrine, Nick Hern Books: London, 2003.
2. R. Hoffmann, *The Same and Not the Same*. Columbia University Press: New York, 1995.
3. P. Goodchild, *J. Robert Oppenheimer, Shatterer of Worlds*. Fromm International Publishing Corporation: New York, 1985, p. 174.

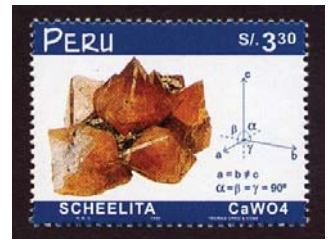
Liberato Cardellini <libero@univpm.it> is a professor in the Dipartimento di Scienze e Tecnologie Chimiche, in Ancona, Italy, and a member of the IUPAC Committee on Chemistry and Education.
Roald Hoffmann <rh34@cornell.edu> is the Frank H.T. Rhodes Professor of Humane Letters at Cornell University, and recipient of the 1981 Nobel Prize in Chemistry (shared with Kenichi Fukui).
***Guilt*, the artwork on the cover of this issue, is by Martin Bolchover.**

Stamps International

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

A Stamp Your Crystallographer Would Like

Minerals and gems are depicted on a relatively large number of stamps due to their inherent beauty, natural abundance, or commercial value. There are at least a dozen different stamps showing attractive samples of pyrite, quartz, or malachite, and many more illustrating diamonds or gold. However, particularly appealing to me are those stamps that portray less conspicuous elements or minerals, especially when pertinent information like the corresponding name or chemical formula is indicated too. A beautiful example can be seen on the stamp that accompanies this note and features a specimen of scheelite, one of the common mineral ores of tungsten.



First identified in 1821, scheelite is a calcium tungstate ($CaWO_4$) and is often found as relatively large golden yellow or orange crystals. Notable sources of this mineral are located in Australia, Austria, Bolivia, Brazil, the Sichuan province in China, England, Finland, France, Italy, Japan, the Tong Wha mine in South Korea, Myanmar, Sri Lanka, Sweden, Switzerland, and the United States. It was named after the famous Swedish chemist Carl Wilhelm Scheele (1742–1786), who discovered tungsten independently from the d'Elhuyar brothers in Spain among many other accomplishments. For example, Scheele is partially credited with the discovery of oxygen and chlorine, which he actually achieved before—but unfortunately published after—the isolation of these elemental gases was reported by Joseph Priestley and Humphry Davy, respectively.

Remarkably, the Peruvian stamp pictured herein not only includes the name and chemical formula of the mineral but accurately shows that it crystallizes in the tetragonal system, which can be regarded as an elongated cube (i.e., a rectangular prism with a square base [thus, $a = b \neq c$] and right angles between the three crystallographic axes [$a = b = g = 90°$])!

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

The Chemical Industry and Sustainable Development

The Role of ICCA and SAICM

by Irina Dumitrescu

The Strategic Approach to International Chemicals Management[1] (SAICM)—a policy framework for international action on chemical risks—is well on track one year after the "Dubai Declaration." Mandated by the United Nations Environment Programme (UNEP) and endorsed by the Johannesburg World Summit on Sustainable Development in 2002,[2] this approach is aimed at ensuring that—by 2020—chemicals are produced and used in ways that minimize significant adverse impacts on the environment and human health.

Adopted by the International Conference on Chemicals Management on 6 February 2006 in Dubai, SAICM affords plenty of opportunities. These range from rational, science and risk-based regulatory policies and programs to greater consistency in national regulatory requirements worldwide to cooperative partnerships between the public and private sectors to improvements in chemical-handling capabilities worldwide. SAICM comprises three core texts:

- a High Level Declaration, known as the "Dubai Declaration," embodying the political commitment of governments and stakeholders, including the private sector
- an Overarching Policy Strategy comprising key long-term strategic elements and principles to achieve the Johannesburg goal 2020
- a Global Plan of Action developed as a working tool and guidance document for national governments to set priorities in chemicals management

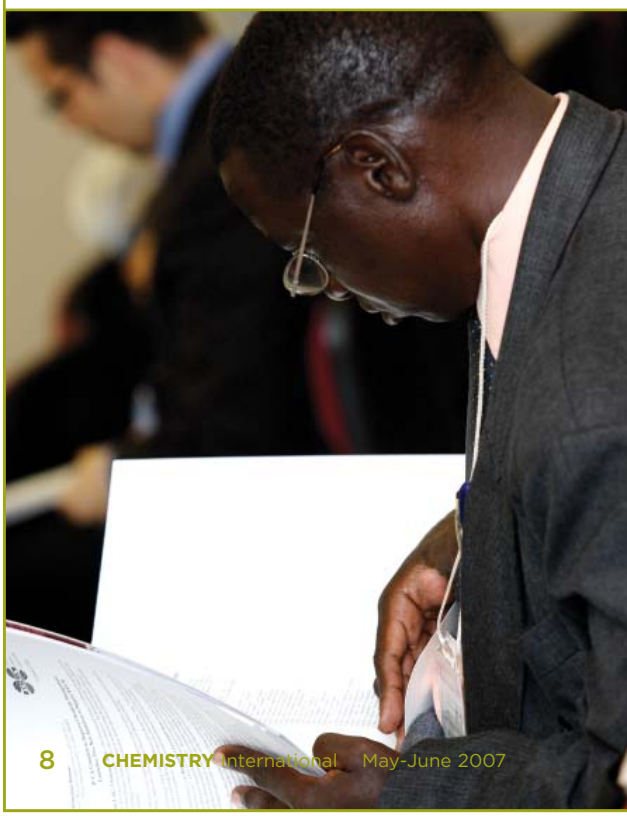
ICCA, the International Council of Chemical Associations,[3] is the recognized voice of the global chemical industry. It is a trusted leader in international advocacy and a leader of world-class performance initiatives. The purpose of the ICCA is to exchange views and coordinate actions among its members and to help present the industry's case to international organizations such as the World Trade Organization, International Maritime Organization, United Nations Environment Programme, Organisation for Economic Co-operation and Development, Commission on Sustainable Development, and the International Organisation for Standardisation.

ICCA is concerned with policy issues of international significance to the chemical industry. These include health, safety, the environment, the safety of international transport, intellectual property, and trade policy.

ICCA's Contributions to SAICM Implementation

The global chemical industry makes a significant contribution to many UN chemicals-related activities. It has launched a number of voluntary actions to help achieve the World Summit on Sustainable Development's goal of safe global management of chemicals.

Two major chemical industry initiatives—the **Responsible Care Global Charter** and the **Global Product Strategy**—were launched at a side event in Dubai,[4] and have become important contributions to SAICM implementation. The Global Product Strategy and Responsible Care are consistent with SAICM and are built upon the chemical industry's long-standing record of improving product stewardship.



A delegate checking ICCA guidelines at the February 2006 meeting in Dubai.

Another example, which was presented as an ICCA initiative, is the **Long-range Research Initiative.** This initiative commits the industry to improving chemical safety throughout the supply chain and to learning from scientific progress as well as from public perception to update its knowledge and adapt its practices. The industry also committed to improving public access to chemical information to build confidence in chemicals and chemistry, building on the **High Production Volume Chemicals Initiative**.

A Global Commitment

The **Responsible Care Global Charter**—a commitment to improve environmental, health, and safety performance—is to be signed by chief executive officers of chemical companies that are members of industry associations. The charter extends and builds upon the original elements of Responsible Care[5] and focuses on new and important challenges facing the chemical industry and society, including sustainable development, effective management of chemicals along the value chain, greater industry transparency, and greater global harmonization and consistency among the national Responsible Care programs. The charter further expands the global chemical industry's implementation of the environmental principles of the United Nations Global Compact.[6]

Improving Product Stewardship

The **Global Product Strategy** is designed to improve the product stewardship performance of global industries by recommending measures to be taken by ICCA and its members along the chemicals value chain, while allowing for considerable flexibility in recognition of the different cultural and national regulatory arrangements. It recommends a broad range of actions, including voluntary industry actions, cooperative efforts with industry groups and companies that are customers and suppliers to the chemical industry, a potential role for partnerships with international organizations and other stakeholders, and a common global position on principles of regulation for the sound management of chemicals.

These two complementary initiatives—Responsible Care Global Charter and Global Product Strategy—can

Data Gathering and Risk Characterization

The ICCA member federations and their companies made additional commitments in conjunction with the **Global Product Strategy**:

- Under the US-Expanded High Production Value program, which is supposed to run until 2010, companies will develop hazard data and minimal exposure data for all chemicals with a 2002 production volume of >1 000 000 lbs.
- Under the Japanese Challenge Program, which is set up as a partnership between industry and government, companies will provide hazard data and available exposure information on high production value chemicals that is not being provided by other international/regional programs.
- Guidelines for prioritization of chemicals in commerce and for risk characterization are under development and will be shared with the OECD.

A panel discussion at the International Conference on Chemicals Management in Dubai in February 2006. Panelists (L to R) are Larry Washington, corporate vice president of Sustainability, Environment, Health, and Safety at Dow Chemical; Guilherme Duque Estrada de Moraes, director general of the Brazilian association Abiquim; Masami Tanaka, vice chairman and director general, Japan Chemical Industry Association; Udo Oels, a member of the Board of Management, Bayer AG; Peter Elverding, DSM Board chairman, and ICCA chairman; Kiyo Akasaka, deputy secretary general of OECD; Alain Perroy, director general, Cefic, and ICCA secretary; Nance Dicciani, chief executive officer of Honeywell Specialty Materials, and member of the ACC Board of Directors; and Pieter Cox, chairman of Sasol.

make a substantial contribution to the SAICM implementation in terms of risk reduction, knowledge/information, and capacity building/technical cooperation.

Replacing Misinformation with Scientific Data

The chemical industry's contribution is by no means confined to these two initiatives. An equally significant voluntary initiative relates to research. The **Long-range Research Initiative** has become one of the industry's signature programs, a long-term voluntary effort to improve the scientific basis for understanding the impacts of chemicals on public health and the environment.

The ultimate goals of the Long-range Research Initiative are to fill the knowledge gap that is distorting public debate; replace misinformation with scientific data; increase the knowledge of the potential impacts that chemicals may have on the health of human and wildlife populations and the environment, especially sensitive sub-populations; replace decisions based on hazard alone with decisions based on risk; address issues such as bio-monitoring, methodologies, and endocrine disruption; and develop alternatives to animal testing and persistent bioaccumulative toxic substances.

Engaging in "Peer Review"

Another major program of the chemical industry is the **High Production Volume Chemicals Initiative**. Launched through the ICCA in 1998 in cooperation with Organisation for Economic Co-operation and Development (OECD), this global program builds on early cooperative work of chemical companies with the OECD Chemicals Programme. Under the program, co-producers of chemicals work together to share health, environmental and safety data, assess chemicals, and engage in a "peer review" of their assessments with government experts of OECD member countries and nongovernmental organizations.

At the end of November 2006, the number of ICCA substances accepted by OECD was 465. It is expected that by April 2007 this will be close to 600. With the European Union's new chemicals legislation, called REACH (Registration, Evaluation and Authorisation of CHemicals), set to enter into force in June 2007, there was some concern that data collection standards under REACH would exclude data collected under the High Production Value program. However, it now seems likely that the data collected within the program will be recognized under REACH.

ICCA's Cooperation with Intergovernmental Organizations

ICCA has worked closely with UNEP, UNITAR, the OECD, and other international organizations and nongovernmental organizations in the past, particularly in developing SAICM and its own new initiatives. The global chemical industry is now further developing its cooperation to ensure that the implementation of its Global Product Strategy contributes effectively to SAICM implementation and the global improvement of chemical safety. In this respect the main focus for ICCA is capacity building.

ICCA has nominated a SAICM Focal Point as contact with UNEP Chemicals. ICCA is a member of the Executive Board of the UNEP Quick Start Programme on capacity building. The ICCA capacity building Task Force is currently developing project proposals for further cooperation with UNEP.

ICCA is continuing its High Production Volume Chemicals Initiative with the OECD Existing Chemicals Program. Just after Dubai, the OECD 22nd Substance Information Data Set Initial Assessment Meeting was a success, bringing the number of finalized substances to 414. ICCA member federations are providing financial support to ensure continuation with the OECD New Chemicals Programme and in kind support for further development of the Global Data Portal.

Is the Industry's Contribution Recognized by Governments around the World?

At the UN World Summit on Sustainable Development in 2002, Responsible Care received the World Summit Business Award, given by the International Chamber of Commerce and UNEP. In the run-up to the International Conference on Chemicals Management, organized by UNEP in Dubai from 4–6 February 2006, ICCA President Peter Elverding and ICCA Council Secretary Alain Perroy received a personal letter from United Nations Secretary General Kofi Annan, warmly congratulating them on the launch of the Responsible Care Global Charter and the Global Product Strategy. Both of these initiatives were unveiled at the conference. In his letter, Kofi Annan stated how impressed he was with the two initiatives, expressing the hope that the chemical industry would be successful in attracting interest in both projects. These he described as "inspiring models of voluntary self-regulation for other industries to consider following."

In Dubai, there was clear recognition of the added value of Responsible Care and the Global Product Strategy by UNEP's Executive Director Klaus Töpfer.

The Role of ICCA and SAICM

A number of agreements exist with regulatory agencies in Canada, UK, USA, and some emergent countries. In the USA, for example, the American Chemistry Council has an agreement with the Environmental Protection Agency (EPA) to help Responsible Care members qualify more easily for membership in EPA's Performance Track Program. This can reduce the number of environmental inspections for companies that participate because Responsible Care companies are used to thinking in terms of systems, measurement, and performance improvement.

ICCA membership includes the national chemical associations of Argentina, Australia, Austria, Belgium, Brazil, Canada, Chile, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Slovenia, South Africa, Spain, Sweden, Switzerland, Turkey, UK, USA, and Uruguay.

Lastly, the results of Responsible Care commitments have been discussed with many national governments (and NGOs) in the context of reducing emissions (air, water, waste, and greenhouse gases).

ICCA aims to position the chemical industry to offer solutions to sustainable development and to demonstrate that the industry cares, is acting responsibly, and is managing risks effectively. It strives, moreover, to increase awareness of the positive contributions of chemistry to everyday health, quality of life, nutrition, and protection of the environment, and to show that the chemical industry is proactively listening, understanding, and responding to societal concerns. Last but not least, it seeks to engage in constructive dialogue and concrete partnerships with society and stakeholders, and to ensure global coordination of communications efforts and consistency of the messages of the chemical industry on global issues.

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6. www.unglobalcompact.org

www.icca-chem.org

Irina Dumitrescu is Communications Officer for Build Trust & Communications, European Chemical Industry Council.

See also
www.iupac.org/publications/ci/indexes/tools-of-the-trade.html

Assuring Quality of Analytical Measurement Results: The IUPAC Role

by Ales Fajgelj

Over the past 30 years the value of world trade has risen dramatically. In 2005 it amounted to almost USD 17 trillion (trillion = 10^{12}; see figure 1). A large proportion of this trade is dependent upon chemical analyses, since food, pharmaceutical products, medicines, ores, and chemical products in general represent the largest groups of trading items. To gain acceptance in the trading process, the quality of analytical measurement results needs to be assured and demonstrated. The term *quality of analytical measurement results* encompasses, among others, comparability of analytical results, their accuracy, reproducibility, metrological traceability, measurement uncertainty, and more.

IUPAC has a long tradition of activities related to quality assurance of analytical measurement results. The formation of the IUPAC/ISO/AOAC Working Party for Harmonization of Quality Assurance Schemes in 1978 was an important milestone. At that time, efforts were focused on harmonizing requirements related to method validation studies (or laboratory collaborative studies), which had been conducted by a number of organizations around the world. IUPAC, offering a completely neutral scientific forum for harmonization activities, was identified as the most appropriate body to host the working party. Today, after almost 30 years, that working party is the IUPAC Interdivisional Working Party for Harmonization of Quality Assurance (WPHQA), which is part of the Analytical Chemistry Division (ACD). The short description of activities that follows and the documents cited here are aimed at highlighting the important role that IUPAC, and specifically the WPHQA, plays in ensuring the quality of analytical measurement results.

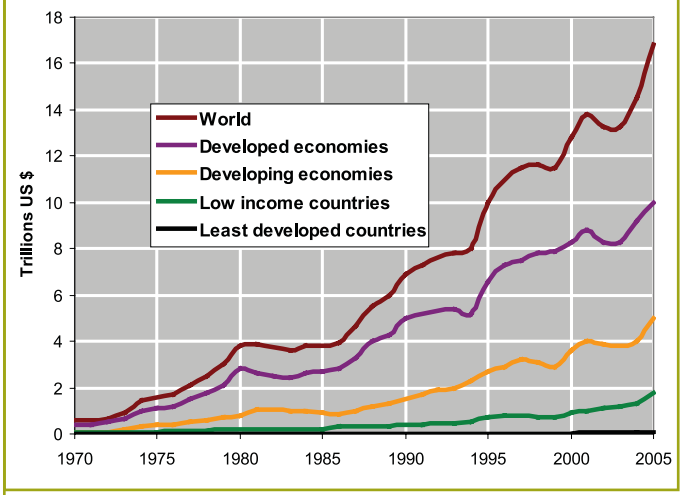


Figure 1: World Trade Development 1970–2005 in Trillions of USD (Source: United Nations Conference on Trade and Development).

Method Validation

The use of standardized methods of analysis in analytical chemistry is one of the most traditional ways of achieving comparability of measurement results. Especially in food analysis, agrochemicals, organic analysis, and other analytical areas where unstable samples and/or measurands are analyzed, the use of standardized methods is often prescribed by legislation.

Two IUPAC internationally harmonized protocols have for many years served as a basis for validation and adoption of standardized analytical methods (procedures). The first is the IUPAC "Protocol for the Design, Conduct, and Interpretation of Collaborative Studies,"[1] and the second the "Harmonized Protocols for the Adoption of Standardized Analytical Methods and for the Presentation of their Performance Characteristics."[2] These principles of collaborative studies for method validation are still widely applied by the AOAC International, as well as by the International Standards Organization (ISO). However, the world is changing rapidly and with the fast development of analytical instrumentation and the availability of new analytical techniques and procedures the prescription of methods to be used is sometimes a limiting factor. Responding to the situation, the WPHQA has opened the door for single-laboratory method validation, also known as in-house method validation. The principles presented in the IUPAC "Harmonized Guidelines for Single Laboratory Validation of Methods of Analysis"[3] and in the proceedings of the Joint AOAC Int./FAO/IAEA/IUPAC International Workshop on the *Principles and Practices of Method Validation*, held in 1999 in Budapest, Hungary,[4] have been accepted as official guidelines by the CODEX Alimentarius Commission.

Quality Control and Proficiency Testing

Established internal quality-control practices and regular laboratory participation in proficiency testing constitute another very important pillar of quality assurance in analytical chemistry. Again, the contributions of the WPHQA have been indispensable. Two IUPAC internationally harmonized documents, namely the "International Harmonized Protocol for the Proficiency Testing of (Chemical) Analytical Laboratories"[5] and the "Harmonized Guidelines for Internal Quality Control in Analytical Chemistry Laboratories"[6] still provide the basic rules, which have received wide international acceptance and utilization.

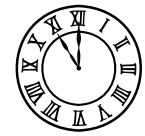
Assessment of laboratory performance based on a z-score evaluation introduced in the IUPAC proficiency testing protocol became the most frequently used approach in evaluation of laboratory performance. Considering the experience gained over 13 years, the protocol has been updated and a revised version titled "The International Harmonized Protocol for the Proficiency Testing (PT) of Analytical Chemistry Laboratories" was published in 2006.[7] To supplement this so-called classical PT approach, the WPHQA recently initiated a separate project on the Selection and Use of Proficiency Testing Schemes for Limited Number of Participants (Chemical Analytical Laboratories).[8] In case of a small number of participants, some limitations on statistical applications may appear and this project is aimed at elaborating some additional approaches for evaluation of participants' results and their reporting.

However, neither of the above described external quality assurance schemes replaces the internal laboratory quality control. They actually should go hand in hand. The ISO/IEC 17025 standard, which serves as a basis for laboratory accreditation, is very general and brief in its Clause 5.9 titled "Assuring the Quality of Test and Calibration Results."[9] It urges laboratories and accreditation bodies to use separate guidance, specifically prepared for their field of application. The large number of citations in scientific literature and translations of both IUPAC documents into numerous languages, including the translation by the Japan Chemical Laboratory Accreditation into Japanese in 2001, reflect the importance of this IUPAC activity for quality in chemical analytical laboratories.

Metrological Traceability and Recovery

One of the most important parameters defining the quality of analytical measurement results is comparability. Comparability of measurement results is based on metrological traceability, which allows results to be compared independently of the time, place, analyst, and procedure used. Two aspects of this description are very much IUPAC's concern. The first is the metrological traceability of chemical measurement results. It is a term often used and cited, but without a firm agreement within the measurement/scientific community regarding associated concepts, their understanding, and requirements. In recent years, IUPAC representatives have been deeply involved in the ongoing revision of the *International Vocabulary of Basic and General Terms in Metrology*, trying their best to assure that specifics of chemical measurements are considered in this guide.

comparability: property of measurement results enabling them to be compared because they are metrologically traceable to the same stated metrological reference; independent of:



Time

Place

Laboratory/operator/procedure

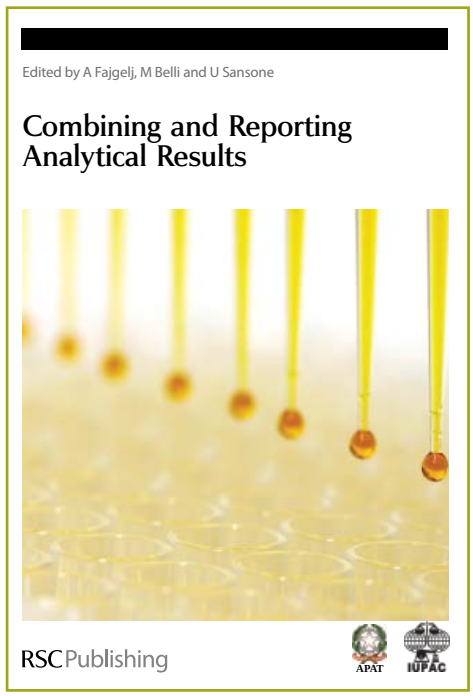
Comparability of measurement is the ultimate goal of quality assurance and is a prerequisite for smooth trade at the national, regional, and global level.

In addition, the WPHQA-coordinated project Metrological Traceability of Measurement Results in Chemistry[11] is also dealing with this issue. Concepts developed in the framework of this project will be underpinned with examples (various scenarios) for establishing traceability in chemical measurement, to provide clear and practical explanations for all levels of laboratories—from field laboratories to metrology institutes. The guide will clarify terms like metrological reference, traceability chain, and metrological hierarchy, and describe the different roles that organizations

in the global metrological infrastructure (metrology institutes, reference material producers, laboratories, etc.) have in establishing metrological traceability. The guide is to be presented during the IUPAC General Assembly in Torino, Italy, in August 2007.

In discussions about metrological traceability of measurement results one frequently hears the claim that the traceability chain in chemistry has been broken. This claim is often related to the chemical process, destructive analysis, where the sample and measurand are converted into the physical and chemical form suitable for the selected measurement technique/instrument. Such conversions (digestions, extractions, etc.) may result in the loss of measurand, incomplete conversion into the required chemical/physical form, or even contamination, and are very much dependent on the procedure used.

In the context of this article, recovery is defined as the proportion of the amount of analyte, present or added to the analytical portion of the test material, which is extracted and presented for measurement. It can be illustrated with the practical example of the determination of pesticide residues in food. The amount of the extracted, and consequently measured, pesticide residue will depend on the procedure used. In the discussion above, the use of standardized methods has been identified as a possible solution to the problem. However, this is only part of the overall process assuring the comparability of measurement results. There is also different legislation in different regions of the world. The European legislation in this specific case requires reporting of results corrected for recovery; this is not the case in the USA. It was a major IUPAC success when IUPAC, ISO, and AOAC Int. agreed on the technical principles for recovery determination provided in the "Harmonized Guidelines for the Use of Recovery Information in Analytical Measurement,"[12] including the fact that recovery values need to be established as a part of the method validation process and be available if necessary, whether or not recoveries are reported or results are corrected. On this basis measured values can always be converted to corrected values and vice versa, thus enabling comparability of results on a global scale.



Combining and Reporting Analytical Results

The correction of results for recovery, or not, is only one illustrative problem related to reporting of analytical results. There are many more. Combining measurement results obtained by one analyst in one laboratory employing one measurement procedure, and using one measurement technique is the starting point for the two questions: How to report the associated measurement uncertainty? and How to establish and demonstrate the metrological traceability of combined results? The complexity of these questions expands with the increasing number of measurement procedures/techniques, and with the number of laboratories and measurement results that need to be considered.

Continuing the tradition of organizing workshops and symposia, the WPHQA, together with the Italian Agency for Environmental Protection and Technical Services, organized the international workshop Combining and Reporting Analytical Results—The Role of (metrological) Traceability and (measurement) Uncertainty for Comparing Analytical Results, in March 2006 in Rome, Italy. The wide international interest in the topics covered by the workshop program was reflected in the number of cosponsoring organizations, namely: Centro Svillupo Materiali. S.p.A, the International Atomic Energy Agency, the Consultative Committee for Amount of Substance—Metrology in Chemistry (CCQM), International Bureau of Weights and Measures, the Co-operation on International Traceability in Analytical Chemistry, the

ISO Committee on Reference Materials and the United Nations Industrial Development Organization.

Most lectures were prepared as full text for the proceedings book published by the Royal Society of Chemistry.[13] Contributions provide an overview of current practices used in different laboratories from different scientific fields to combine and report measurement results, at the same time they describe some basic scientific considerations as well as discussions related to legislative aspects. Practical examples from environmental monitoring laboratories, reference material producers, clinical chemistry, and the top metrological level are included.

Although the workshop was a successful event, it represented only one small step forward in providing answers for dilemmas analytical chemists face in combining and reporting analytical results. Much still needs to be done. In April 2007 a workshop was organized by CCQM focusing on calculating the CCQM Key Comparison Reference Values.

Harmonization Today

From this article, the reader should recognize that in its harmonization efforts IUPAC has never been working alone. There has always been cooperation with relevant bodies and other organizations. Cooperation is considered the only possible approach to achieving agreement at a global level. However, in the 1970s and early 1980s, the international standardization and harmonization scene was smaller than today. Cooperation between AOAC Int., ISO, and IUPAC was sufficient for assuring appropriate arrangements and the flow of information. The situation has changed drastically in the last 20 years. Metrology, accreditation, and standardization infrastructures have developed at all levels.

A careful look into the distribution of the most influential organizations and bodies related to standardization and harmonization in the area of analytical chemistry reveals that there is a strong concentration in the northern hemisphere. The fact is that barriers of trade exist and are still growing between developed and developing economies. One reason for this is the standardization and application of very strong quality requirements in the accreditation process, without provision of the required assistance and support to developing countries. In this respect, the role of independent, non-commercial, non-profit scientific organizations like IUPAC is of utmost importance. The second important way of overcoming such differences is by open access to scientific literature (e.g., via the Internet). The IUPAC journal *Pure and Applied Chemistry* is a valuable example.

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Send your comments by e-mail to <edit.ci@iupac.org>.

IUPAC Council Round Table Discussions

For the first time, four round table discussions will he held during the 2007 General Assembly. This will allow small groups of Council delegates to discuss subjects of mutual interest in a setting conducive to the easy exchange of ideas.

Each round table will be limited to no more than 40 participants. When registering for the Council, delegates interested in participating in a discussion will be asked to prioritize their interest in the discussion topics. Assignments to the various round tables will be based as much as possible on these priority interests. In each case, two members of the Bureau will chair and mediate the discussion.

In this article, each topic is presented in some detail by the named chair and moderator, allowing them to set the stage for later discussions.

The actual sessions will take place on the morning of Friday 10 August. Registration is required. Participation is restricted to delegates attending the Council. Contact your National Adhering Organization or the IUPAC Secretariat for more information.

Topic A

How can we attract more students to chemistry? Do we need to modify the curriculum? Can IUPAC play a role?

Chair: Maria C.E. van Dam-Mieras (Netherlands)
Moderator: David StC. Black (Australia)

This question raises many issues. In general terms the attraction of students to chemistry, both as a course of study and a potential profession, depends on many interconnecting influences. These include:

- community appreciation of the intrinsic value of chemistry in daily life
- community understanding of chemistry
- community and government acknowledgement of the importance of chemistry
- community and government acknowledgement of the role of chemistry in sustainable development
- parental influences in determining career paths for children
- the level of esteem held by the community for the chemistry profession

These general influences form an underlying social attitude. More direct and tangible influences come from the education systems involved at the primary and secondary level. These include:

- the methods of introduction of chemistry to young children
- how chemistry is taught in schools
- the curriculum content and sequence of delivery
- the quality of teachers
- the difficulty of the subject
- the ability to carry out interesting experiments
- the ability to transfer an interest in chemistry to further tertiary study

All of the above influences are the nature of concern in all countries, but their relative importance differs from country to country. While the level of understanding of chemistry might not vary too much from country to country, the perception of its importance does. The major, rapidly developing countries in Asia certainly value chemistry as an important key to future development, while European and other Western countries have gone beyond that stage and are more concerned with tighter regulation. There is a link between the emphasis on regulation and a poor community understanding—and particularly appreciation—of chemistry. So this brings us back to the matter of education of the public about chemistry.

The issues are also cyclical. A student wishing to become a teacher can choose between chemistry and other science subjects such as mathematics or biology. In many ways, given the available classroom facilities, mathematics and biology would be easier to deliver than chemistry. Without dedicated and stimulating chemistry teachers, it is unlikely that students will be attracted to further chemistry study. If students become genuinely enthusiastic about chemistry, they frequently transfer this enthusiasm to other areas such as the more socially esteemed field of medicine at the tertiary level.

While medicine, and indeed biology as a whole, are becoming more molecular in their level of understanding, the importance of a strong chemistry background has not yet emerged in (or in some cases returned to) the relevant medicine and biology curricula. The

fundamental chemistry curriculum needs to be strong and well designed. In this respect it arguably needs dramatic revision. Most curricula are designed by chemists who know and understand the importance of chemistry, but fail to justify this importance. A systematic approach usually starts with the fundamentals of the subject, which are not always seen as relevant in the eyes of students. Chemistry teaching needs to start with the basis that we, and indeed the entire world, are just collections of molecules. So perhaps we should start with the molecules of nature, in other words organic chemistry, then move to physical and general chemistry because we need to understand what such molecules are and how they behave. The reasons for studying chemistry need to be made clear at the outset of the educational program—and this means at the primary school level.

The issues of stimulating students and developing more exciting curriculum material are already being taken up with varying degrees of vigor by individual national chemical societies. However, chemistry is a truly international subject that transcends national boundaries. Globalization is a major influence in the world today, and an unprecedented amount of material can be accessed easily via the internet, but primary and secondary education systems retain a largely national focus. The question for IUPAC is "What can most effectively be done at the international level?" IUPAC could:

- work to increase the general public understanding of chemistry
- work to raise the level of public appreciation of the value of chemistry
- play a coordinating role in linking and sharing national strategies
- act as a neutral nongovernmental organization (NGO) in dealing with government agencies
- develop generic educational material for international application
- seek to develop truly innovative approaches to the teaching of chemistry
- provide publicity and promotional material for use by national chemical societies

IUPAC has the mechanisms through the project system to bring together international task groups to gather and assess data, and then to inspire novel and effective approaches to the encouragement of young people into chemistry. There are existing projects that address some of the above points, and these will provide a good basis for discussion.

Topic B

How can we help regions and small countries to have a more effective voice within IUPAC?

Chair: Christoph F. Buxtorf (Switzerland)
Moderator: Stanislaw Penczek (Poland)

In many worldwide organizations and operations (e.g., the United Nations) smaller countries feel that their voices are not well heard amidst the discussions among big nations. In response, many such organizations are giving smaller countries higher visibility, proportionally more rights and votes (e.g., in their General Assembly), and more assignments in committees and working groups. IUPAC has already done many of these things.

Smaller countries in IUPAC's view are National Adhering Organizations (NAO) with a lower "chemical turnover," which means a smaller chemical industry. In recent years, large companies have been searching for applied science research opportunities in particular in countries with large populations, sizable education systems, and a nascent chemical industry. IUPAC's influence could help such companies establish better contacts.

In many ways, IUPAC has already understood the needs of smaller countries and responded with special programs, meetings, training, lectures, and scholarships and visiting programs, particularly for young scientists. But is it enough and what else could be done? There is definitely not a "one size fits all needs" solution. A smaller country in Africa may need different assistance than a smaller country in Asia or Eastern Europe.

What Can IUPAC Do?

- What could IUPAC do to improve general chemistry education in small countries?
- Can IUPAC help educate the public and government authorities in smaller countries?
- Could IUPAC play a role as an NGO in concert with ICSU and UNIDO?
- Does IUPAC have a role to enable smaller countries to develop their own research programs?
- Is there room for less-sophisticated, lower-technology chemistry, which could be followed by higher-technology chemistry?

- Can IUPAC provide "first aid" via the internet or with "flying experts, using its pools of volunteers—those specialized in education, environmental sciences, production safety, etc.?
- Could IUPAC help provide better access to chemical libraries and technical and chemical literature?
- Should IUPAC encourage publishers to provide free access to electronic versions of books?
- How could IUPAC help bring industry in contact with small countries (e.g., through an affiliated company of a large multinational)?

What Can A "Smaller Country" Do to Be Better Heard and Recognized?

- How can a smaller country explain its needs for scientific and educational programs?
- Could geographic regions bundle their programs and help each other out?
- Is there a possibility for seminars to exchange experiences and expertise?
- Could IUPAC create "clusters of interest" in these geographical regions?
- How can we ensure that smaller countries—which are equal to any other country—take an active part in the work of IUPAC?

Addressing these types of questions in the round table discussion should help us ensure that the every "citizen" in IUPAC has a voice and an adequate platform for their issues and concerns.

How can we interact more effectively with governments and other decision makers? How can we improve our interactions with industry, other unions, ICSU, UNESCO, and others?

Chair: Bryan R. Henry (Canada)
Moderator: Nicole J. Moreau (France)

The topic of improved interactions with other organizations could be approached with the following sequence of questions:

1. Do we need more interactions than we have at present? What is their purpose?
2. The topic title lists a number of possibilities for interaction partners. Is this list complete? Are there any other groups we should include in our interactions?
3. What is the most effective way to increase our interactions with each of these groups?
4. What do we expect to get out of our interaction with each of these groups?
5. How aggressively should we pursue formal NGO status with various bodies?

Further elaborating on question 1, let us assume the answer is yes and we need more interactions. Perhaps one purpose of these increased interactions is to broaden knowledge of IUPAC's existence and its role. IUPAC was created in response to a demand from chemical industry for international standards to facilitate patents, trade, and exchanges. Thus, we have become known for terminology, nomenclature, and critically evaluated databases. Should we build on this reputation or should we devote our efforts to letting the world know that IUPAC is much more than just the above three topics? For example, our project system involves close to 1 000 scientists worldwide, we are active in supporting conferences, we are working with the Organization for the Prohibition of Chemical Weapons, and we produce a number of publications. Perhaps we should try to build on our traditional strengths and publicize the breadth of our operations.

Additional reasons for increased interactions might include attracting more students to chemistry, increasing the global visibility of chemistry, and enhancing public understanding of chemistry. Are there others?

Thinking of questions 2, 3, and 4, let us be reminded that the purpose of ICSU, which was founded in 1931, was to form a coalition of scientific unions that would focus on interdispciplinary science. It has a large number of national members (more than 100), which has produced an interesting dichotomy. ICSU has some effective interactions with governments and international organizations. Should IUPAC try and take more advantage of ICSU and its governmental and international contacts to broaden the outreach of its own activities? This might be an appropriate time for such an initiative given that the IUPAC president is one of eight elected members of the ICSU Executive.

In addition to working through ICSU, should we more aggressively pursue contacts with decision makers directly through IUPAC itself and perhaps through our national committees?

We have a number of programs that attempt to involve younger scientists in IUPAC activities. Given

the pressures on younger scientists early in their career, is this a group that we should try to interact with more effectively? When we attempt to interact with governments, should we focus on the public understanding of chemistry or should we direct our efforts to the public appreciation of chemistry and to its benefits to society? In interacting directly with the public, are we better to focus on chemistry educators and national associations and support their efforts? The fields of green chemistry and sustainable development are both popular and crowded. Do we have a unique contribution to make and to share with decision makers?

With regard to question 5 and IUPAC's NGO status, let us not forget that through its Committee on Chemistry and Industry (COCI), IUPAC works to include chemical industry more actively in its activities. These efforts have involved strengthening the Company Associates program and a number of other initiatives. For example, we have tried to interact more directly with industry-based organizations. IUPAC can help industry in its attempts to bring rationale discussions and solutions to the attention of government as they relate to chemical problems. However, to do so effectively, we need the cooperation and participation of chemical industry. The Strategic Approach to International Chemicals Management is a policy framework for international action on chemical hazards (see feature on page 8). This is the type of organization where COCI believes it is important for IUPAC to establish official NGO status. We are in the process of doing so. Is such an initiative important and should we seek additional opportunities to associate with other bodies as an NGO?

Topic D

How can we increase the global visibility of chemistry, enhance public understanding of chemistry, and improve its public image?
How can we improve the visibility and image of IUPAC?

Chair: Peter G. Mahaffy (Canada)
Moderator: Leiv K. Sydnes (Norway)

Increasing the global visibility of chemistry, enhancing its public understanding, and improving its public image can all be seen as explicit, central elements of IUPAC's strategy to "contribute to the worldwide understanding and application of the chemical sciences, to the betterment of the human condition." The global perspective and networks provided by IUPAC as a worldwide scientific organization should position us well to make a meaningful contribution in each of these areas.

But sorting out what IUPAC is best positioned to do relative to the many other players is challenging, and we must avoid confusion between the three important but different goals of enhancing public understanding of chemistry, improving its public image, and improving the visibility and image of IUPAC.

For background, participants in this round table discussion are strongly encouraged to read a recent report and recommendations by the Committee on Chemistry Education (CCE) on IUPAC's role in achieving mutual understanding between chemists and the public (see July 2006 *CI*, p.14, and IUPAC project # 2004-047-1-050 <www.iupac.org/projects/2004/2004-047-1-050.html>).

The report suggests the following motivations for IUPAC's involvement in public understanding of chemistry (PUC) initiatives:

- IUPAC wants to provide leadership to enable chemists to address global issues that involve the molecular sciences.
- IUPAC acknowledges that the public ultimately decides whether and to what extent the benefits of chemistry are realized.
- Chemists therefore need to engage with the public to create a climate in which the potential benefits of chemistry can be realized.
- To create and support effective two-way communication, chemists need to understand the needs and concerns of the public.
- Good decision making in society depends on mutual understanding and trust between chemists and the public.
- IUPAC needs strategies to promote this mutual understanding.

Noting that "one size fits all" messages are ineffective, the report addresses the question: Who are the public(s) IUPAC should be trying to reach? IUPAC can be considered to be at the center of a set of concentric circles, each of which represents a "public" with which IUPAC may wish to interact in relation to the public understanding of chemistry. IUPAC is closest to and/or can readily interact with its own adhering bodies and national chemical societies, other multinational orga-

nizations, and the scientific and educational arms of national governments. It is relatively remote from most chemists, who are members of national bodies rather than of IUPAC itself, and very remote from teachers, students, and the general public. IUPAC has neither the resources, nor the expertise to address all of these "publics." It needs to concentrate its activities with those publics with which it is well placed (and perhaps better placed than others), while interacting indirectly with those publics that are more remote (and who are better addressed by others). Primary publics for IUPAC are those chemists who are closely associated with IUPAC, and one of the first steps for IUPAC is to assist its chemist-members in understanding the needs and aspirations of their target audiences. The media and the public will see through any imbalance or confusion of motives and will spot anything that is self-serving.

The four recommendations in the report are a good starting point for our round table discussion about IUPAC's role in PUC initiatives and in enhancing the visibility and public image of chemistry.

Recommendation 1: In keeping with its mission to "contribute to the worldwide understanding and application of the chemical sciences, to the betterment of the human condition," IUPAC has an important role to play in enhancing public understanding of chemistry.

Recommendation 2: Public understanding of chemistry activities aimed at supporting teachers and students within the formal school system are more effective than those aimed at the general public.

Recommendation 3: IUPAC is just one of many actors in public understanding of science, and will frequently need to work collaboratively with the other scientific unions and other bodies. IUPAC can not cover the full range of possible activities and address all audiences, not least because it is remote from the general public. IUPAC's primary targeted public should be IUPAC chemists and educators, and IUPAC's most important role is to help them understand and work with a variety of other publics.

Recommendation 4: We propose IUPAC's niche as focusing on activities that indirectly enhance public understanding, such as the following:
(a) helping scientists identify and understand their publics
(b) influencing international organizations
(c) supporting science education systems, particularly in countries in transition
(d) supporting scientists and educators by communicating relevant findings from IUPAC projects and activities at an appropriate level
(e) supporting national chemical societies and other organizations

Guided by these recommendations, we suggest the following eight questions to focus on in our round table discussion:

1. What is IUPAC's motivation in increasing the global visibility of chemistry, enhancing public understanding of chemistry, and improving its public image? How does our motivation as a worldwide scientific organization coincide with and how does it differ from other players such as national chemical societies and chemical industry?
2. Which "publics" is IUPAC closest to, and how are we best positioned to work with those publics to increase the global visibility of chemistry, enhance public understanding of chemistry, and improve its public image?
3. Which international organizations is IUPAC best positioned to work with to achieve these goals? (See Roundtable Topic C)
4. How can IUPAC best support science education systems, particularly in countries in transition? (See Roundtable Topic A)
5. Do we currently do a good job of highlighting the educational dimensions of IUPAC projects, conferences, and activities. Are they visible, intelligible, and useful to teachers and students? How can we improve?
6. How can we best support industrial associations, national chemical societies, NAOs, and other organizations in achieving these goals?
7. What role might an International Year of Chemistry play in achieving these goals?
8. How might the initiatives above be carried out in such a way as to improve the visibility and image of IUPAC?

CONCLUSION

It is a relatively easy task to outline the questions, but much more difficult to provide practical answers. It is hoped that the round table discussions will lead to some really good suggestions and plans for future IUPAC activity.

www.iupac.org/symposia/conferences/ga07/roundtables.html

Margaret Brimble Wins Major International Award

Margaret Brimble, a member of the IUPAC Subcommittee on Organic Synthesis of the Organic and Biomolecular Chemistry Division, received the L'Oréal-UNESCO for Women in Science Award in Paris on 22 February 2007. Professor Brimble holds the chair of Organic and Medicinal Chemistry at the University of Auckland. She received the award for her research on the synthesis of biologically active natural products that provide new lead compounds for the development of new drugs.

Based in Paris and now in its ninth year, the annual awards recognize and encourage women scientists. Professor Brimble received USD 100 000 for the award and travelled to Paris for the awards ceremony at UNESCO headquarters, which was attended by 2 000 distinguished guests. Brimble also presented her research to her peers at the highly regarded French Academy of Science.

"I am extremely honored to receive this award which reflects not only the work I have been involved in, but also the contribution made by my research students at The University of Auckland," said Brimble. "I hope this award will serve to stimulate added interest in science amongst young women of New Zealand, gain recognition for scientific excellence in our country, and close the gender gap that exists in this rewarding field."

The L'Oréal-UNESCO awards partnership comprises five laureates and 15 fellowships. The laureates are awarded to five eminent scientists for excellence in research, with one chosen from each of the world's five major regions: Africa, Latin America, North America, Asia-Pacific, and Europe. Laureates are selected based on scientific excellence by a jury of eminent members of the international scientific community led by Günter Blobel who received the Nobel Prize in Medicine in 1999.

The main therapeutic areas that Brimble's research focuses on are treatments for cancer, cardiovascular disease, peptic ulcer disease, anti-fungal agents and Alzheimer's disease. She describes her group's work as a complex game of molecular chess whereby chemical reactions reproduce the complex chemical structures of nature. By producing the molecules in the laboratory, improvements can be made and many similar yet unique molecules with even better biological activity can be used to develop new drugs. Brimble's group comprises 13 Ph.D. students, three honors students, and several postdoctoral fellows.

FOR WOMEN IN SCIENCE
L'ORÉAL
UNESCO
United Nations Educational, Scientific and Cultural Organization

2007 L'OREAL-UNESCO Laureates

Africa
Ameenah Gurib-Fakim—professor of Organic Chemistry and pro-vice-chancellor, University of Mauritius, Mauritius—for her exploration and analysis of plants from Mauritius, and their bio-medical applications.

Asia/Pacific
Margaret Brimble—chair of Organic and Medicinal Chemistry, University of Auckland, New Zealand—for her contributions to the synthesis of complex natural products, especially shellfish toxins.

Europe
Tatiana Birshtein—Institute of Macromolecular compounds, Russian Academy of Sciences, St Petersburg, Russia—for her contribution to the understanding of the shapes, sizes and motions of large molecules.

Latin America
Ligia Gargallo—Department of Physical Chemistry, Pontifical Catholic University of Chile, Santiago, Chile—for her contributions to understanding solution properties of polymers.

North America
Mildred Dresselhaus—institute professor of Electrical Engineering and Physics, Massachusetts Institute of Technology, Cambridge, USA—for her research on solid state materials, including conceptualizing the creation of carbon nanotubes.

The annual L'Oréal-UNESCO For Women in Science Awards are designed to inspire new scientific vocations while overcoming the gender gap in the world of science and to promote excellence in scientific research. Laureate nominations are submitted from each country via 2000 members of the global scientific community and UNESCO to the awards' international jury for selection.

RSC Publishing Launches Project Prospect

In February 2007, RSC Publishing, the publishing arm of the Royal Society of Chemistry, announced a new initiative in which electronic RSC journal papers will be enhanced so that their data can be read, indexed, and intelligently searched by machine, a first step towards the "semantic web."

Readers will be able to click on named compounds and scientific concepts in an electronic journal article to download structures, understand topics, or link through to electronic databases. Compounds and ontology terms will be published as RSS feeds enabling automated discovery of relevant research.

The initiative, coined "Project Prospect," is the first of its scope from a primary research publisher. Developed together with UK academics based at the Unilever Centre of Molecular Informatics and the Computing Laboratory at Cambridge University, the Project uses InChIs (IUPAC's International Chemical Identifier for compounds); OBO ontology terms (Open Biomedical Ontologies: a hierarchical classification of biomedical terms) such as the Gene Ontology (GO) and the related Sequence Ontology (SO); terms from the IUPAC Gold Book; and CML (Chemical Markup Language: a means to describe molecular information in a structured form).

This is a completely free service for authors and readers of RSC journals. The enhanced articles have an at a glance HTML view with additional features accessed by a tool box. Downloadable compound structures and printer friendly versions will be available via this new service.

"Project Prospect demonstrates our commitment to invest in innovative technologies to provide our authors and readers with the best publishing service available," said Robert Parker, the RSC's acting managing director.

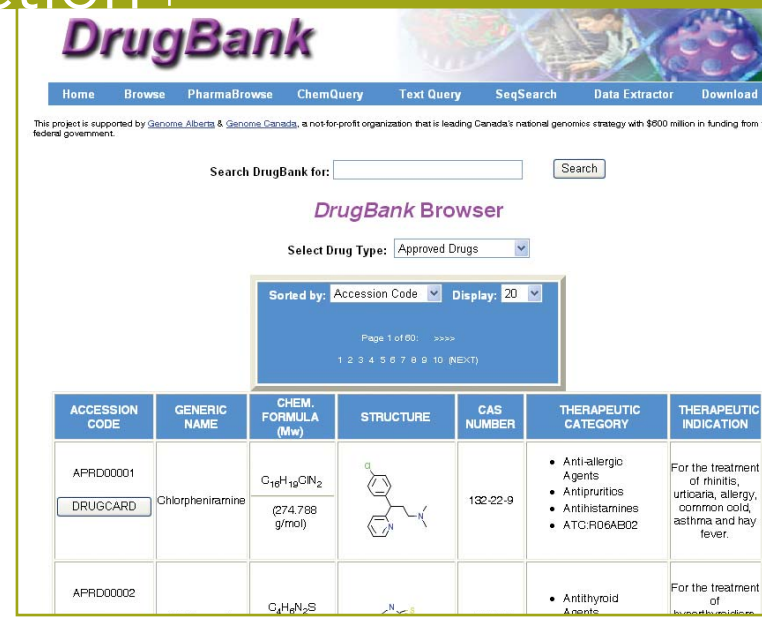
Midori Harris, GO's editor from the European Bioinformatics Institute in Hinxton, UK, welcomes the developments: "We're delighted by the RSC's decision to use GO and SO terms to annotate scientific papers they publish. It's an exciting application of ontologies that will help researchers search the ever-growing body of scientific literature more quickly and effectively. We hope to see more publishers following the RSC's example in the future."

The RSC intends to develop the Project over the coming months and years to increase the amount of structured science in its research articles.

www.rsc.org/Publishing/Journals/ProjectProspect/index.asp

DrugBank—An Internet Source for Drug Information

by John Proudfoot



The rapid evolution of the worldwide web has provided general access, unimagined even a decade ago, to information of many kinds. As a medicinal chemist involved in drug discovery, I have seen access to the basic information of drug discovery—drug structures, drug effects, and drug targets—evolve from print-only format (comprehensive but difficult to update) to proprietary computer databases (easily searchable but expensive and with no public availability) to the current situation where a surprising amount of sophisticated information is freely available via the internet. This article is intended to draw attention to one particularly useful source of information, Drugbank[1] <http://redpoll.pharmacy.ualberta.ca/drugbank/>, which was designed and created by Dr. Wishar and his colleagues at the University of Alberta. This free resource pulls together a surprisingly comprehensive amount of information on drugs and drug targets and contains data on over 1 000 marketed and over 3 000 additional experimental drug substances.

The Drugbank homepage (above) displays links to multiple search options, **Browse**, **PharmaBrowse**, **ChemQuery**, **TextQuery**, **SeqSearch**, **Data Extractor**, and a **Download** feature. Information can be accessed in a number of ways ranging from simple text queries to more sophisticated structure queries using a ChemSketch applet or SMILES string input via **ChemQuery**.

DrugCards (accessible via the **Browse** function) provide drug-related information, including indication, pharmacology, and mechanism of action. Active hyperlinks to the FDA label and other information may also be available. The **DrugCard** also gives information on the drug target, including function, and protein sequence information, along with hyperlinks to the 3D PDB structure and polymorph information where available.

The **PharmaBrowse** function allows users to view drugs grouped by indication and the **Data Extractor** allows users to search over various combinations of database fields. The **Download** feature allows users to save structure files, DrugCards, protein sequence, and DNA sequence data.

I became aware of the Drugbank database while working on project 2004-025-1-700, which was initiated in 2005 within Division VII with the objective of providing a compendium of drug and drug target information for the top 100 drugs. As work on the project proceeded, it was clear that our envisioned product was already outstripped by information sources such as Drugbank that were available on the world wide web, and the project was recently terminated.

I would like to take this opportunity to acknowledge the hard work of the project contributors, Janos Fischer, Stefan Jaroch, Susan Dana Jones, Michael Liebman, and Erika Alapi, Attila Szemzo, Mark Samuels, and Tom Perun.

http://redpoll.pharmacy.ualberta.ca/drugbank

Dr. John Proudfoot <jproudfo@rdg.boehringer-ingelheim.com> is distinguished scientist with Boehringer Ingelheim Pharmaceuticals Inc., in Ridgefield, Connecticut, USA. He is a member of the Subcommittee on Medicinal Chemistry and Drug Development of the IUPAC Chemistry and Human Health Division.

Reference

1. Wishart, D. S.; Knox, C.; Guo, A. C.; Shrivastava, S.; Hassanali, M.; Stothard, P.; Chang, Z.; Woolsey, J. DrugBank: a comprehensive resource for in silico drug discovery and exploration. *Nucleic Acids Research*. 2006, 34, D668-72.

continued on page 24

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

Glossary of Terms Related to Kinetics, Thermodynamics and Mechanisms of Polymerization

This document presents recommended definitions of basic terms related to polymerization processes, principally to the kinetics, thermodynamics, and mechanisms of polymerization.

Comments by 31 July 2007

Dr. Graeme Moad
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Clayton South, VIC 3169, Australia
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www.iupac.org/reports/provisional/abstract07/moad_310707.html

Glossary of Terms Related to Solubility

This glossary defines 151 terms used to describe solubility and related phenomena. The definitions are consistent with one another and with IUPAC recommendations for terminology and nomenclature.

Comments by 31 July 2007

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www.iupac.org/reports/provisional/abstract07/shaw_310707.html

Graphical Representation Standards for Chemical Structure Diagrams

Comments by 30 June 2007

www.iupac.org/reports/provisional/abstract07/brecher_300607.html

Structure-Based Nomenclature for Cyclic Macromolecules

Comments by 31 May 2007

www.iupac.org/reports/provisional/abstract06/mormann_310507.html

Further Conventions for NMR Chemical Shifts

Comments by 31 May 2007

www.iupac.org/reports/provisional/abstract06/harris_310507.html

continued from page 23

Free Information Resources for Chemists, Part 2—*Update*

This is an update to the Internet Connection that appeared on page 29 of the Sep.-Oct. 2006 *CI*.

Protein Explorer is a derivative of Rasmol, rather than an update as previously stated: Rasmol itself and OpenRasMol (an open-source version) can be found at <http://OpenRasMol.org>. Not mentioned in Part 2 is Jmol (not JMol), a Java-based, open-source, interactive web browser applet, available at <www.jmol.org>, for molecular display. Jmol is currently under very active development as a promising successor to Chime and a list of websites using Jmol may be found at <http://wiki.jmol.org/index.php/Websites_Using_Jmol>. The base site for the World Index of Molecular Visualization resources can be found at <www.molvisindex.org>. This URL transfers your browser to <http://molvis.sdsc.edu/visres/index.html>.

Dr. Angel Herraez of Universidad de Alcala, Spain, provided this useful information to Leslie Glaser.

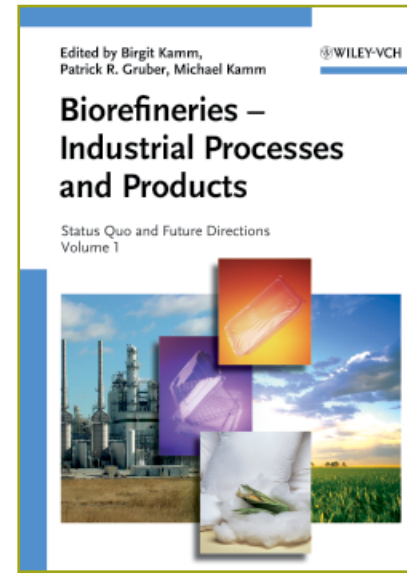
Biorefineries—Industrial Processes and Products: Status Quo and Future Directions

edited by Birgit Kamm, Patrick R. Gruber, Michael Kamm, with forewords from Henning Hopf and Paul T. Anastas
Wiley-VCH, Weinheim (2005)
ISBN 3-527-31027-4

reviewed by Wladimir Reschetilowski

For the first time, a comprehensive, systematically composed and clearly structured book about the processing of biomass in the form of whole crops in biorefineries has been published. This 900-page two-volume set focuses on the technological principles, as well as the economic aspects, green processes, plants, concepts, and current and forthcoming biobased product lines. In the preface, Hennig Hopf (University of Braunschweig) of the President of the Community of German Chemists, makes it clear that the great challenge to chemistry and chemists is establishing interdisciplinary cooperation in this field. Paul Anastas, director of the Green Chemistry Institute, emphasizes that the enthusiasm of the best scientists and engineers is essential in order to develop a bio-economy with biobased raw materials, processes, and products.

The book, which contains 33 articles by 85 authors, is essentially a survey of current biorefinery research and industrial implementation strategies, particularly in the chemical industry. Thereby, the first volume is divided into four, the second into three main chapters. Volume 1 begins with a review of the history of carbohydrates and the beginnings of integrated biobased production, followed by the definition of the term biorefinery and a brief description of the biorefinery-systems in research and development. Next, it covers the global, technological, and economic dimensions of biomass refining. The remainder of the volume is devoted to the different technologies available, including biorefineries for large-scale industry, lignocellulosic-feedstock biorefineries, whole crop biorefineries, fuel-oriented biorefineries, sugar-based biorefineries, biorefineries based on thermo chemical processes, green biorefineries, and bio catalytic processes to synthesize bulk chemical.



The second volume focuses on biobased product family trees; biobased industrial products, materials, and consumer products; and biobased industry: economy, commercialization and sustainability

The book uses the principles of logic and efficiency of petrol refineries, to assign product lines and product family trees to biomass. Both volumes should be incorporated into the education of chemists, biotechnologists, and engineers. The book also makes an excellent encyclopaedia (partly due to its very good index) for professionals in the field of biobased raw materials, technologies, and products.

www.wiley-vch.de

Wladimir Reschetilowski <Wladimir.Reschetilowski@chemie.tu-dresden.de> is Director of the Institute of Industrial Chemistry at the University of Technology Dresden, Germany. He studied chemistry at the Technical University Leuna-Merseburg and received his PhD in 1978. His current research interests are in the field of heterogeneous catalysis and adsorption with the focus on the production of chemicals from biogenic resources.

Combining and Reporting Analytical Results

Ales Fajgelj, M. Belli, and U. Sansone
The Royal Society of Chemistry, 2006
ISBN 0 85404 848 0

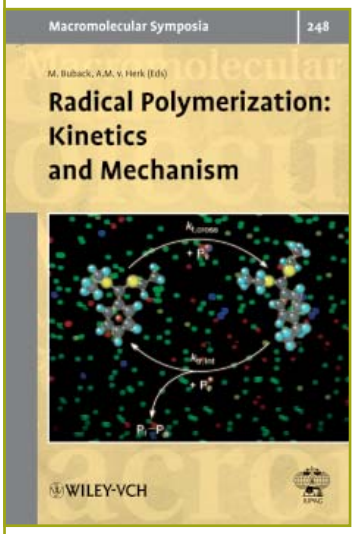
This book contains lectures presented at the international workshop on Combining and Reporting Analytical Results—The Role of (Metrological) Traceability and (Measurement) Uncertainty for Comparing Analytical Results, held 6–8 March 2006 in Rome, Italy. The IUPAC Interdivisional Working Party on Harmonization of Quality Assurance and the Italian Agency for Environmental Protection and Technical Services cooperated in organizing this event.

See Ales Fajgelj's feature on page 12.

www.iupac.org/publications/books/author/fajgelj_2006.html

Macromolecular Symposia—recent volumes

Radical Polymerization: Kinetics and Mechanism
Editors: M. Buback and A. M. V. Herk
***Macromolecular Symposium*, Vol. 248**
WILEY-VCH Verlag GmbH, 2007, pp. 1–258



This volume of *Macromolecular Symposia* contains articles of the invited speakers at the IUPAC-sponsored International Symposium on "Radical Polymerization: Kinetics and Mechanism" held in Il Ciocco (Italy) during the week 3–8 September 2006. (See report, page 28)

This symposium was the fourth within the series of so-called SML conferences, which are the major scientific forum for addressing kinetic and mechanistic aspects of free-radical polymerization and of controlled radical polymerization.

The symposium comprised five major themes:

- Fundamentals of free-radical polymerization
- Heterogeneous polymerization
- Controlled radical polymerization
- Polymer reaction engineering
- Polymer characterization

www.iupac.org/publications/macro/2007/248_preface.html

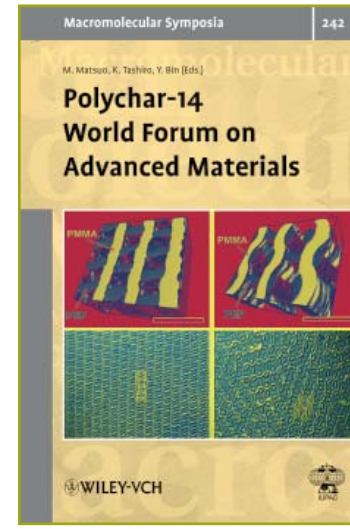
World Polymer Congress—MACRO 2006
***Macromolecular Symposia*, vol 245/246**
Wiley-VCH, 2006, pp. 1–680

"Polymers Promoting Life Quality" was the theme of the 41st International Symposium on Macromolecules (Macro 2006), which was held in Rio de Janeiro, Brazil, 16–21 July 2006. Papers from this conference, contained in this issue of *Macromolecular Symposia*, involve the following topics:

- Polymer Chemistry and Reaction Processes
- Polymer Characterization Polymer Processing
- Structure and Properties of Polymers
- Polymer Solutions and Gels
- Polymer Blends and Composites
- Modelling and Simulation
- Novel Applications
- Biomaterials and Environment Recycling
- Advances in Commercial Polymers
- Polymer Education
- International Cooperation

www.iupac.org/publications/macro/2006/245_preface.html

Polychar-14—World Forum on Advanced Materials
Masaru Matsuo, Kohji Tashiro, and Yuezhen Bin (editors)
***Macromolecular Symposia*, Vol. 242**
Wiley-VCH, 2006, pp. 1–324

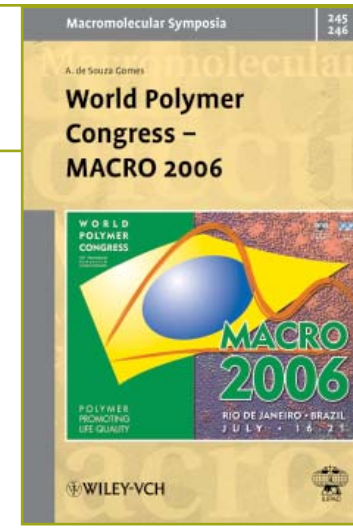


The synthesis and processing of polymer materials have been advanced in many research works to increase their performance under mechanical stress and in various chemical and thermal conditions. Recently, there has been increasing interest in developing polymer materials with many functional properties such as electro-conductivity, piezoelectricity, heat and weather resistance, super-absorbance, and permeability. These high-performance or high-functional materials are replacing aluminum and other structural metals in certain electronic and optical applications and in computers. Novel methods for controlling polymer structure and characterization, novel architectures for polymers, and novel concepts for nano-scale materials are leading to these new applications.

This issue of *Macromolecular Symposia* is devoted to papers from the POLYCHAR-14 World Forum on Advanced Materials, held at Nara Women's University in Nara City, Japan, April 17–22, 2006. The papers demonstrate the spectacular advances in polymer synthesis, processing, manufacturing, and properties.

www.iupac.org/publications/macro/2006/242_preface.html

Bookworm



Recent Trends in Ionic Polymerization

D. Baskaran and S. Sivaram (editors)
Macromolecular Symposia, Vol. 240
Wiley-VCH, 2006, pp. 1–251

The IUPAC Symposium on Ionic Polymerization, held in Goa, India, from 23–28 October, 2005, provided an opportunity for the Indian scientific community to interact with leading scientists from around the world working in the area of ionic polymerization. This issue of *Macromolecular Symposia* contains selected papers from the conference.

www.iupac.org/publications/macro/2006/240_preface.html

Advanced Polymers, Composites and Technologies

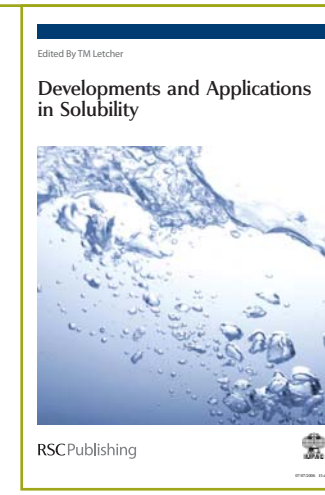
J. Marosi and T. Czigány (editors)
Macromolecular Symposia, Vol. 239
Wiley-VCH, 2006, pp. 1–265

This issue of *Macromolecular Symposia* contains selected papers presented at the 8th International Symposium on Polymers for Advanced Technologies (PAT 2005) held in Budapest in September 2005. Polymer technologies used in the pharmaceutical and biomedical fields, such as photoelectronics, environmental biodegradable systems, and specific composites, are increasingly interrelated. As this collection of papers shows, the following advancements were the result of interdisciplinary research:

- rapid developments in syntheses
- greater understanding of the theoretical basis of multicomponent systems
- increased possibilities for simple and controllable nanocomposite technologies
- advancements in surface/interface engineering

www.iupac.org/publications/macro/2006/239_preface.html

Developments and Applications in Solubility



Trevor M. Letcher (editor)
The Royal Society of Chemistry, 2006
ISBN 0 85404 372 1; ISBN-13 978 0 85404 372 9

Solubility is one of the most basic and important of thermodynamic properties, and a property that underlies most industrial processes. This book is a collection of 24 chapters involving recent research works, all related to solubility. The objective is to bring together research from disparate disciplines that have a bearing on solubility. Links between these chapters could lead to new ways of solving problems and looking at new and old solubility-related issues. Underlying this philosophy is the inherent belief that a book is still an important vehicle for the dissemination of knowledge. The book highlights the theory, techniques, interesting and new results, modeling and simulation, and industrial applications related to solubility.

The book has its origins in committee meetings of the International Association of Chemical Thermodynamics. It is a project produced under the auspices of IUPAC. In true IUPAC fashion, the authors, which represent some of the most important names in their respective fields, come from many countries around the world, including Australia, Austria, Finland, France, Germany, Ireland, Netherlands, New Zealand, Portugal, Slovenia, South Africa, Switzerland, Poland, UK, and USA.

www.iupac.org/publications/books/author/letcher07.html

Radical Polymerization—Kinetics and Mechanism

by Philipp Vana

The **4th International Symposium on Radical Polymerization—Kinetics and Mechanism** was held 3–9 September 2006 in Italy at the International Conference Centre Il Ciocco, which is located north of Lucca in the mountains of Garfagnana, Tuscany. This symposium was the fourth in a series of which the first two meetings were held in Santa Margherita Ligure, Italy, in 1987 and 1996, and the third in 2001 in Il Ciocco.

The conference was jointly organized by the Technical University of Eindhoven (The Netherlands) and the University of Göttingen (Germany). Alex van Herk and Michael Buback were conference chairmen. The symposium was sponsored by IUPAC, the Foundation Emulsion Polymerization, and the European Graduate School "Microstructural Control In Free-Radical Polymerization."

The conference was attended by more than 180 scientists from 23 countries, including around 25 persons from chemical industry and more than 25 scientists from non-academic research institutions. It is especially noteworthy that quite a substantial number of Ph.D. students, mostly from European countries, attended the conference and actively participated. The well-proven format of the symposium series was maintained in that the entire area of radical polymerization was covered. Clustering around the central theme of kinetics and mechanisms of radical polymerization, the lectures were organized in five sections:

- Fundamentals
- Polymer Characterization
- Controlled Radical Polymerization
- Polymer Reaction Engineering, including Simulations
- Heterogeneous Polymerization

Participants in the 4th Symposium on Radical Polymerization—Kinetics and Polymerizations.

As with the previous meetings, there were no parallel sessions. This organizational mode is a very popular feature of this conference series, and the fact that every attendee has the same information available stimulates the scientific discussion after the talks. In addition to the 25 invited lectures, 8 papers were selected from the submitted posters for oral presentation. The lecture program was complemented by 116 posters, which were mounted inside the lecture hall over the entire week. Four poster sessions of two hours each gave plenty of time for extensively discussing all contributions, demonstrating the fact that within the course of this meeting posters were considered equally important as lectures. Three outstanding poster contributions were selected by the conference participants to receive poster awards.

- The prestigious SML poster prize (SML is for Santa Margherita Ligure, where the first meeting in this series was organized in May 1987) was awarded to J. Reuber and D. Johannsmann for "Formation of Thermo-Responsive Hydrogel Films via Electrochemically Initiatied Polymerization."
- C. Yoshikawa, A. Goto, Y. Tsuji, and T. Fukuda received an IUPAC poster prize for "Protein Repellency of Concentrated Polymer Brushes Prepared by Surface-Initiated Living Radical Concentration."
- P.J. Saikia and S. Choe received an IUPAC poster prize for "The Influence of Reversible Addition Fragmentation Chain Transfer Agent on the Dispersion Polymerization of Styrene."

Yoshikawa and Saikia each received a certificate signed by the IUPAC president, a copy of the IUPAC *Gold Book*, and a two-year subscription to *Chemistry International*.

It is difficult to present selected contributions from the multitude of excellent talks and posters without disregarding other important papers. A complete compilation of oral contributions as well as selected poster presentations have been published in *Macromolecular Symposia* volume 248, February 2007 (see page 26). In summary, some important developments in the field of radical polymerization kinetics became evident through the presented research:

- Knowledge of the basic kinetics and mechanisms of radical polymerization has increased tremendously in recent years due to the application and further development of powerful experimental techniques such as the pulsed laser polymerization methods.
- The use of controlled radical polymerization (CRP) for obtaining well-defined macromolecules is rapidly growing. Novel methods, which pursue new concepts and employ new types of mediating agents, are emerging, and the already established methods, such as NMP, ATRP, and RAFT, are continuously refined and explored in depth. The kinetics and mechanism of the various CRP methods are subject of intense research and the concepts of CRP are sparking the development of new techniques for studying fundamental aspects of radical polymerization.
- Many researchers are using their kinetic expertise for rationally designing new polymerization processes (e.g., polymerization from surfaces or generation of colloidal particles) for designing novel polymeric materials.
- Radical polymerization in aqueous phase is becoming increasingly important. Aside from progress understanding emulsion polymerization, an increasing body of work is addressing radical polymerization of strongly polar and ionic monomers in homogenous aqueous phase.

These tendencies underpin the fact that radical polymerization is progressively expanding into new areas. Recent advances in the field, which were mainly driven by the rapid development of controlled radical polymerization, now offer the opportunity of introducing high degrees of control by radical polymerization over physical and chemical properties. Molecular weight, polydispersity, intramolecular chemical composition distribution, glass transition temperature, branching and branching distribution, the incorporation of functional groups, particle morphology in heterogeneous systems, and polymer surface properties can now be tailored with unrivalled precision under retention of the versatility and robustness of radical polymerization. The improved control over the resultant macromolecular properties will lead to more efficient polymer production and new polymer products.

Philipp Vana <pvana@uni-goettingen.de> teaches at the University of Göttingen, Germany, and is chairman of an IUPAC task group on RAFT polymerization. He was a member of the scientific secretariat of the SML06 meeting.

Advanced Polymers for Emerging Technologies

by Jung-Il Jin

The **IUPAC International Symposium on Advanced Polymers for Emerging Technologies** (PSK 30) was organized in Busan, Korea, 10–13 October 2006, by the Polymer Society of Korea in commemoration of the 30th anniversary of its foundation. This society organized the very successful IUPAC MACRO SEOUL '96 conference just about 10 years ago. Once again, PSK held another excellently executed international conference with a high scientific standard. Since the meeting commemorated the 30th anniversary of PSK, the majority (87 percent) of the participants (1 935) were Koreans. However, the conference attracted 249 foreign participants from 26 countries: Japan (136), USA (23), China (15), Germany (14), Thailand (12), Iran (6), and Australia (5).

The four plenary speakers were Jean Fréchet (USA), Jung-Il Jin (Korea), Tisato Kajiyama (Japan), and Gerhard Wegner (Germany). Of the 84 invited speakers, 29 were Koreans, which reflected the international atmosphere of the celebration.

The 10 subsessions (Polymers for Electronics and Photonics, Smart Polymers for Sensors and Intelligent Systems, Biomedical Polymers, Polymers for Energy Conversion and Storage, Polymer Nanomaterials and Nanotechnology, Polymer Syntheses and Reactions, Polymer Physics, Properties, and Characterization, Environmental and Green Polymers, Polymer Engineering and Processing, Industrial Polymers) encompassed the research areas of Advanced Polymers for Emerging Technologies and Contemporary Polymer Science and Technology, both of which dealt very much with futuristic subjects. A real contrast in audience participation was observed between the two types of sessions: Practically all of the first five sessions were packed with participants, whereas the second half attracted a much smaller audience. This strongly implied that, at least among Korean polymer scientists, polymer science is heading toward the development of high functional materials linked to advanced technologies in electronics, photonics, energy, and bio- and nanotechnologies.

The scientific discussion in each session was very lively, especially those with internationally renowned invited speakers. Colorful poster presentations (936) by young scientists offered ample opportunities not only for heated discussion, but also for building friendships. The three IUPAC Poster Prizes were conferred

upon Young-Jun Yu (Korea University, Korea) for "Photopatterning of Electroluminescent Polymers," Shinichi Mochizuki (Kyushu University, Japan) for "Bioconjugates for Targeted Delivery," and Sung-Kyoung Kim (Hanyang University, Korea) for "Elastic Modulus of Composite Nanofibers." The prizes were given by Christopher K. Ober, vice president of the Polymer Division, during a banquet.

Past Presidents of the Polymer Society of Korea.

The outstanding arrangement of the scientific and other events was due to the meticulous preparations of the organizing committee members (Sung-Chul Kim, chairman; Doo-Sung Lee, secretary general; and Kwang-Duk Ahn, chairman of the Program Committee), for which all participants were very thankful. And the support of this event by PSK was exceptional as shown by the active participation of most of the past presidents.

During the opening ceremony, I had the honor of delivering a congratulatory message, including a presentation on the activities of the IUPAC Polymer Division. My congratulations to the organizers and the Polymer Society of Korea for their successful organization of the conference and the 30th anniversary of the society.

Jung-Il Jin <jijin@korea.ac.kr> is the current president of the IUPAC Polymer Division. Jin is currently at Korea University, College of Sciences in the Department of Chemistry.

Green Chemistry

by Fabio Aricò

Dresden, an integral part of the River Elbe valley, is surely one of the most spectacular cities in eastern Germany. Its architecture and historical monuments offer a great variety of attractions to the almost 10 million tourists that visit annually. Dresden is also one of the greenest cities in Europe. Due to its magnificent landscapes and to far-sighted urban planning, 63 percent of the city is devoted to woods and green spaces. Thus, it should not be a surprise that this fantastic location was selected for the **First International IUPAC Conference on Green-Sustainable Chemistry**, held 10–15 September 2006.

The conference, initiated upon the launching of the IUPAC Green Chemistry Subcommittee, was conceptualized and planned by Consorzio Interuniversitario Nazionale "La Chimica per L'ambiente" (INCA) with the collaboration of the German Chemical Society. It was sponsored by the Deutsche Bundesstifung Umwelt and Bundesministerium fur Umwelt, Natursutz und Reaktorsicherheit and was organized under the auspices of IUPAC, the Italian Ministry of Research, and the German Federal Ministry of Environment, Nature Conservation and Nuclear Safety. Logistical aspects of the conference were planned by Wladimir Reschetilowski.

The conference kicked off with remarks by Pietro Tundo (president of INCA), Wolfgang F. Hoelderich (RWTH Aachen), and David StC. Black (secretary general of IUPAC). This was followed by the lecture of

Wolfgang Höelderich (left), Pietro Tundo, and David StC. Black.

Frank Ruff, who gave his outlook on "Social Change and Innovation in the 21st Century."

The week-long conference was divided into five topics:

I. Benign Synthesis Routes: heterogeneous catalysis, homogeneous catalysis, enzymatic catalysis, alternative solvents, new reagents, "end of pipe" technology
II. Future Green Energy Sources: hydrogen technology, fuel cell technology, biodiesel, energy saving
III. Use of Renewables: starch, cellulose, sugar, new detergents, biomass technology
IV. Benign Process Technology: micro-reactor technique, microwave technology, photo chemistry, new regulation devices
V. Education in Green Chemistry

The wide selection of topics was intended to attract industrial researchers and representatives, university educators and researchers, as well as politicians and students interested in green and sustainable chemistry. The enormous efforts of the organizing committee paid off, as 450 people from 42 countries attended the conference.

Each subtopic of the conference was presented by a keynote lecture delivered by an international expert in that field. Each day was divided into two parallel sessions, so that the overall number of presented lectures was almost 120.

The program also included two plenary lectures. The first, given by Jean-Marc Ané, of the Association Euratom-CEA, on "Will Fusion Ever Be a Safe, Clean and Sustainable Energy Source?" focused on the use of nuclear energy as a possible, future green energy source. The European Union is consuming more and more energy and importing more and more energy products since its energy production is insufficient to meet requirements. Ané showed that one of the most promising energy sources is nuclear power. Euraton, as part of its research on nuclear energy, is currently investigating the fusion of lithium with tritium to obtain two helium molecule (ITER Project). The energy derived from this process can be collected. The main advantage of this process is that it produces much less radioactive waste since no radio isotopic atoms are involved in the process. Ané believes that the European Union must maintain a leading position in the field of civil nuclear technology in order to retain the necessary expertise and develop more efficient fission reactors and enable fusion to become a reality.

Ryoji Noyori, Nobel Prize laureate for chemistry, 2001.

Ryoji Noyori, Nobel laureate in chemistry, delivered a fascinating plenary lecture titled "Pursuing Practical Elegance in Chemical Synthesis." Noyori discussed how the concept of Green Chemistry should not be seen as a matter of clear-cut scientific or technical expertise, but rather as a serious, complex social issue. In fact, he explained that the current standards of chemical synthesis need to be much improved. Many existing chemical processes, though beneficial, produce unwanted wastes along with the target products. He noted that the inefficient recovery of solvents

Group photo of participants in the 1st International IUPAC Conference on Green-Sustainable Chemistry.

is also an environmental problem. Noyori pointed out that every reaction should proceed with a high atom-efficiency, and the overall synthesis must be accomplished with a low E-factor, thereby minimizing the cost of waste disposal. Without such approaches, chemical manufacturing is unsustainable. Researchers must influence public opinion, Noyori said, in order to change government policies in favor of creating sustainable societies. On the scientific side, he noted, molecular catalysis plays a key role in achieving this goal. Noyori presented some enlightening examples of hydrogenation reactions that are ideal processes for Green Chemistry.

The conference also included two poster sessions in which the students discussed their latest results and achievements. More than 280 posters were presented, making it very difficult for the judging committee to chose the poster prize winners. Finally, two students were selected for the genuine interest they showed in their research, Maiko Kaneko, from the Japan Advanced Institute of Sciences and Technology, and Falsig Hanne from the Technical University of Denmark, Centre for Sustainable and Green Chemistry.

On the final day of the conference Tundo and Hoelderich remarked that the event had exceeded the expectations of the organizing committee. They also stressed that this big event should be considered an important starting point for collaboration between IUPAC and the Green Chemistry community. They concluded by inviting everyone to the second International IUPAC Conference on Green Chemistry, which will be held in September 2008 on a boat traveling from Moscow to St. Petersburg.

Fabio Aricò <fabio.arico@unive.it> works with Pietro Tundo in Venezia (Italy) where he is involved in a joint project between INCA and Imperial Chemical Industries PLC.

How to Apply for IUPAC Sponsorship

Conference organizers are invited to complete an Application for IUPAC Sponsorship (AIS) preferably 2 years and at least 12 months before the Conference. Further information on granting sponsorship is included in the AIS and is available upon request from the IUPAC Secretariat or online.

www.iupac.org/symposia/application.html

Occupational Health and Safety Management in East Africa

COCI Corner

by Kelvin Khisa

A three-day regional conference on **Occupational Health and Safety Management in East Africa** was held in Nairobi, Kenya, from 27–29 September 2006. It attracted over 120 participants, drawn mainly from industry, the service sector (hotels and hospitals), business associations, consultancy, NGOs, and academia.

This conference was sponsored by IUPAC, which provided some financial support. The IUPAC Committee on Chemistry and Industry (COCI) endorsed the event and Mark Cesa, COCI chairman, participated in the conference.

The conference featured 30 presentations by health and safety practitioners drawn from the UK, USA, Uganda, and Kenya. The well-attended conference also had two exhibitions by SGS and Bureau Veritas Quality International, two companies that provide certification services in health and safety management.

In recent years there has been increased emphasis in East Africa on the need to improve occupational health and safety (OH&S) in response to a marked increase in the number of work-related accidents. Public awareness of these accidents has provided a driving force for industry and allied activities to improve on their safety records. Local and national governments and the insurance industry are taking a hard look at safety in industry as a whole and the chemical industry in particular, and there has been a great increase in the amount of government regulation in this area. It is against this background that the conference was organized.

The conference aimed to enable industrialists and other stakeholders to appreciate the purpose of an OH&S management system, explain its enabling legal and regulatory framework, and explore the purpose and intent of OH&S Assessment Series (OHSAS) 18001/2. It was concluded that measures to improve health and safety should first eliminate hazards where practicable, then reduce risks as a second choice, and then mandate the use of personal protective equipment (PPEs) as a last resort.

Whereas industry in developed countries often takes OH&S issues very seriously, their counterparts

Participants in the Regional Conference on Occupational Health and Safety Management in East Africa that was held in Nairobi, Kenya, from 27–29 September 2006.

in the developing world do not do so. This is largely due to lack of awareness, non-enforcement of relevant safety laws and regulations, and a lack of a systematic structure that guides the establishment of sound OH&S management systems. The end result has been an uncoordinated approach to safety issues, a development that exposes workers to high levels of risks and hazards.

Although hazard elimination is the goal, experience has taught us that guaranteed, failure-free designs and devices have so far eluded mankind, despite his astonishing advances in knowledge and technology. Certainly all of us in our personal experiences have had many opportunities to reconfirm the wisdom of the admonition, "Plan for the best, but prepare for the worst." There is therefore an urgent need for developing country industrialists and key stakeholders to be exposed to OHSAS specifications that give requirements for an OH&S management system and enables organizations to control their full range of risks and hazards.

The presented papers covered a wide range of topics such as IUPAC's role in helping chemical industry contribute to sustainable development, wealth creation and the improvement of quality of life; the OHSAS certification process; the legal and regulatory framework for OH&S; OHSAS as a tool for enhancing industrial competitiveness; health and safety policy statements; accidents and first aid; the role of cleaner production in occupational health and safety management; responsible care in chemical production; hazard identification in chemical production; risk assessments in chemical production; systematic safety, health, and environment reviews; noise management in the work environment; and classification and labeling of hazardous substances. Additional presentations included Home Grown Solutions to Health and Safety Management; Fire Emergency Preparedness and Response; Management of Asbestos Materials; Material Safety Data Sheets; Work Place Safety and Welfare; Benefits of Acquiring OHSAS Certification: The GlaxoSmithKline Experience; Electrical Safety; and the Role of PPEs in Occupational Health and Safety Management.

The participation of Kenya and Uganda enabled the participants to share experiences and lessons learnt within the framework of the provisions of their respective legal and regulatory regimes. Video presentations during the conference from the UK helped conference participants to visibly appreciate the importance of having a functional OH&S system.

The conference also allowed for group discussions on following OH&S issues: institutional and enforcement frameworks; legal, regulatory, and policy regimes; emergency preparedness and response; technological shortcomings; capacity building; and research and development. It was unanimously agreed that there is a need for follow up activities after the execution of health and safety audits in selected companies in Uganda and Kenya. Specifically, these companies need help developing performance indicators that will guide the long term monitoring and evaluation program. Logistical arrangements that will enable the realization of this goal are underway.

The main sponsors of this conference were IUPAC and the United Nations Educational, Scientific and Cultural Organization, which works as a laboratory of ideas and a standard setter for the purposes of forging universal agreements on emerging ethical issues. The success of the conference demonstrates the emerging importance of public-private sector partnerships in the promotion of occupational health and safety issues in the region.

The next step is to embark on actual health and safety audits in Uganda and Kenya, once the logistical arrangements are finalized. This will be completed as part of IUPAC project <www.iupac.org/projects/2005/2005-046-1-022.html>.

Kelvin Khisa <kkhisa@cpkenya.org> was the conference organizer for this meeting. He is currently a deputy director at the Kenya National Cleaner Production Center in Nairobi. In August 2002, Kelvin Khisa was a fellow of the COCI Safety Training Program. His training included a visit to Sankyo Co., Ltd. production and research facilities in Japan.

Where 2B & Y

Asian Chemistry Education

30-31 July 2007, Taipei, Taiwan

The **2nd NICE Symposium (Network for Inter-Asian Chemistry Educators)** aims to promote communication among inter-Asian chemistry educators, encourage the exchange of chemistry teaching strategies and materials among different countries, and disseminate fruitful results.

The conference is intended to bridge the gap between chemistry researchers and chemistry teachers. Part of the conference will involve disseminating research results to the academic community. However, most of the conference is devoted to increasing opportunities for communication between theory and empirical teaching. The following discussion topics are based on the real needs of teachers:

- Representation of Textbooks
- Students' Conceptions and Conceptual Change
- Analysis of Classroom Discourse and Instructional Strategies
- Lab Activities
- Chemistry in Daily Life
- Use of Audio-Visual Aids in Classes
- Attitudes toward Chemistry

The conference welcomes teachers, professors, researchers, and graduate/undergraduate students who are interested in promoting chemistry education.

For more information, contact Dr. Jing-Wen Lin <jwlin@ntnu.edu.tw>, Graduate Institute of Science Education, National Taiwan Normal University.

http://science.gise.ntnu.edu.tw/nice2007

Emerging Chemical Regulatory Environment

World Chemistry Leadership Meeting, IUPAC 2007 General Assembly
10 August 2007, Torino, Italy

COCI Corner

The **2007 World Chemistry Leadership Meeting** will be held 10 August 2007 as part of the IUPAC General Assembly and 41st World Chemistry Congress in Torino, Italy. This year's WCLM will focus on the **emerging chemical regulatory environment and its effect on the basic chemical sciences, the chemical industry, and society.** Increasingly, regulation is being driven by health concerns arising from long-term exposures to low levels of chemicals in the real environment (i.e., where many different factors may be acting simultaneously, and possibly causing effects that might span generations). The regulatory lead that Europe is taking is strongly influencing thinking about chemical use and production throughout the world. The objective of the WCLM is to discuss the contributions IUPAC could make in bringing objective chemical science to help rationalize this new world of regulation.

See "The Chemical Industry and Sustainable Development" on page 8.

World Chemistry Leadership Meetings have been held at IUPAC General Assemblies since 2001. Each has been a forum for leaders of national chemical societies and regional chemical federations, senior government officials, and leaders of the chemical industries to discuss topics of importance and international or global impact.

IUPAC has an obvious interest in the development of the chemical sciences and the regulatory environment in which they are deployed by industry. The purpose of the 2007 WCLM will be to share views on the health and environment issues facing both science and industry in the context of the European Union's REACH (Registration, Evaluation, Authorization of CHemicals), UNEP's SAICM (Strategic Approach to International Chemicals Management), and industry responses through the Global Product Strategy and Responsible Care. In particular, developing aligned or joint perspectives on the safety and use of chemicals, including both the intentional and unintentional exposures workers and consumers face, is seen of great importance. Along these lines, IUPAC has previously organized critical reviews of endocrine disrupting chemicals that helped move the science forward significantly and provided new perspectives. It is a goal of this year's WCLM to identify ideas for IUPAC-sponsored and –supported projects, related to the regulatory environment, that can benefit science and industry.

The WCLM will include talks on the following topics:

- regulatory trends such as REACH and SAICM
- industry issues and responses
- emerging issues—views from industry and academia

The talks will be followed by an open, moderated panel discussion in which all attendees will be encouraged to participate. To date, Rainer Koch (of ICCA and formerly of Bayer, lead industry negotiator for SAICM) has agreed to speak of the changing world of chemicals regulation. Dr. Jeff Lewis, chief medical officer of Rohm and Haas, will speak on chemical industry response through Responsible Care and Global Product Strategy. John H. Duffus of The Edinburgh (Scotland) Centre for Toxicology has agreed to speak on "The Need for Better Science in Regulatory Toxicology," and Richard Philips Sr., a toxicologist from ExxonMobil, will speak on emerging health issues arising from factors in the environment. In addition, panelists are being invited from WHO, UNEP, and the medical sciences to help broaden the perspective of the extended discussion.

Organizers of the 2007 WCLM are Leiv Sydnes, past-president of IUPAC; Mark Cesa, chair of the IUPAC Committee on Chemistry and Industry (COCI); and Colin Humphris, titular member of COCI and until recently the executive director of research and science at Cefic (The Chemical Industry Association in Europe).

Participants at the IUPAC Congress should note that a Workshop on the COCI Safety Training Program will take place Tuesday 9 August, as part of Congress session 10—see Congress Program for more details.

Registration is required. For further information, please contact the IUPAC Secretariat at <secretariat@iupac.org>.

www.iupac.org/symposia/conferences/ga07

MacroMolecular Complexes

27–31 August 2007, Fukuoka, Japan

The **12th IUPAC International Symposium on MacroMolecular Complexes (MMC12)** will be held 27–31 August 2007 at Fukuoka International Congress Center in Fukuoka, Japan. The MMC Symposium brings together leading scientists and engineers to discuss the latest advances in macromolecular complexes, which include macromolecule-metal complexes, polynuclear complexes, capped metal nanoparticles, organic-inorganic hybrids, supramolecular complexes and self-assembled materials, and polyelectrolytes. In addition to syntheses and characterization of those materials, the conference will deal with various conductive, photophysical, catalytic, electronic, optical, magnetic, and biological properties and functions.

The series of MMC symposia have previously been held in Beijing (1985), Tokyo (1987), New Jersey (1989), Siena (1991), Bremen (1993), Kuang-chou (1995), Leiden (1997), Tokyo (1999), New York (2001), Moscow (2003), and Pisa (2005).

The conference will feature plenary lectures, invited lectures, and contributed posters with a short oral preview. In addition to the invited guest lectures, about 25 invited lectures will be selected by the Scientific Committee from poster applications. Proceeding of MMC-12 will be published in *Macromolecular Symposia*. English will be the working language of the conference.

Fukuoka, the largest city on Kyushu Island, is located southwest of Japan Islands. Exciting places such as Dazaifu, Mt. Aso, Mt. Sakurajima, and Nagasaki are close to Fukuoka. A half-day excursion is planned for the afternoon of 29 August 2007 to the "God of Learning" at Dazaifu Tenmangu Shrine, Komyozenji Temple, and the Kyushu National Museum.

See Mark Your Calendar on page 40 for contact information.

www.ed.yama.tus.ac.jp/~mmc-12/

Mendeleev Congress

23–28 September, Moscow, Russia

The **XVIII Mendeleev Congress on General and Applied Chemistry** will be held 23–28 September 2007 in Moscow, Russia. The Congress is organized by the Russian Academy of Sciences in cooperation with the Ministry of Education and Science of the Russian Federation and Moscow Government. The Mendeleev Congress, which is the most prestigious national meeting of Russian chemists, also embraces leading chemists and technologists from all over the world.

The scope of the XVIII Mendeleev Congress covers all the major trends and problems of modern chemistry. The program includes plenary and invited lectures as well as oral and poster communications in the areas of pure and applied chemistry, materials science, chemical technology, and chemical education.

This congress will be dedicated to the 100th anniversary of Mendeleev Congresses in Russia. Co-chairmen of the Organizing Committee are Yu.S. Osipov (president of the Russian Academy of Sciences), Yu.M. Luzhkov (mayor of Moscow and a chemist!), and A.A. Fursenko (minister of Education and Science of the Russian Federation). More than 1 500 scientists and distinguished chemical leaders are expected to attend.

Plenary speakers will include Nobel Prize laureates J.I. Alferov (Russia) and J.-M. Lehn (France), ISCU President G. Mehta (India), IUPAC President Bryan Henry (Canada), Moscow Mayor Yu. Luzhkov, Executive Vice-President of the Chinese Academy of Sciences Chunli Bai (China), Vice-President of the Russian Academy of Sciences N. Platé, RCS President P. Sarkisov, Seaborg Institute Director D.L. Clark (USA), RSC Director of Science and Technology R. Townsend (UK), and full members of RAS E. Kablov, A. Miroshnikov, V. Parmon, and A. Tsivadze.

The organizing committee has planned an extensive scientific program, accompanied with various exciting social events, exhibitions, round table discussions, and visits to research centers in Moscow, as well as several tours to St. Petersburg and other historical places in Russia.

See Mark Your Calendar on page 40 for contact information.

www.chemend.ru

Physical Organic Chemistry

30 September–5 October 2007, Córdoba, Argentina

The **9th Latin American Conference on Physical Organic Chemistry (CLAFQO 9)** will be held in the pleasant surroundings of Córdoba, Argentina, where a peaceful countryside in the foothills of the Sierras Chicas Mountains offers an appropriate atmosphere for the event.

The conference, organized by researchers from the National Universities of Córdoba and Río Cuarto, Argentina, is sponsored by IUPAC, SAIQO (Argentine Society of Organic Chemistry Research) and AAIFQ (Argentine Association of Physicochemical Research). It is financially supported by FONCYT (Agencia Nacional de Promoción Científica y Tecnológica) and CONICET (Consejo Nacional de Investigaciones Científicas y Técnicas) of Argentina. The previous five conferences were held in Florianopolis, Brazil (2005, 2003 and 1998), Isla de Margarita, Venezuela (2001), and Viña del Mar, Chile (1999). In 1998, CLAFQO 4 was held together with the 14th IUPAC Physical Organic Conference.

The scientific program is intended to cover most areas of modern research in physical organic chemistry and its interplay with other fields of science. The main topic areas include organic photochemistry; supramolecular chemistry; reactions in the gas phase, in solution, and in organized systems; reaction dynamics; organic nanostructuration; bio-organic chemistry; electron transfer; radical chemistry; and molecular modeling.

See Mark Your Calendar on page 40 for contact information.

www.fcq.unc.edu.ar/claf9

Food Security in Africa

2–5 December 2007, Stellenbosch, South Africa

Stellenbosch University will host **CHEMRAWN XII**, an international conference on the role of chemistry in sustainable agriculture and human well-being in Africa. The conference, which will take place 2–5 December 2007 in Stellenbosch, South Africa, is part of the CHEMRAWN series of conferences. CHEMRAWN, or Chemical Research Applied to World Needs, is a Standing Committee of IUPAC.

The conference has already attracted recognized scientists from various African countries and elsewhere as speakers and workshop presenters. The keynote address will be delivered by Pedro Sanchez, a former recipient of the World Food Prize and currently the director of Tropical Agriculture at the Earth Institute, Columbia University.

The academic program will focus on improving the quality of life of the peoples of Africa through the provision of adequate food, with specific attention to the role of chemistry. The goals of the program are as follows:

- come to a better understanding of sustainable agriculture in Africa in a globalized market
- develop a systems approach to optimizing food provision in Africa
- utilize high technology in ensuring food security in Africa
- highlight chemistry as a core science for food security in Africa
- take advantage of agricultural produce from Africa as a source of high value and niche products
- promote science-based capacity development at universities as a prerequisite for food security in Africa

The conference organizers endeavor to attract top scientists, research students, industrialists, and policymakers involved in the food chain in Africa to the conference and to ensure that the findings of the conference are well communicated and acted upon.

Pieter Steyn, chairperson of the conference organizing committee, says: "The holding of CHEMRAWN XII is most timely as evidenced by recent events. The provision of safe and adequate food is very high on the political and economic agenda in Africa and the proposed scientific program coincides with Africa's Science and Technology Consolidated Plan of Action."

Interested persons are invited to visit the conference website, or to contact the secretary of the conference organizing committee, Christoff Pauw <cpauw@sun.ac.za> for more information.

See Mark Your Calendar on page 40 for contact information.

www.chemrawn.co.za

Space Research

13–20 July 2008, Montreal, Canada

The **37th COSPAR Scientific Assembly and 50th Anniversary Celebration** will be held from 13–20 July 2008 in Montréal, Quebec, Canada. COSPAR is the Committee on Space Research of the ICSU, now the International Council for Science. COSPAR's objectives are to promote on an international level scientific research in space, with emphasis on the exchange of results, information and opinions, and to provide a forum, open to all scientists, for the discussion of problems that may affect scientific space research.

The conference will feature approximately 85 meetings covering a wide range of topics, including Earth's Surface, Meteorology, and Climate; Upper Atmospheres of the Earth and Planets; Materials Sciences in Space; Fundamental Physics in Space; Satellite Dynamics; Potentially Environmentally Detrimental Activities in Space; and Space Weather, among many others.

Papers from the conference will be published in *Advances in Space Research*.

www.cospar2008.org or www.cospar-assembly.org

ORGANISATION FOR THE PROHIBITION OF CHEMICAL WEAPONS

ACADEMIC FORUM

18 - 19 September 2007

World Forum Convention Centre
The Hague, The Netherlands

The year 2007 marks the 10th anniversary of the entry into force of the Chemical Weapons Convention (CWC). This anniversary provides a special occasion to publicly renew commitment to the multilateral treaty system and to the object and purpose of the CWC.

The OPCW Academic Forum is an integral part of a wider initiative by OPCW to celebrate this anniversary and to promote the public interest in the work and achievement of the OPCW. Scholars, policymakers and others with an interest in CWC are invited to take part in this academic event.

KEYNOTE SPEAKERS

Jayantha Dhanapala

Rolf Ekéus

FORUM TOPICS

Elimination of CW stockpiles – progress, outlook and challenges
The future of chemical weapons non-proliferation
The CWC and advances in science and technology
The OPCW in a post-CW, (almost) chemical weapons free world

Interested? Please visit our website for more information on the OPCW academic forum and registration to the event. Registration closes July 16th 2007.

www.opcwacademicforum.org

Mark Your Calendar

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

2007 (later than 15 June)

IUPAC poster prizes to be awarded

26–30 June 2007 • Advanced Materials • Kharkiv, Ukraine
Modern Physical Chemistry for Advanced Materials (MPC'07)
Prof. Yuriy Kholin, Materials Chemistry Department, V.N. Karazin Kharkiv National University, Svobods Square 4, Kharkiv 61077, Ukraine, Tel.: +380 57 707 51 26, Fax: +380 57 705 12 61, E-mail: kholin@univer.kharkov.ua

8–11 July 2007 • Medicinal Chemistry • Istanbul, Turkey
6th AFMC Medicinal Chemistry Symposium (AIMECS 07)
Prof. Ismail Yalcin, Faculty of Pharmacy, Ankara University, Ankara, TR-06100 Turkey, Tel.: +90 312 223 92 53, Fax: +90 312 223 69 40

8–12 July 2007 • Greenhouse Gases • Ontario, Canada
CHEMRAWN XVII and ICCDU-IX Conference on Greenhouse Gases—Mitigation and Utilization
Dr. Gary van Loon, Department of Chemistry, Queen's University, Kingston, ON K7L 3N6, Canada, Tel.: +1 613-533-2633, Fax: +1 613-533-6669

8–12 July 2007 • Polymers and Advanced Materials • Cracow, Poland
IXth International Conference on Frontiers of Polymers and Advanced Materials
Prof. Jan Pielichowski, Cracow University of Technology, ul. Warszawska 24, Krakow, 31155, Poland, Tel.: +48 12 6282719, E-mail: pielich@usk.pk.edu.pl

8–12 July 2007 • Nanostructured Polymers • Prague, Czech Republic
2007 Prague Meetings on Macromolecules (70th PMM)—46th Microsymposium "Nanostructured Polymers and Polymer Nanocomposites"
Prof. Libor Matejka, Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic, Heyrovsky Sq. 2, CZ-16206 Prague 6, Czech Republic, Tel.: +420 (2) 9680-9281, Fax: +420 (2) 9680-9410, E-mail: matejka@imc.cas.cz

15–20 July 2007 • Heterocyclic Chemistry • Sydney, Australia
21st International Congress of Heterocyclic Chemistry
Dr. Kate Jolliffe, School of Chemistry, The University of Sydney, Sydney NSW 2006, Australia, Tel.: +61 2 9351 2297, Fax: +61 2 9351 3329, E-mail: jolliffe@chem.usyd.edu.au

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

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

2–6 August 2007 • Organometallic Chemistry • Nara, Japan
14th International Symposium on Organometallic Chemistry Directed Towards Organic Synthesis (OMCOS-14)
Prof. Koichiro Oshima, Department of Material Chemistry, Graduate School of Engineering, Kyoto University, Kyoto-daigaku katsura, Nishikyo-ku, Kyoto 615-8510, Japan, Tel.: +81-75-383-2437, Fax: +81-75-383-2438, E-mail: oshima@orgrxn.mbox.media.kyoto-u.ac.jp

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

5–11 August 2007 • IUPAC 41st Congress • Torino, Italy
Chemistry Protecting Health, Natural Environment, and Cultural Heritage
E-mail: IUPAC.2007@unito.it <www.iupac2007.org>

26–31 August 2007 • Plasma Chemistry • Kyoto, Japan
18th International Symposium on Plasma Chemistry
Mr. Tatsura Shirafuji, International Innovation Center, Kyoto University, Kyoto-Daigaku-Katsura, Nishikyo-Ku, Kyoto, 615-8520 Japan, Tel: +81 75 383 3052, Fax: +81 75 383 3031

Mark Your Calendar

27–31 August 2007 • Macromolecular Complexes • Fukuoka, Japan
12th IUPAC International Symposium on Macromolecular Complexes (MMC-12)
Dr. Naoki Toshima, Department of Materials Science & Environmental Engineering, Tokyo University of Science, Yamaguchi, SanyoOnoda-shi, Yamaguchi 756-0884, Japan, Tel.: +81 836-88-4561, Fax: +81 836-88-4567, E-mail: toshima@ed.yama.sut.ac.jp

2–7 September 2007 • Ionic Polymerization • Kloster Banz, Germany
International Symposium on Ionic Polymerization
Prof. Axel Müller, MC II/NW II, Universität Bayreuth, D-95440 Bayreuth, Germany, Tel.: +49 921 553399, Fax: +49 921 553393, E-mail: ip07@uni-bayreuth.de

23–28 September 2007 • Transactinide Elements • Davos, Switzerland
Third International Conference on the Chemistry and Physics of the Transactinide Elements (TAN'07)
Prof. H.W. Gäggeler, Paul Scherrer Institut, Radio- und Umweltchemie, CH-5232 Villigen, Switzerland, Tel.: +41 (0)56 310 24 01, Fax: +41 (0)56 310 44 35, E-mail: heinz.gaeggeler@psi.ch

23–28 September 2007 • Mendeleev Congress • Moscow, Russia
XVIII Mendeleev Congress on General and Applied Chemistry
Prof. Natalia P. Tarasova, D. Mendeleev University of Chemical Technology, Miusskaya Square, 9, RU-125047 Moscow, Russia, Tel.: +7 495 9732419, Fax: +7 495 2004204

30 September–5 October 2007 • Physical Organic Chemistry • Los Cocos, Cordoba, Argentina
9th Latin American Conference on Physical Organic Chemistry (CLAFQO 9)
Prof. Elba I. Bujan, Dpto. de QuÃmica Organica, Universidad Nacional de Cordoba—INFIQC, Fac. de Ciencias Quimicas, Medina Allende y Haya de la Torre, X5000HUA, Argentina, Tel.: +54 351-4334170, Fax: +54 351-4333030, E-mail: elba@fcq.unc.edu.ar

1–3 October 2007 • Systems for Energy Conversion • Moscow, Russia
International Conference and Exhibition "Molecular and Nanoscale Systems for Energy Conversion"
Prof. Sergey Varfolomeev, Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, Kosygin St. 4, Moscow 119991, Russia, Tel.: +7 495-137-6420, Fax: +7 495-137-4101

17–21 October 2007 • Novel Materials • Shanghai, China
3rd International Symposium Novel Materials and their Synthesis (NMS-III)
Prof. Yuping Wu, Department of Chemistry, Fudan University, Shanghai, 200433 China, Tel.: +86 21 55664223

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

Mark Your Calendar

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

28 July–1 August 2008 • Photochemistry • Göteborg, 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

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

The Whole of Nature and the Mirror of Art

Images of Alchemy from the Roy G. Neville Historical Chemical Library

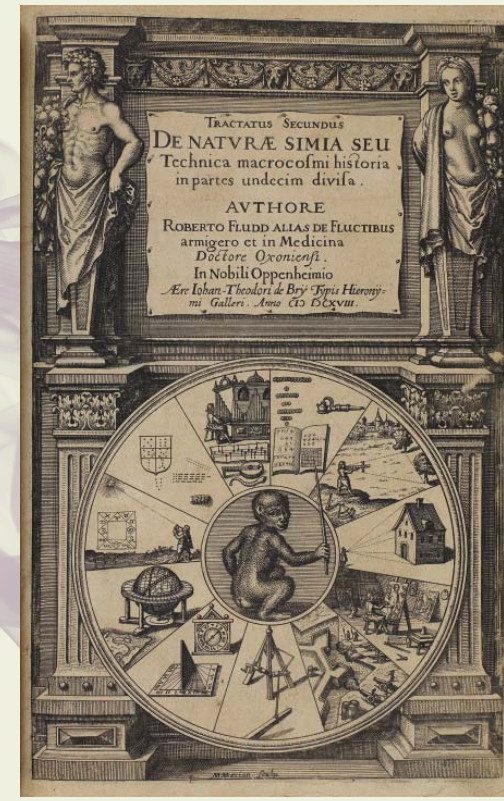
Alchemy was intriguing, inspiring, and mystifying to early modern society, and the engaging duality of its nature continues to fascinate today: it can be seen as a practical laboratory exercise and a powerful metaphor of change and transformation, as an exercise of human power in the natural world, and as a philosophical search for the inks that bind diverse aspects of the universe.

The Chemical Heritage Foundation (CHF) acquired the Roy G. Neville Historical Chemical Library in early 2004. The collection spans six centuries of print and contains over five thousand titles dealing with all aspects of chemistry and closely related subjects.

Alchemy is extremely well represented in the Neville collection and that is Alchemy's role in art that is highlighted in the CHF exhibit The Whole of Nature and the Mirror of Art. The permanent exhibit is hosted at CHF, in Philadelphia, Pennsylvania, USA. A brief preview will be on display during the IUPAC Congress, in Torino, from 4–12 August 2007.

To order images from this exhibit, or from the entire Roy G. Neville Historical Chemical Library, please contact <digitallibrarian@chemheritage.org>.

www.chemheritage.org



DE NATURÆ SIMIA [Of the Ape of Nature]
Engraved by Matthias Merian (1593–1650)
Robert Fludd, Utriusque cosmi historia [The History of Both Worlds], Oppenheim: Johann Theodor de Bry, 1617