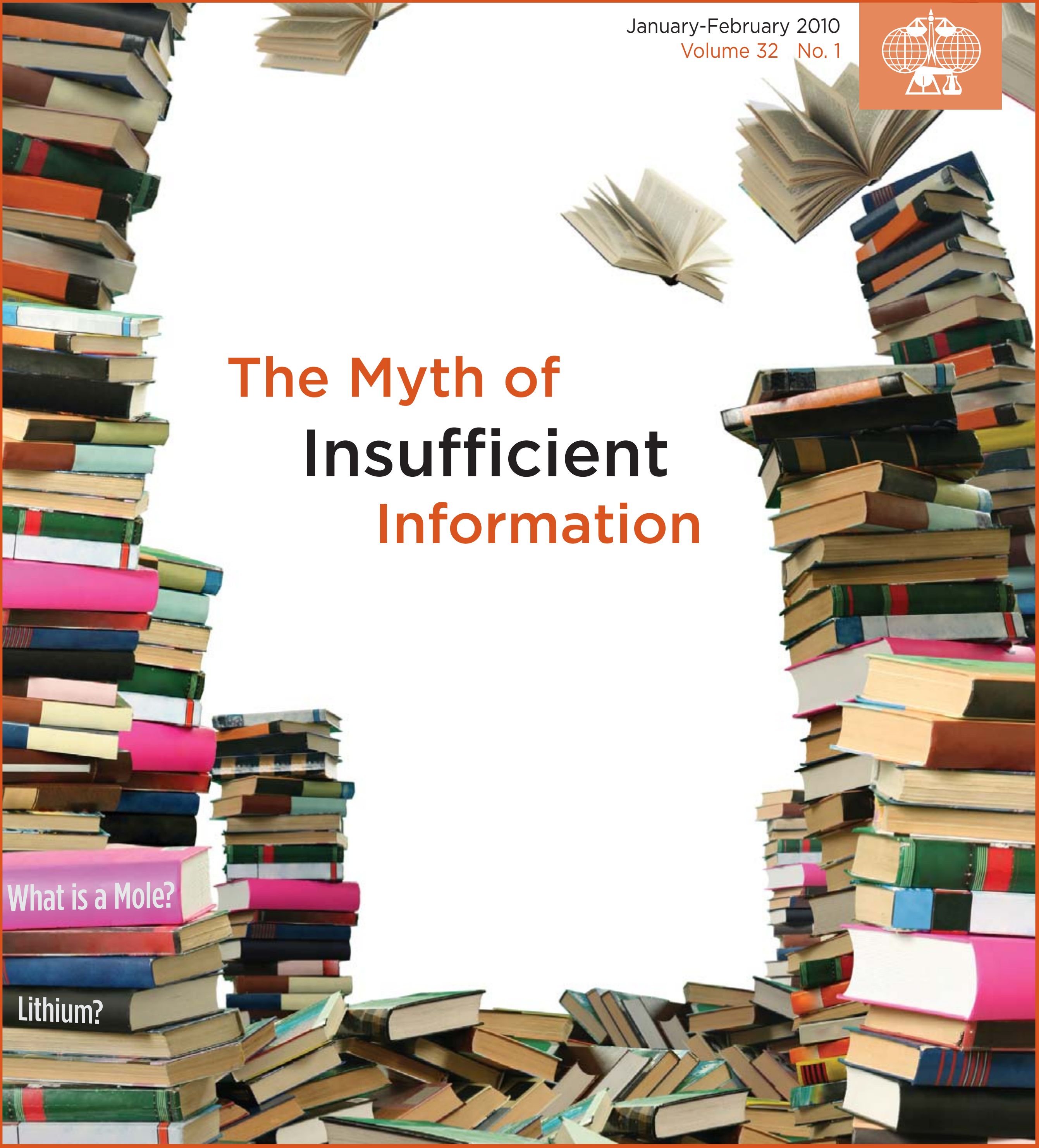
The News Magazine of the
International Union of Pure and
Applied Chemistry (IUPAC)

CHEMISTRY International

January-February 2010
Volume 32 No. 1



The Myth of Insufficient Information

What is a Mole?

Lithium?

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www.iupac.org/publications/ci

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Printed by:
Cadmus Communications, Easton, PA, USA

Subscriptions
Six issues of *Chemistry International* (ISSN 0193-6484) will be published bimonthly in 2010 (one volume per annum) in January, March, May, July, September, and November. The 2010 subscription rate is USD 110.00 for organizations and USD 50.00 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.

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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

There are many ways to close a year and to begin a new one. This year, I chose to walk down memory lane by instituting my own miniupac awards. In looking back at 2009, I tried to recall a few simple, lasting things that made up my IUPAC year.

In the *meeting* category, the winner is the Bit Group, based in Cambridge, Massachusetts, USA; none of you have met these folks, but they are the web guys/girls who designed the IYC website. I had a great time working with them all year round. (If you have not visited www.chemistry2011.org recently, check it out for yourself!)

In the *conference* category, the '09 miniupac award goes to the IUPAC Congress in Glasgow, UK; our colleagues at the RSC did everything they could and more to make that event memorable. Most of you were there, but if you want more of Glasgow, just plan to go to Macro2010!

In the *not-so-easy topic* category, I give the award to the mole and its porte-parole, Professor Ian Mills. This effort started with Mills' feature in the March-April 2009 *CI* issue and was followed up in Glasgow with his presentation at the meeting of the Interdivisional Committee on Terminology, Nomenclature and Symbols. For the next chapter in the story, turn to the article on page 6.

In the *keeps-getting-better* category, I will put *PAC* under the spotlight. The journal *Pure and Applied Chemistry* continues to undergo changes and to transform itself into a contemporary scientific journal with both a timely online release and traditional printed version. Since 2009, the journal has been publishing "As Soon as Publishable" articles online before they appear in the print version—one of numerous new features to be found in *PAC*.

In the *he-is-ready* category, I give the award to incoming Division VIII President Richard Hartshorn, most likely the youngest-ever DP in IUPAC history (fact not checked). Regardless, he has already shown he is well suited for the job—see him all geared-up in the March-April 2009 *CI*. Good luck Richard!

In the *most-used-TLA* (three-letter acronym) category, there was no contest: IYC is the absolute winner and likely to be again this year and next.

Now, the last of the miniupac '09 awards is for the *coolest and simplest online tool*: The award goes to **goldify**. Despite the name, this is not one of James Bond's latest gadgets. It is simply a pure and applied IUPAC product based on the Gold Book. Paste your text into the magic box and voilà, in return your text appears with all Gold Book terms underlined and linked to their definitions. Try it at <http://goldbook.iupac.org/goldify.py>. This tool was developed by Bedrich Kosata and among various uses, it is applied automatically to all abstracts of *PAC*. So, enhance your online content by transforming your text into gold!

With that, I hope to see you in *CI* (or in Boston), and have a pure and happy chemistryear!

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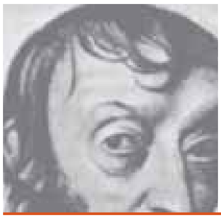

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President's Column

". . . for the times they are a-changin"

by Nicole Moreau

"Come writers and critics who prophesize with your pen . . ."* Fortunately, you don't need to be a prophet to know that in IUPAC even and odd years have important differences. In the even years—like this one—membership changes take place that were approved the previous year.

As IUPAC is a dynamic organization, with a changing and growing membership, efforts are periodically made to improve its functioning. The changes carried out for this purpose are generally not abrupt, but smooth. For instance, in 1999 the establishment of the project system was a huge modification, but the Finance Committee's proposal to add unspent project funds to the Strategic Opportunity Fund helped ease the transition. The smaller changes can make a major difference too: The Streamline Committee's suggestion to make a detailed agenda for meetings has greatly improved their efficiency. And I could cite more examples, such as the round table experiment at the 2007 GA in Torino, now fully adopted, or the Union's further involvement in the International Chemistry Olympiad.

Odd years at IUPAC involve an important event: Council's election of a new vice president at the General Assembly. For Council members, this may seem like a small change that results in a new public face for the Union. However, for the officers, Executive Committee, Bureau, executive director, and staff of the Secretariat, the changes following the elections are a necessary disruption. For the Secretary General and the Treasurer, whose terms are for four years and renewable for another four, a new vice president every two years is still a major change.

Since the IUPAC president's "life expectancy" is only two years, the officers of the union play a bit of musical chairs every January of an even year. With the arrival of the new vice president the former vice president becomes president, the president becomes past president, and the past president retires. IUPAC was certainly smart to institute the role of past president since it would be a little embarrassing and sad for the incoming president to push out the former president. Fortunately, with the former president on the scene, the new president can benefit from his/her experience. In my case, I look forward to benefitting from our past president's cheerful nature and highly efficient and energetic style. Clearly, I won't be alone on the dreadful "Dr. Moreau's Island" because I know that I can count on my predecessor as well as the more "stable" elements of the Union, which include Secretary General David Black, Treasurer John Corish, Executive Director John Jost, and the Secretariat staff.

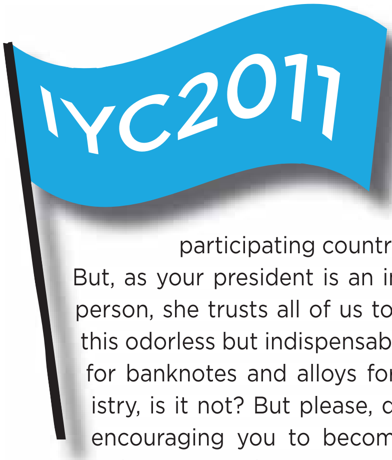
Of course, the president is not the only "fresh blood." As the newest of the officers, incoming vice presidents are hopefully less sceptical or blasé. This year, what an unusual and interesting situation as the incoming president is European and the past president and vice president are Asian! But as times are changing, I'll lose my mentor of sorts who was president when I became an officer and who was so friendly, so helpful, and so reliable. This is, of course, Bryan Henry, whom IUPAC will greatly miss. Fortunately, Bryan has professional reasons to stay in touch with us; since he is still the IUPAC representative on ICSU, our relationship will be sustained.

Despite what some detractors might say, life within IUPAC will change after IYC.

There is another change coming, and a very big one: Remember, a year ago, in November 2008, we were all awaiting word on the UN's decision about the International Year of Chemistry. And since we were told that some months would pass before the UN would give its advice, following the favorable one from UNESCO, we were not really in a state of expectation. Yet, just before the end of the year, on 30 December, the UN's declaration of the 2011 International Year of Chemistry arrived, as a beautiful New Year's gift. So, now that we are in the throes of preparing for IYC, the change I refer to is upon us: Despite what some detractors might say, life within IUPAC will change after IYC.

After 2011, the vessels of the Union will flow with a vivid new fluid. For so long, so many of us in IUPAC have said "we have to change the public image of chemistry, we have to more deeply involve industry, we have to make politicians know what chemistry can do to sustain our world, and we have to convince young people that chemistry can be their future and can provide them with useful and exciting jobs." Now that the opportunity is here, we must take full advantage. I am rather confident, when I see, through meetings, discussions, or e-mail exchanges, both globally and in my own country, how deeply most Adhering Organizations and chemical societies are involved. In addition, I am encouraged to see the numerous ideas for celebrating the year that have arisen from all corners of the world.

> *. . . I am imploring you to find ways to diversify and increase our funding sources, to be able to successfully fund IYC celebrations.*



Of course, the big problem, particularly in the midst of an economic downturn, is the funding for each participating country and for IUPAC itself. But, as your president is an indefectibly optimistic person, she trusts all of us to successfully manage this odorless but indispensable material. The paper for banknotes and alloys for coins—this is chemistry, is it not? But please, do not think that I am encouraging you to become counterfeiters, but rather I am imploring you to find ways to diversify and increase our funding sources, to be able to successfully fund IYC celebrations.

I wish all of you a very happy, fruitful, and active New Year, the last one before the arrival of the first-ever international year of chemistry! And "Keep your eyes wide open. The chance won't come again."*

Nicole J. Moreau <nj.moreau@free.fr> is IUPAC president starting this January 2010. She has been an elected member of the Bureau since 2000, a member of the Executive Committee since 2006, and vice president for 2008-2009. She is also general secretary of the French National Committee for Chemistry.

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*The Times They Are a-Changin is singer-songwriter Bob Dylan's third studio album, released in January 1964 by Columbia Records.

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(Executive Committee members are denoted in bold).

The Myth of Insufficient Information*

by Terry Clayton

Pick any topic. It could be as broad as "conservation" or as specific as the reproductive cycle of *Viverricula indica*. Chances are good that at the next meeting or workshop you attend or in the next report you read, you will hear or read a claim that "we have insufficient information" on the subject and "there is, therefore, a need for more research." This always sounds like a reasonable claim, partly because everybody at these meetings likes doing research and so—if a little is good, more is better. The problem is that every time I hear this, my mind's eye ashes up images of thousands of studies and reports I have seen gathering dust on library shelves throughout the region and elsewhere. I always want to stand up and say, "Don't you mean perhaps that we simply don't know of or don't have convenient access to many of the studies that do exist?" I don't though. It would be like asking Barack Obama to give tax cuts to the rich.

Do researchers make sufficient use of the information we already have? I suspect that in some fields, particularly the "hard" and life sciences, they may. I know that in social sciences and "development" research, there is room for improvement. Why should this be so? Perhaps the first reason is the one I already mentioned. The people who attend the kind of meetings where people present research tend to be the kind of people who like doing research. For one thing, you can get money for doing research. You don't get money for doing literature searches.

Searching the literature has no sex appeal. Research, however, is *A Noble Calling*. When people ask, "What do you do?" an exciting and impressive response is, "I'm conducting a biodiversity survey in Southern Laos" or "I'm measuring sediment loads in tributaries of the Mekong." A not exciting and unimpressive response is, "I'm searching libraries for previous studies on sediment loads." It's the difference between, "I drive a Lexus" and "I drive a Nissan Sunny."

Doing research is taking action. That action might be long hours in a lab, long days knee deep in marshes and swamps, or long weeks trekking around the backwaters of poor developing countries. Action means "doing something about the problem," whatever the problem is. Poring through old research reports is tedious and boring and hard to reconcile with "doing something about the problem."

I have yet to attend a conference of experts when I don't hear half a dozen speakers proclaim that their research is . . .urgently needed to influence ***policy.***

Then there is the relevance issue. I have yet to attend a conference of experts when I don't hear half a dozen speakers proclaim that their research is *vital* to decision makers or *urgently needed to influence policy.* I'm not convinced this is true. Most of the researchers I know would not recognize a "policy maker" if one bit them on the ankle. Researchers seldom have to make any of the big decisions. As a researcher, my job is done when I hand in my report. If somebody acts on the results, I can bask in the reflected glory. If they don't, I get the satisfaction that comes from complaining about the stupidity of people who don't see the importance of my research.

I am not against research. I am against uninformed researchers. Uninformed researchers write up fat project proposals and go rushing off, gathering data, and having a great old time and have absolutely no interest in what anybody has done before them because that might spoil the fun. Let me give an example.

A regional river basin organization I know of wrote up a project that required hiring lots of very expensive international consultants to come and travel around four countries and talk to lots of people and conduct lots of expensive national and regional workshops and write up guidelines for conducting environmental

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*This article first appeared in the August 2009 issue of *Chemistry in Australia*; Volume 76, Issue 7; Aug 2009; 19–21. It is reprinted here with permission.

impact assessments in tropical climates. The rationale was that the existing guidelines applied to temperate climates and new relevant guidelines were necessary to inform decision makers and influence policy. I happened to be working for this organization at the time in the same unit. Since I had more time on my hands than things to do, I thought to myself, "I wonder if anyone has done anything along these lines before?" Over the course of a few days, I did a quick and dirty search of the available literature and this is what I found:

- a book published by the same river basin organization in 1989: *Environmental Impact Assessment in Tropical Ecosystems*
- reports on several workshops with lists of participants' names, many who were still working for the same ministries but in higher positions
- a list of names of people on a national environmental group in one of the four countries, all now in more senior positions.

I handed my little bibliography over to the lead consultant and got a mumbled "thanks very much, this will be very useful" and never heard a word about it again. Nor did I see any reference to it in their final report. They already had their work plan and their travel plan and probably had the guidelines half written as well. I might as well have handed them a closet full of skeletons.

My point is this: Before investing scarce resources in yet more surveys and studies on any particular topic, it would be prudent to stop and conduct a comprehensive search of the existing literature, including the gray literature in languages other than English. A literature search helps clarify where the existing gaps in our knowledge actually lie so we can target our efforts and resources more effectively. It also helps bring to light other dimensions of the problem.

That a gap exists is not a sufficient rationale for filling it. Too many development research projects are driven by the personal interests of the researchers. Resources for research and information gathering are limited and the agents driving development are not going to put their plans on hold while advocates of sustainable development conduct more surveys and impact studies. Time, effort, and money need to be directed towards activities that have the most chance of achieving the development goals of a project. If a research study or a habitat survey seems the most effective way of achieving a particular goal, then it should be done. If those same resources would have more impact helping villagers learn to engage more effectively with district and provincial authorities or learn new livelihood skills, those surveys may be a waste of time and effort.

Funding agencies need to take more responsibility by insisting that proposals include a review of the relevant literature. Agencies are demanding more evidence of impact, but they should not forget the "front end" and ask for a review of what impact has already been achieved. Teaching faculty and thesis and dissertation advisors at universities need to put more emphasis on the literature review. Most of the "reviews" I have seen are nothing more than a cut-and-paste catalog: "I read Jones (2005) and he said [cut-and-paste]; I read Smith et al. (2006) and they said [cut-and-paste]."

With more people doing more research than ever before, the task of searching for relevant work can be overwhelming, but we also have more sophisticated tools to help us. With the enormity and complexity of the problems facing our world, we can no longer afford the luxury of redundant research. In the meantime, I am waiting to hear some presenter at a conference say, "I have searched all the available literature I could find and we don't have sufficient information on . . ."

Terry Clayton <t.clayton@cgiar.org> is a writer with the Information and Knowledge Group of the International Water Management Institute.

What is a Mole?

Old Concepts and New

In the March-April 2009 issue of Chemistry International, *Ian Mills and Martin Milton reviewed concepts familiar to chemists: the quantity "amount of substance" and its unit, the "mole." They also presented a possible new definition for the mole. The reasoning behind the possible new definition is currently being debated in the community. The IUPAC Interdivisional Committee on Terminology, Nomenclature and Symbols was invited to review the question during its recent meeting in Glasgow in August 2009.* CI *asked the ICTNS Chair Jack Lorimer to recap the issue.*

by Jack Lorimer

The current definition of the base unit for the SI base quantity "amount of substance," the "mole," was adopted in 1971 by the CGPM (Conférence Générale des Poids et Mesures). The CGPM is the body in charge of maintaining the International System of Units (SI), in accordance with the requirements of the Metre Convention, which is the legal basis for use of the SI in the many countries that subscribe to the convention. The definition reads:[1]

1. The mole is the amount of substance of a system which contains as many elementary entities as there are atoms in 0.012 kilogram of carbon 12; its symbol is "mol".
2. When the mole is used, the elementary entities must be specified and may be atoms, molecules, ions, electrons, other particles, or specified groups of particles.
3. (Addendum in 1980) In this definition it is understood that unbound atoms of carbon 12, at rest and in their ground state, are referred to.

Since that time, two associated problems have been recognized. First, the name of the base quantity is awkward, with the word "substance" being a source of confusion. Other names, such as "chemical amount" and the problematic "enplethy" have been suggested,[2] among others. The second problem is more fundamental for metrology, because the current definition makes use of a second SI base unit, the kilogram.

In 2005, at the ICTNS meeting in Beijing, a proposal from the CCU (Consultative Committee on Units) of the BIPM (Bureau International des Poids et Mesures) to redefine not only the mole but all other SI base units (kg, m, s, A, K, cd) in terms of fundamental physical constants led to a resolution to the IUPAC Bureau in support of this general goal, but specific recommendations were only in a preliminary stage.

In 2009, Mills and Milton[3] published an article in *CI* that brought the attention of the ICTNS to a specific proposal for redefinition of the mole in terms of fundamental physical constants. ICTNS also received information from CCU giving specific recommendations for revision of the base units, and in particular, asking for support of the redefinition of the mole by IUPAC, given that the mole has special interest for chemists. At its Glasgow meeting at the IUPAC General Assembly, ICTNS devoted a half-day session to this request, which started with a presentation by Ian Mills, IUPAC's representative on the CCU and currently president of that body. Vigorous discussion followed, leading to conclusions that the redefinition should be supported, and that redefining the unit should provide an excellent opportunity to redefine the name of the base quantity at the same time. The outcome of the session was a resolution to the Bureau:

"Given that: (a) definition of the mole in a way that is independent of mass is desirable; (b) the mole is often thought of by chemists as an Avogadro number of entities; and (c) the name of the ISQ (International System of Quantities) base quantity "amount of substance" has been a source of much confusion, ICTNS recommends to the Bureau that:

> The recommendation of the CCU (Consultative Committee on Units) of the BIPM, that the mole be defined as follows:
>
> "The mole, unit of amount of substance of a specified elementary entity, which may be an atom, molecule, ion, electron, any other particle or a specified group of such particles, is such that the Avogadro constant is equal to exactly 6.022 141 79 x 10^{23} per mole.
>
> Thus, we have the exact relation N_A = 6.022 141 79 x 10^{23} mol^{-1}. The effect of this definition is that the mole is the amount of substance of a system that contains 6.022 141 79 x 10^{23} specified elementary entities."

be supported by the IUPAC, with the following suggestions:

1. The greatest effort should be made to change the name of the ISQ base quantity "amount of substance" at the same time that a new definition of the mole is approved.

2. A note should accompany the new definition to explain that the molar mass of ^{12}C will be an experimental quantity, with a relative measurement uncertainty of about 1.4×10^{-9}."

The ICTNS had at its disposal, prior to the meeting, a number of relevant documents. These included a dissenting view to the recommendation by former IUPAC President Yves Jeannin on behalf of the Chemistry Section, French Academy of Sciences, and a supporting view from the U.S. National Institute of Standards and Technology (NIST). One of the co-authors of the NIST paper is Peter Mohr, who is also the current chair of SUNAMCO (Symbols, Units, Nomenclature and Atomic Masses Committee), the counterpart of ICTNS in the International Union of Pure and Applied Physics. The definition in the ICTNS resolution was taken directly from this latter document. The document by Jeannin is reproduced below, and followed by closing comments by Ian Mills, in which the arguments are summarized and the relation between the old and new definitions is discussed.

It may be of interest to readers to know the sequence of resolutions that must accompany any approved change in the SI, and also to be aware of the alphabet soup of acronyms that describes the various committees involved. The BIPM was set up in 1875 by the Metre Convention to ensure worldwide unification of measurements,[1] and has it headquarters and laboratories in Sèvres, just outside Paris, on international territory ceded by the French government. It operates under supervision of the CIPM (International Committee on Weights and Measures), which in turn is under the authority of the CGPM (General Conference on Weights and Measures). Delegates from Member States of the Metre Convention attend the General Conference every four years, and ratify recommendations that arise, in this case, through (in succession) the CCU, CIPM, and CGPM, with the CGPM having responsibility for final decisions. Any changes in the SI are thus subjected to extensive scrutiny over a number of years. The process of redefining the SI base units is currently at the CIPM stage. Input from IUPAC is possible at either the CCU or CIPM stages through ICTNS, which has responsibility for interactions with international organizations outside IUPAC, but in important cases, ICTNS makes recommendations to the Bureau. As noted, IUPAC has a representative on the CCU, and the director of BIPM is a member of ICTNS.

Some of the scientists whose breakthroughs contributed to the modern definition of the mole (from left): Lord Kelvin, Johann Josef Loschmidt, Amedeo Avogadro, and Stanislao Cannizzaro.

The ICTNS hoped that presentation of these articles would provide IUPAC members with a broad picture of the problems associated with definition of the mole and with the cogent arguments that led to the support of ICTNS for redefinition. Those interested in the redefinitions of the other SI base units will also find relevant information.

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3. I.M. Mills and M. Milton, *Chemistry International* 31 (March-April), 3–7 (2009).

J.W. Lorimer <lorimer@uwo.ca> is an emeritus professor of chemistry at the University of Western Ontario, in London, ON, Canada. He was chair of ICTNS from January 2004 to December 2009.

Post Scriptum: On behalf of the Bureau, the IUPAC Executive Committee at its 2 October 2009 meeting reviewed and endorsed the ICTNS recommendations to support the redefinition of the mole as proposed by the CCU.

A Fixed Avogadro Constant or a Fixed Carbon-12 Molar Mass: Which One to Choose?

by Yves Jeannin

In a recent issue of *Chemistry International*, Ian Mills and Martin Milton suggested a new definition for the mole, one of the seven base units.[1] This matter is controversial and needs a careful examination.

The IUPAC Green Book[2] describes the seven base units and gives their definitions. They are the length unit, the metre; the time unit, the second; the mass unit, the kilogram; the current unit, the ampere; the temperature unit, the Kelvin; the amount of substance unit, the mole; and the luminous intensity unit, the candela. Some of them require the help of another base unit: for instance, the time unit involves the length unit, the current unit involves the length unit, and the amount of substance unit involves the mass unit.

Historically, the first standard for the metre was based upon the earth so that it was accessible to everyone at any time. Later on, Johnstone-Stoney and Planck had a completely different view and recommended the use of fundamental constants of theoretical physics for defining units. In the mean time, and independent of each other, base units and corresponding standards have been defined on a purely experimental basis. Although it provides a set of clearly defined units, this set is not very consistent. Moreover, advances in modern physics led to fundamental constants known with a great accuracy.[3] This suggests that we should think again about using base unit definitions based upon fundamental constants since it could result in fewer base units.

Presently, discussions are in progress about this subject. As an example, let us take the case of the speed of light c. It has already been decided that c is a fixed value equal to 299 792 458 m s^{-1}. Indeed, the speed of light is a fundamental constant of physics, the value of which is independent of the galilean referential in which it is measured; it allows a clear definition for the unit of length. Now, considering the well-known formula $\lambda = c/v$, in which wave length λ is bound to frequency v through c, it appears that it is no longer necessary to define two base units, metre and second, if the speed of light is arbitrarily considered as a constant without a unit. If the length is chosen as a base unit, the time is expressed in m^{-1}. If the second is chosen as a base unit, the length is expressed in s^{-1}. Let us underline that this is a metrology approach. For practical purposes, speed should keep its traditional unit. This view has the great advantage for metrologists of reducing the number of base units by one.

Exploring the development of this idea, Mills, Mohr, Quinn, Taylor, and Williams[4] presented a choice of four constants to be fixed similar to fixing the speed of light to define the metre: the Planck constant to define the kilogram, the elementary charge to define the ampere, the Boltzmann constant to define the kelvin, and the Avogadro constant to define the mole. Mills and Milton have discussed further the specific example of fixing the Avogadro constant to define the mole, according to the definition:

> "The mole is the amount of substance of a system which corresponds to 6.022 141 79 x 10^{23} elementary entities."

This may be contrasted with the present definition of the mole, which is:

> "The mole is the amount of substance of a system which contains as many elementary entities as there are atoms in 0.012 kilogram of carbon-12." (14th CGPM, 1971)

This present definition of the mole implies a fixed carbon-12 molar mass $M(^{12}\mathrm{C})$ equal to 12 g/mol exactly and involves the use of another base unit: the kilogram. Therefore, the mass unit has to be defined prior to the mole unit. The definition proposed by Mills et al.[4] and further discussed by Mills and Martin[1] disconnects the mole from the kilogram, which is one of the advantages of this definition.

From the known relation: $h = \alpha^2 c m_\mathrm{e} / 2R_\infty$ (1)

with h Planck constant, α fine structure constant, c speed of light, m_e mass of one electron, R_∞ Rydberg constant, one can deduce:

$$h\,N_\mathrm{A} = [\alpha^2 c m_\mathrm{e} / 2R_\infty].[M(^{12}\mathrm{C})/m(^{12}\mathrm{C})]$$

with $m(^{12}\mathrm{C})$ mass of one atom of carbon-12 isotope and $M(^{12}\mathrm{C})$ molar mass of carbon-12; this formula can be shortened as :

$$h\,N_\mathrm{A} = K\,M(^{12}\mathrm{C})$$

If fixed values are assigned to the Planck constant, and/or to the carbon-12 molar mass, and/or to the Avogadro constant, there are three possibilities:

1. A fixed Planck constant h and a fixed Avogadro constant N_A, the carbon-12 molar mass $M(^{12}C)$ is to be determined.
2. A fixed Planck constant h and a fixed carbon-12 molar mass $M(^{12}C)$, the Avogadro constant N_A is to be determined.
3. A fixed Avogadro constant N_A and a fixed carbon-12 molar mass $M(^{12}C)$, the Planck constant h is to be determined.

The choice of a fixed Planck constant seems obvious because of its central position in quantum physics. The advantages have been detailed in a note "On the Possible Redefinition of the Kilogram" written by Taylor and Mohr.[5]

What about N_A or $M(^{12}C)$? Which one to choose? Let us look at the consequences of a new mole definition.

First, the molar mass of carbon-12 is no longer constant if N_A is fixed. Increasing the accuracy of experimental methods in the future will consequently yield a better $M(^{12}C)$ value; any improvement will introduce changes on the whole table of element molar masses. Such modifications will indeed remain minor if a fixed $M(^{12}C)$ is chosen as it is today. From a practical point of view, every chemist concerned with synthetic chemistry will not be troubled by these changes. Nevertheless, it is a major modification with respect to the actual situation of stable values for all molar masses; it will raise some feeling of unstability.

Let us consider together the speed of light, the Planck constant, and the Avogadro constant. Physics meets quite a number of such constants which relate to phenomena or to the properties of matter. One might mention the electron charge, the electron mass, the fine structure constant, the permeability of vacuum, and so on. Each of them has a deep physical meaning. Some of them already have fixed values by international agreement.

The nature of N_A is completely different. It is nothing but a proportionality constant. When Dalton thought about atomic weights and set up his famous table, which has considerable historical and practical value, he took 1 for the lightest element, hydrogen.[6] It led to the value 16 for oxygen and 12 for carbon. At that time, nobody really had any idea about the mass of a single atom. Later on, Berzelius proposed to use oxygen's atomic weight as a starting value because, he noted, oxygen reacts with many more elements than hydrogen to yield compounds, a mandatory step to determine atomic weights. He chose 100.[7] The chemical community did not follow his proposal. If this value had been retained, the Avogadro constant would have been different. The physics behind the Avogadro constant cannot be compared with the physics of the speed of light or of the Planck constant.

A fixed Avogadro constant leads to a definition of the mole without reference to any other unit. The mole becomes independent of any other unit so that it gets its status of base unit. If $M(^{12}C)$ is kept equal to 12 g/mol exactly as it is today, the mole definition implies another unit, the kilogram. The kilogram definition is presently based upon the standard kept at the Pavillon de Breteuil where the Bureau International des Poids et Mesures is located. Unfortunately, this standard weight slightly changes over the years without any clear explanation: this is not very satisfactory. It seems possible to get a new definition for the mass unit with a fixed Planck constant without unit. By comparing a mechanical power and an electrical power, mass is found to be proportional to frequency.[8] The kilogram mass unit then would be defined with only the help of the time unit. Then, it would no longer be necessary to consider the mass unit as a base unit. Consequently, the mole would also lose its status of base unit. The choice of a fixed carbon-12 molar mass would decrease the number of base units by one. It is attractive from a metrology point of view.

If N_A is fixed, the relation $h\,N_A = K\,M(^{12}C)$ provides $M(^{12}C)$ by computation. The silicon sphere method compares experimentally the macroscopic volume of a sphere and the microscopical one of a single atom.[9] A fixed N_A yields $M(\mathrm{Si})$ which in turn yields $M(^{12}C)$. There are thus two independent entries to the molar mass table. This is not the most favorable situation. The isotopic abundance determination remains a weak step in the silicon sphere method. One should point out that there are considerable efforts going on to enrich silicon into its most abundant natural isotope so that difficulties with isotopic abundances will be overcome. One may also note that any other isotope could be introduced in place of carbon-12 in relation 1 (see page 8) particularly an element having a single stable isotope that could also be used in place of silicon for the experimental volume comparison. However, is it possible?

The exact number 12 is designated by $A_r(^{12}C)$ and called carbon-12 atomic weight; it has no unit. Although it is not strictly speaking a weight, this word is accepted by IUPAC due to its long traditional use and as a tribute to Dalton. By definition, the molar mass M_r is this number expressed with a unit that is the kilogram. One can write:

$$M_r = A_r M_u \quad \text{with} \quad M_u = 0.001 \text{ kg/mol}$$

M_u is called molar mass constant. All the other atomic weights are determined relative to the carbon-12 atomic weight, so they are called "relative atomic weights." In the present SI, the atomic weight and molar mass of carbon-12 have exact values; M_u is exactly 0.001 kg/mol.

With the new proposal of a fixed N_A, molar mass $M(^{12}C)$ is known with a standard deviation; it is no longer fixed and will slightly fluctuate at the rythm of the accuracy improvement of experimental methods. Consequently, the molar mass constant M_u will also fluctuate so that the value 12 for the carbon-12 atomic weight will remain constant. However, this situation seems rather unfortunate. To use a unit conversion factor that is not really a constant is disturbing. Moreover, Martin and Mills recommend a larger use of M_u, especially in teaching.[1] It will be difficult for pupils and even advanced chemistry students to understand the need for a new constant M_u that fluctuates. Finally, if a chemist wants to compute a number of mole, he will use a balance so that the weight of the substance is known with a mass unit: This result will then be divided by the molar mass also expressed with a mass unit, not by the relative atomic weight which has no unit. For this reason, it is important that element molar masses be constant.

A good definition for a base unit is supposed to provide a standard that can be easily used by anyone anywhere in the world. The definition proposed by Mills and Martin means that one has to count atoms. It does not seem possible to get a standard by this method. A weighing balance is the tool used by a chemist to measure an amount of substance with the help of molar masses. While the kilogram is needed in the present definition, it disappears from the new definition, yet it still has to be used to measure an amount of substance. Thus, why not keep a mass unit in the mole definition and maintain the present definition.

For these reasons, the choices of a fixed $M(^{12}C)$ and of the actual definition are favored.

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Closing Comments from Ian M. Mills

This discussion is really about choosing between two alternative definitions for the unit mole:

1. The mole is that amount of substance that contains the same number of entities as 12 grams of carbon 12.

   This is the current definition. It has the effect of fixing the molar mass of carbon 12 as exactly 12 g/mol.

2. The mole is that amount of substance that contains exactly 6.022 141 79 x 10^{23} entities.

   This is the proposed new definition. It has the effect of fixing the value of the Avogadro constant to be exactly 6.022 141 79 x 10^{23} mol^{-1}.

The choice 1 is connected with the history of the development of the quantity amount of substance and the unit mole. The choice 2 is thought to be simpler, and removes the dependence on the kilogram; this is thought to be desirable, in order to clarify the distinction between the quantities **amount of substance** and **mass** (which are often confused). Although I can see advantages in choice 1, most people prefer choice 2 because of its simplicity.

Jeannin also believes that the Avogadro constant is a "fundamental constant of a lesser breed," in contrast—for example—to the Planck constant, or the speed of light, which he thinks of as true fundamental constants. He argues that the Avogadro constant is free for us to choose; we could choose to have a different number of entities in a mole; it is at our choice. Many people express that view. However, I believe that is a misunderstanding. It is the **numerical value** of the Avogadro constant that is free for us to choose, but the **value** of the Avogadro constant, N_A, is a true constant of nature just like c and h.

Consider the effect of choosing 12.044 in place of 6.022. We would then have twice as many entities in a mole, so that we would in effect be defining a new mole that would be twice as large. It should then be given a new name, such as new-mole. We would have 1 new-mole = 2 mole. For the value of the Avogadro constant we would have N_A = 12.044 x 10^{23} new-mol^{-1}, but this is equal to 6.022 x 10^{23} mol^{-1} because we have doubled both the number and the unit, and the value of N_A is the number divided by the unit mol. That is perhaps my strongest criticism of Jeannin's presentation.

The impact of redefinition of the mole is significant for practical metrology. The following excerpt from section 4.1.4 of ref. 4 (*vide supra*, *Metrologia*, **43** (2006) 227–246) summarizes the idea: "One of the most significant benefits of redefining the mole so that it is linked to an exactly known value of the Avogadro constant N_A (assuming h, e, and k also have exactly known values) is that other constants will become exactly known, namely, the Faraday constant F, molar gas constant R, Stefan-Boltzmann constant σ, and molar volume of an ideal gas V_m (at a specified reference temperature and pressure), all of which have practical importance in a number of fields of chemistry and physics."

The actual values are presented and compared in tables 1 and 2 below. Overall, the uncertainties across the new SI will decrease significantly, and this is desirable.

Even though not exactly zero by definition, the molar mass uncertainty in the new SI is sufficiently small that it can be considered negligible in calculating molar mass for use in the determination of amount of substance. Consequently, the new definition of the mole will require no change in current metrological practice in any field.

Table 1. Comparison of constant uncertainties in the current SI versus and new SI.

unit	constant used as reference	symbol	uncertainty in the current SI		uncertainty in the new SI	
kg	mass of IPK	$m(K)$	exact	0	exptl	5.0 x 10^{-8}
	Planck const	h	exptl	5.0 x 10^{-8}	exact	0
A	magnetic const	μ_0	exact	0	exptl	6.8 x 10^{-10}
	elementary charge	e	exptl	2.5 x 10^{-8}	exact	0
K	temp of TPW	T_{TPW}	exact	0	exptl	1.7 x 10^{-6}
	Boltzmann const	k	exptl	1.7 x 10^{-6}	exact	0
mol	molar mass ^{12}C	$M(^{12}C)$	exact	0	exptl	1.4 x 10^{-9}
	Avogadro const	N_A	exptl	5.0 x 10^{-8}	exact	0

Table 2: Relative standard uncertainties for a selection of fundamental constants multiplied by 10^8 (i.e., in parts per hundred million).

constant	current SI	new SI	constant	current SI	new SI
$m(K)$	0	5.0	α	0.068	0.068
h	5.0	0	K_J	2.5	0
e	2.5	0	R_K	0.068	0
k_B	170	0	μ_0	0	0.068
N_A	5.0	0	ε_0	0	0.068
R	170	0	Z_0	0	0.068
F	2.5	0	q_P	2.5	0.034
σ	700	0	$J \leftrightarrow kg$	0	0
m_e	5.0	0.14	$J \leftrightarrow m^{-1}$	5.0	0
m_u	5.0	0.14	$J \leftrightarrow Hz$	5.0	0
$m(^{12}C)$	5.0	0.14	$J \leftrightarrow K$	170	0
$M(^{12}C)$	0	0.14	$J \leftrightarrow eV$	2.5	0

Tables 1 and 2 are reproduced from Mill's presentation to the 23rd CGPM; available at <www.bipm.org/en/convention/cgpm/23cgpm_cc_presentations>.

The Impact of Depleted ^{6}Li on the Standard Atomic Weight of Lithium

by Norman E. Holden

Li (lithium) is one of a handful of elements whose stable isotopic ratio varies in natural terrestrial samples to the extent that the resulting atomic weight variation exceeds the measurement uncertainty on the value. As a result, the standard atomic weight of lithium is more accurately characterized as a range of atomic weight values from 6.9387 to 6.9959. Lithium has become the least accurately known atomic weight because of the existence and the distribution in the distant past of some chemical reagents, which were depleted in the ^{6}Li isotope of natural lithium. This background story brings to light an interesting page of history.

Lithium is an element with only two stable isotopes, ^{6}Li and ^{7}Li, and so there is only one stable isotope ratio involved (see Figure 1). The standard isotopic reference material for lithium,[1] IRMM-016, has a measured stable isotope ratio that leads to a mole fraction for ^{6}Li of 0.0759 (which corresponds to an isotopic abundance value of 7.59%) and a mole fraction for ^{7}Li of 0.9241 (which corresponds to the isotopic abundance value of 92.41%). The product of each isotope's atomic mass and its isotopic abundance, summed over both isotopes leads to a calculated value of 6.94 for the atomic weight of lithium. For the isotopically fractionated lithium samples with depleted ^{6}Li in our story, the mole fractions in the extreme case[2] would be ^{6}Li is 0.02007 (or isotopic abundance of 2.007%) and ^{7}Li is 0.97993 (or isotopic abundance of 97.993%). These mole fractions lead to a value of about 7.00 for the atomic weight of the lithium sample that is depleted in ^{6}Li.

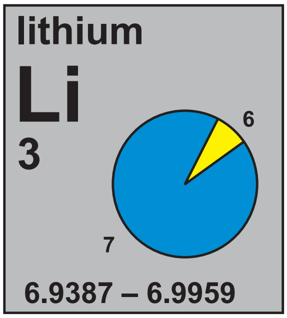

Figure 1: Lithium cell proposed for IUPAC's Periodic Table of the Isotopes.

At this point, let it be noted that the isotopic abundance values are also weighting factors that relate the thermal neutron absorption cross section (or probability that a neutron reaction will occur) of each stable isotope to the thermal neutron absorption cross section of the natural chemical element. In the case of lithium, the thermal neutron cross section reaction for one of its isotopes, ^{6}Li, had an interesting impact on the atomic weight of lithium in reagents found on the shelves of chemists.

The majority of the thermal neutron absorption in the various target chemical elements usually involves the neutron capture reaction. In this reaction, the neutron projectile is absorbed by the target nucleus and any excess energy created in this process is released by the emission of a gamma-ray photon. This energy release allows the product nucleus to decay from the excited state to the normal ground state. However, in the case of a ^{6}Li target nucleus, a much larger contribution to the absorption cross section results from the neutron reaction: ^{6}Li (n, ^{3}H) ^{4}He. The neutron cross section for this reaction has a very large value. The value is approximately 940 barns† (or 940 x 10^{-28} m^{2}), compared to values of a milli-barn (or 1 x 10^{-31} m^{2}) for typical neutron capture cross sections in light elements targets.

From the late 1940s to the early 1950s, a number of nations, which had previously developed and tested nuclear fission weapons, were attempting to construct thermonuclear weapons of mass destruction (or in the vernacular, hydrogen bombs). The approach involved the use of the ^{2}H^{3}H reaction (or DT reaction), which released a large amount of energy. The successful method that was suggested for producing this reaction was to irradiate lithium deuteride with neutrons. To improve the efficiency for generation of the tritium component, the lithium sample was enriched‡ in ^{6}Li.

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† The International System of Units[9] (SI) has a unit of area of meters^{2} (m^{2}). The barn can be expressed as 10^{-28} m^{2}. (The history of the origin of the name of the unit "barn" would also make an interesting story). The large value of 940 barns for the neutron isotopic cross section of ^{6}Li would correspond to a natural element cross section of about 71 barns (which is also a relatively large value) for "normal" lithium. This large value led to the use of natural lithium as a neutron cross section standard. For isotopically fractionated lithium depleted in ^{6}Li, the natural elemental cross section would be about 19 barns. Neutron cross-section measurements that were made relative to the lithium standard that was depleted in ^{6}Li would be too low by almost a factor of 4.

‡ It is interesting to note that the ^{7}Li component of the lithium deuteride also provided a source of additional tritium. It was not initially realized that the cross section at high neutron energies for the reaction ^{7}Li (n, 2n) was so significant. Since there was not a very large source of ^{6}Li available at the start, the initial lithium was not very highly enriched and this lithium had a significant amount of ^{7}Li in it. The total yield (energy release) from the explosion of the first dry lithium deuteride weapon's test was two and one half times greater than originally anticipated and this had unexpected consequences.

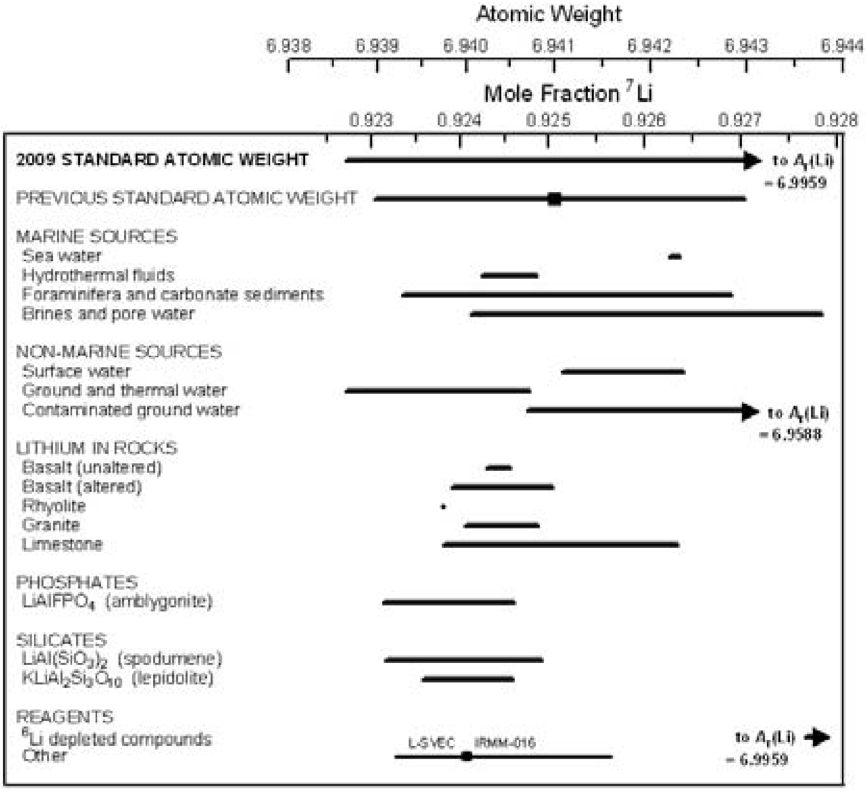

Figure 2. Variation in atomic weight with isotopic composition of selected lithium-bearing materials (modified from reference 2). Isotopic reference materials are designated by solid black circles. The previous (2007) standard atomic weight of lithium was 6.941 ± 0.002.

Rather than waste all of the left-over by-product of these isotopically fractionated lithium samples, this by-product, which would be enriched in ^{7}Li, was commercially distributed in laboratory reagents. Because of the fact that the enrichment of ^{6}Li was part of a classified military weapons program, the general scientific community and the public were never provided information that the lithium being distributed in the chemical reagents was depleted in ^{6}Li. This distribution resulted in labels on containers of reagents, which had incorrect atomic weight values listed on them.

The isotopic fractionation of lithium was first noted when measurements of the neutron cross section of various materials, that were normalized to the natural lithium standard cross-section value, provided results that were much lower than those same cross sections when measured against all other neutron cross-section standards.§

The large discrepancy in the isotopic abundance of ^{6}Li in reagents was later measured via neutron activation analysis and by mass spectrometric measurements. The detection of this problem was published in the open scientific literature at various times in 1958,[3] 1964,[4] 1966,[5] 1968,[6] 1973,[7] and 1997,[8] with ever increasing depletion of ^{6}Li in the commercial samples noted. Figure 2 shows the variation in isotopic composition and atomic weight of selected lithium-bearing materials. Note that lithium enriched in ^{7}Li has made its way into ground waters (see Figure 2), and the lithium isotopic composition has been used as an environmental tracer to identify lithium compounds in waste waters down gradient of a mental institution using pharmaceuticals containing lithium (T. Bullen, U.S. Geological Survey, written communication).

Although many of lithium's elemental properties would not affected by the use of depleted lithium, the incorrect atomic weight would lead to errors in the concentration of the lithium being used. It has a major effect when isotopically fractionated lithium is used as a reference in mass spectrometric measurements. In the neutron cross-section field, natural lithium was eliminated as a measurement standard more than half a century ago because of the problem of depleted ^{6}Li.

The atomic weight of terrestrial and commercial lithium sources varies between 6.9387 and 6.9959.[2] If the standard isotopic reference material's atomic weight is recommended, the value would be 6.94 (6), where the number in parentheses indicates the uncertainty needed to cover the isotopically fractionated lithium sources, which is an uncertainty of about 0.9% (see Figure 2). If a value were recommended that is accurate to one in the last quoted digit, the atomic weight becomes 6.9 (1), and an uncertainty of about 14%. In either case, lithium is the element with the least accurate atomic weight, and all because of the unacknowledged distribution of depleted ^{6}Li in chemical reagents in the distant past.

It has been noted on many occasions by the Commission on Isotopic Abundances and Atomic Weights that the published standard atomic weight is chosen to apply to samples for all potential users, no matter which terrestrial or commercial sample they

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§ A similar (although a much less dramatic) result occurred from the use of natural boron as a neutron cross-section standard. This was due to the large value (about 3838 barns) of the cross section for the reaction ^{10}B (n, ^{4}He) ^{7}Li. There are two major boron sources in the world, which have different ratios of ^{10}B and ^{11}B in their samples. (However, that would also be a story for another day). The direct result of these problems with lithium and boron resulted in natural lithium and natural boron being eliminated as neutron cross-section standards by the late 1950s.

may be using. If the published value of the standard atomic weight in the Commission's report is not of adequate accuracy for a particular application when the uncertainty budget is determined, one needs to measure the atomic weight value for the specific sample.

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Stamps International

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

R is for Rutherford

He may well be the best-known scientist born and raised in New Zealand and the most famous physicist to receive the Nobel Prize in Chemistry (1908). Ernest Rutherford was born in 1871 in a rural community near Nelson, on the South Island of New Zealand. He received his early education at local schools and then attended Canterbury College (1890–1895), where he obtained B.A., M.A., and M.Sc. degrees in math and physics and did research on the magnetic properties or iron exposed to high-frequency oscillations. After a three-year stint at Trinity College in Cambridge, England, he accepted a position as a professor of physics at McGill University in Montreal, where he conducted most of the work that led to the Nobel Prize "for his investigations into the disintegration of the elements and the chemistry of radioactive substances." He subsequently investigated the nature of alpha rays and established the nuclear structure of the atom while at the University of Manchester (1907–1919). From there, he succeeded J.J. Thomson as head of the famous Cavendish Laboratory at Cambridge, where he remained until his death in 1937. A talented experimentalist and gifted mentor, he is regarded as one of the most important scientists of the 20th century. Element 104 (rutherfordium, Rf) is named after him.

The stamp illustrated herein is part of an eclectic set of 26 stamps (A through Z . .) issued by New Zealand Post on 6 August 2008 to celebrate the achievements and cultural heritage of New Zealanders. Thus, G is for Goodnight Kiwi, a beloved cartoon character that used to signal the end of nightly broadcasts on New Zealand television, and K is for Kia Ora, a traditional Maori greeting that literally means "be well" but is indistinctly used to say hello or goodbye. Rutherford, coincidentally bestowed with the honor of representing the letter R stamp on the centennial of his Nobel Prize, is the only scientist portrayed on the set. He may have spent most of his professional career in Canada and the UK, but there's little doubt that most people in New Zealand consider him a source of national pride, a cultural icon, and a symbol of kiwi ingenuity.

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

Division Roundups, Part II

Committee on Chemistry Education

by Christiane Reiners, national representative from Germany, and with contributions from Chris Brouwer.*

Among the many committee meetings at IUPAC's General Assembly in Glasgow in August 2009, the passion and enthusiasm for the International Year of Chemistry in 2011 was perhaps most evident in the deliberations of the Committee on Chemistry Education (CCE). After all, this committee was instrumental in building support for the UN Declaration of IYC2011 and it will play a lead role in planning and organizing IYC events. However, the committee's meeting on 2–3 August encompassed much more than IYC. The "normal" committee business was simply condensed into about half the allotted time.

Shortly into the meeting, CCE Chair Peter Mahaffy framed the magnitude of what lies ahead, calling IYC an "opportunity of a lifetime for the professional chemistry community." Against this backdrop, much of the meeting was devoted to discussing "How best can we contribute to the IYC?" Mahaffy encouraged committee members to "focus on the importance of chemistry in our lives" as they devised strategies and developed ideas for activities.

"It is impressive to see what has happened all ready in national chemical societies," said Mahaffy about IYC progress so far. "My hope is that there be something of a scientific legacy that we leave behind." As he explained, the year of geophysics in 1957 resulted in extensive atmospheric monitoring, which then led to our understanding of climate change.

Mei-Hung Chiu, chair of the CCE Subcommittee on Chemistry Education for Development, discusses the Flying Chemists Program.

有朋自遠方來，不亦悅乎?!

"Isn't it delightful to have friends visiting from afar!" (Mei-Hung Chiu).

In order to contemplate such grand ideas, and smaller ones too, CCE members broke into working groups for a portion of the meeting to identify, formulate, and plan projects that CCE could coordinate. Before the working groups met, Tony Wright (Australia) and Mustafa Sözbilir (Turkey) presented the results of a task group that had considered the best types of IYC activities for CCE to pursue.

Since IUPAC has limited financial and human resources, Wright said, there should be an emphasis on activities that support developing countries and a focus on helping teachers. In addition, the task group suggested that IYC activities should be evaluated to see if they meet the following criteria:

- reinforce curiosity among elementary school students
- encourage cooperative learning rather than didactic
- teach responsible stewardship, which includes sustainable development and ethical issues
- facilitate appropriate curriculum development and learning

Four main proposals emerged from CCE's meeting at the GA: (1) global experiments; (2) celebrations of national stories of chemistry; (3) coordination of an international chemistry day or week; and (4) efforts to directly engage the general public. For a more detailed description of these proposals, see the November 2009 *CI* (p. 10, "WCLM Generates Ideas for IYC2011").

As noted previously, CCE plans to emphasize IYC2011 through some of its existing activities, including the Young Ambassadors for Chemistry and the Flying Chemists Program. Mei-Hung Chu, chair of the Subcommittee on Chemistry Education for Development, provided an overview of the Flying Chemists Program, which, since 2005, has provided resources to developing countries that want to promote chemistry. Chu reported that in 2011, the program will focus on Ethiopia, which is fitting since the Ethiopian Chemical Society was the lead petitioner to UNESCO and then the United Nations in the successful designation of 2011 as the International Year of Chemistry.

The meeting included presentations by Lida Schoen, who discussed the Young Ambassadors for Chemistry (YAC) project, and by Natalia Tarasova, who discussed the UN-Decade for Education for Sustainable Development. Furthermore, presentations were made about several important groups: the

Network for Inter-Asian Chemistry Educators (NICE), the Australian Collaborative Education Network, FACS, the National Association of Research in Science Teaching, Chemical Heritage Foundation, and OPCW. All these activities aim at bringing partners and stakeholders together and underline the versatility of chemical education, which is a focusing and radiating enterprise at the same time.


Thomas Tritton, president of the Chemical Heritage Foundation, addresses the CCE meeting.

Apart from the activities within CCE, it was interesting and encouraging to listen to the contributions from divisional representatives and from the standing committee representatives of COCI (Chemistry and Industry) and CHEMRAWN (Chemical Research for Applied World Needs). On the one hand, those interactions support the idea that chemistry education needs strong partners in other disciplines as chemistry education without chemistry is knitting without wool. On the other hand, chemistry teachers turn out to be important multipliers for spreading innovations in chemistry. Consequently, the interactions with other divisions helped to build up a close communication network, smoothing the way to an International Year of chemistry.

High on the meeting agenda was CCE's flagship activity: the International Conference on Chemical Education. Morton Hoffman, the CCE member responsible for the series, reviewed the successful ICCE held in Mauritius in 2008. He was followed by Mei-Hung Chiu, who made a compelling case for attending the 21st ICCE in Taiwan 2010, to be held 8 to 13 August. Meeting participants were then asked to consider competing bids from Poland and Italy to host the 22nd ICCE in 2012. The presentations by the Polish and Italian representatives were impressive and convincing at the same time, which made the final vote rather difficult. After the final tally, Italy was declared the winner, which means that the 22nd ICCE will take place in Rome. But, before then, see you in Taiwan!

21st International Conference on Chemical Education

Chemical Education & Sustainability in the Global Age

8–13 August 2010
Taipei, Taiwain

http://icce2010.gise.ntnu.edu.tw/

Chris Brouwer, production editor of *CI* and principal of pubsimple, contributed to this report.

Division IV: Polymer

by Michael Hess, division secretary

The Polymer Division gathered in sunny Glasgow on 31 July to 1 August 2009, with 36 participants from more than 20 countries. The division, which has Christopher Ober (Cornell University, USA) as president and Michael Buback (University Göttingen, Germany) as vice president, comprises six subcommittees:

- Polymer Terminology
- Developing Polymer Materials
- Polymer Education
- Molecular Characterization of Polymers
- Structure and Properties of Commercial Polymers
- Modeling of Polymerization Kinetics

The chairs of these subcommittees reported the results of their work since the last division meeting at the IUPAC World Polymer Congress 2008 in Taipei. At this meeting and in Glasgow, minisummits were held between the Polymer Division and representatives of many international polymer societies (e.g., The European Polymer Federation, The Japanese Society of Polymer Science, The Korean Polymer Society, the American Chemical Society) in order to contemplate tangible cooperation in certain areas. Ideas that emerged from these meetings include the following:

- Organize joint symposia and conferences with large international organizations (e.g, during the meetings of the European Polymer Federation or the Asian Pacific Federation as well as at the 2011 GA in Puerto Rico).
- Improve the division's presence on the Internet. The Polymer Division has established a polymer education website <www.iupac.org/polyedu> that has generated strong interest.
- Improve public awareness of the importance and the value of polymer science and technology to our societies. Contacts with industry are being cultivated for a fruitful implementation of the division's ideas.

In order to arouse public interest and to improve visibility of IUPAC activities, the Polymer Division administers the IUPAC-SAMSUNG Polymer Scientists' Award, the DSM Performance Materials Award in cooperation with the Polymer Division, and the IUPAC-Polymer International Award. In particular, these awards acknowledge the activities of young scientists in the field. For 2008, the DSM Award went to Craig Hawker (USA), the IUPAC Polymer International Award to Zhenan Bao (USA), and the Samsung Award to Eric Cloutet (France) in 2008.

An International Research Funding (Pilot) Project was launched by the Polymer Division with the cooperation of the IUPAC task group on International Research Funding in Chemical Sciences. Discussions in Washington, D.C., in 2008 resulted in a detailed plan to call for proposals involving (at least) three scientists and students from a minimum of three countries as a part of the division's educational efforts. The call was launched in October 2009 (for more details see www.iupac.org/polyedu/DivIVCall/). A symposium assembling all participants is planned during the IYC 2011.

Part of the Glasgow meeting involved updates on activities of individual subcommittees. Following is a sampling of some of these updates.

Polymer Terminology

The Subcommittee on Polymer Terminology consists of 38 members from 15 countries. In the past two years, the subcommittee has worked on 24 projects, 7 of which are concerned with polymer nomenclature or are nomenclature related and which involve interdivisional cooperation, specifically with Division VIII. The most important publication is the new edition of the Purple Book, or *Compendium of Polymer Terminology and Nomenclature*, which was finally completed by a group of editors, headed by Richard G. Jones. The compendium comprises 13 chapters of terminology and 9 chapters related to nomenclature, all of which are based on documents previously published in *PAC*. Another five glossaries containing recommendations have been published in *PAC*.

Developing Polymer Materials

The subcommittee consists of 25 members and has currently two projects in progress. One of its goals is to identify promising developments in the forefront of polymer science.

Polymer Education

A major focus of the Polymer Education Subcommittee is preparing for IYC, but it also is working on providing new teaching materials for free online and improving international research funding. In addition, the subcommittee tries to encourage the hiring of students and post-docs from developing regions to improve their training and broaden their scientific networks. Ongoing projects are the UNESCO/IUPAC Postgraduate Course organized by Pavel Kratochvìl at the Institute of Macromolecular Chemistry in the Czech Republic and the tutorial (Short Course in Polymer Characterization) offered before the annual IUPAC-sponsored POLYCHAR Conference (Delhi/Lucknow, India, in 2008; Rouen, France, in 2009).

Molecular Characterization of Polymers

This subcommittee is currently working on five projects with a high number of participants from industry. Many of the projects tackle statistical problems in chromatographic characterization of polymers, such as reproducibility and reliability of results, but also basic problems involving the description of the separation process that are important when the validity of results has to be considered.

Group photo of Division IV at the General Assembly in Glasgow.

Structure and Properties of Commercial Polymers

This subcommittee has the most members from industry, with 33 out of 65 members in total from 12 countries. The subcommittee is divided into an Asian-Pacific and a European-American group, which each have two co-chairs. Since the GA in Torino, four projects were completed dealing with topics such as scratch resistance, structure and properties of cyclic polyolefins, and guidelines for rheological characterization.

Modeling of Polymerization Kinetics

The subcommittee consists of 34 members from 11 countries. Modeling and mechanistic studies into free-radical polymerizations are important for science and industry, but often completely different model assumptions and parameter values are reported for ostensibly the same systems. Projects of the subcommittee aim to rectify this situation by producing critically evaluated kinetic parameters, whose values are reliable and which can be used by the international polymer community.

Conferences

There were 16 IUPAC-sponsored international conferences in almost all continents since the last GA, from which six volumes of *Macromolecular Symposia* (Wiley & Sons) were produced, totaling nearly 1000 pages.

The next meeting of the Polymer Division will be at the IUPAC-World Polymer Congress 2010 in Glasgow, Scotland.

Division II: Inorganic Chemistry

by Leonard Interrante, division secretary

The Inorganic Chemistry Division meeting in Glasgow was attended by 25 division members and guests, including 4 Young Observers. It was preceded by a meeting (23–30 July 2009 in Vienna) of the Commission on Isotopic Abundances and Atomic Weights and its major working subcommittees at which isotopic data and atomic weights for the 2007–2009 period were evaluated.

A particularly interesting aspect of the Glasgow meeting was the enthusiasm and involvement of the Young Observers present, with several YO's presenting excellent ideas for the upcoming International Year of Chemistry. In addition to reports from the division president, commission representative Tiping Ding, the subcommittee chairs, and from our project coordinator, Ty Coplen, on the various active and completed projects, along with the proposals submitted and in preparation, we had presentations from CCE, COCI, and the Analytical Division regarding the activities of these groups and from Fabienne Meyers on *Chemistry International*.

Group photo of Division II at the General Assembly in Glasgow.

Among the topics discussed at this meeting was the name and symbol of the new element with atomic number 112: A provisional recommendation for the name "copernicium" and the symbol "Cn" was made by the division and is now available for public comment. (See <www.iupac.org/reports/provisional/abstract09/corish_310110.html> or page 23). The provisional recommendation is co-authored by Kasuyuki Tatsumi and John Corish, and is open for public comment until 31 January 2010. At the end of the review period, the division will consider the comments received and make the final recommendation.

Another important outcome was approval of the recommendation of the Subcommittee on Materials Chemistry to transform itself into a truly Interdivisional Subcommittee on Materials Chemistry by developing a new structure that would recognize the interdisciplinary and interdivisional character of this subject. Following the meeting in Glasgow, two division members, Leonard Interrante and Tony West, attended a meeting with members of Divisions I (Physical Chemistry) and IV (Polymer) at Cornell University in Ithaca, New York, USA, on 17 October 2009 to set up this new ISMC structure and plan its activities for the coming biennium.

Division II will begin 2010 with a new division president and vice president. Since Division President Kazuyuki Tatsumi was elected vice president of IUPAC in Glasgow, Bob Loss, current division vice president, will become president in January 2010. In a special election held just after the Glasgow meeting, titular member Jan Reedijk was elected vice president of the division, also effective January 2010.

IUPAC Wire

News and information on IUPAC, its fellows, and member organizations.
See also www.iupac.org/news

IUPAC Welcomes New Members

With a new biennium starting in January 2010, IUPAC welcomes numerous new members, including four new National Adhering Organizations and several newly elected Bureau members, division presidents, and committee chairs—see listing on page 3 or <www.iupac.org> for a complete list.

Nicole Moreau (France) will serve as president for the next two years, while Jung-Il Jin (Korea) will become past president. On 1 January 2010, Kazuyuki Tatsumi, professor of chemistry at Nagoya University, Japan, will became vice president and president elect; he was elected at the IUPAC General Assembly in Glasgow, Scotland, in August 2009.

Tatsumi as Vice President

Kazuyuki Tatsumi started his carrier as a theoretical chemist, and his research subjects have shifted into synthetic inorganic chemistry, extending over coordination chemistry, organometallic chemistry, and bioinorganic chemistry. His recent research interests include the synthesis of coordinateively unsaturated organometallics, transition metal chalcogenides, and transition metal sulfide/thiolate clusters modeling the active sites of reductases such as nitrogenase, hydrogenase, and acetyl-CoA synthase.

IUPAC's incoming and outgoing presidents: On 1 January 2010 Nicole Moreau (left) became president and Jung-Il Jin became past president.

Since 2005, Tatsumi has served on the Council for Science and Technology Committee (Subdivision on Science Committee) of Japan's Ministry of Education, Culture, Sports, Science, and Technology. He became a member of the Science Council of Japan in 2008. He led the Grant-in-Aid on Priority Area Project, "Reaction Control of Dynamic Complexes" from 2002 to 2006, and has been a head investigator of Grant-in-Aid on Creative Scientific Research on the chemistry of reductases since 2006. He has been a member of the International Organizing Committee of Pacifichem since 1996; he is currently the vice chair for Pacifichem 2010. He served on the Editorial Advisory Board of the *New Journal of Chemistry* (1995–1997) and on the International Advisory Editorial Board of *JCS Dalton* (1998–2002). Presently, he serves on the Editorial Board of *Chemistry: An Asian Journal*. He has also been the regional editor of *The Journal of Organometallic Chemistry* since 2002. Tatsumi received the Inoue Prize for Science in 1998, the Humboldt Research Award in 2004, and The Chemical Society of Japan Award in 2006. He was awarded lectureships from the Chinese Academy of Science in 2000, KAIST (Korea) in 1999 and 2001, and the National Science Council (Taiwan) in 2003. He was appointed honorary professor of Nanjing University of Science of Technology (2004) and Lanzhou University (2004), and visiting professor at the University of Helsinki (1985), EPFL (Switzerland, 1987), Suzhou University (2001), and the University of Heidelberg (2005).

New IUPAC Vice President Kazuyuki Tatsumi of Japan (right) is congratulated by Ram Lamda of Puerto Rico upon winning election.

In his candidate statement for vice president, Tatsumi emphasized the need for IUPAC to expand collaborations with other organizations. "In particular," he said "closer ties with NAOs of emerging and developing countries are imperative in order to make IUPAC a more representative body of the whole chemistry community." Citing the International Year of Chemistry, he said "The opportunity for better recognition of IUPAC is greater than ever."

New National Adhering Organizations

Following the approval last August by Council of National Adhering Organization Status, the following organizations are now full members:

- Fonds National de la Recherche (Luxembourg)
- Institut Kimia Malaysia (Malaysia)
- Institute of Chemistry, Ceylon (Sri Lanka)
- Chemical Society of Thailand (Thailand)

Chemical Heritage Foundation Fellowships

The Chemical Heritage Foundation, an independent historical research center, library, and museum in Philadelphia, Pennsylvania, USA, is now accepting applications for long-term and short-term fellowships in residence at CHF's Beckman Center for the History of Chemistry for the academic year 2010–2011. These fellowships are for scholars working in some area of the history and social studies of alchemical, chymical, chemical, and related sciences, technologies, crafts, or industries in all chronological and geographical areas. An overview of the kinds of research CHF supports, including work being done by its current and past fellows, can be found online at <www.chemheritage.org/research/research.html>.

The research collections at CHF, where the chosen fellows will be in residence throughout their fellowship period, range from the fifteenth century to the present and include approximately 10 000 rare book volumes, significant archival holdings, thousands of images, and a large artifact and fine arts collection, supported by over 100 000 reference volumes, monographs, and journals. Within the collections there are many areas of special strength, including alchemy, mining and metallurgy, dyeing and bleaching, balneology, gunpowder and pyrotechnics, gas lighting, books of secrets, inorganic and organic chemistry, biochemistry, food chemistry, and pharmaceuticals. Recipients of all fellowships are expected to participate in and make a contribution to CHF's intellectual life. CHF is also an active member in the Philadelphia Area Center for the History of Science <www.pachs.net>.

CHF currently has nine staff members with Ph.Ds. and targets to have at least an equivalent number of visiting scholars in residence at any one time to have an active and thriving scholarly community. Last year CHF gave four long-term postdoctoral, three long-term dissertation, and nine short-term fellowships.

The deadline for applications is 15 February 2010. Apply online at <www.chemheritage.org/research/research-nav4.html>. Fellows will be selected by an external peer-review selection committee and awardees should be notified in April 2010.

www.chemheritage.org

New Leadership at IOCD

Alain Krief has been named executive director of the International Organization for Chemicals Science in Development, replacing Robert Maybury, whose more than two decades of leadership enabled the IOCD to become a highly diversified and recognized organization throughout the world. Krief, previously director of the Laboratory of Organic Chemistry at the University Notre Dame de la Paix at Namur in Belgium is widely known in scientific and industrial circles. He is a member of numerous scientific committees, an expert for scientific associations, and a member of editorial boards of scientific journals. Krief's international experience is extensive: Born in Africa, he studied in France, UK, and USA, and was a visiting professor several times at more than 15 universities worldwide.

IOCD was created in 1981 by Pierre Crabbé, a Belgian chemist working at UNESCO in Paris, with the objective of engaging scientists from developing countries in collaborative research with scientists from industrialized countries. After the sudden death of Crabbé in 1987, Maybury was appointed to continue and develop the work of its founder. Under Maybury, several additional working groups were created to round out IOCD's attention to the needs and limited resources of developing countries in the areas of environmental and analytical chemistry, medicinal chemistry, plant chemistry, biotic exploration, and natural products chemistry. For this, IOCD received generous funding from public and private donors. A great effort was made to transfer knowledge, through the project Books for Development and through the provision of grants to early-career scientists to enable them to participate in workshops and international scientific congresses. In recognition of his work, IOCD has named him honorary director.

IOCD's mission is to support collaboration in the chemical sciences to benefit the health, agricultural, and economic sectors of developing countries. The IOCD is an Associated Organization of IUPAC and has conducted several successful joint projects (e.g., on Standardization of Analytical Approaches and Analytical Capacity-Building in Africa (see Nov-Dec 2006 *CI*, <www.iupac.org/publications/ci/2006/2806/ud2.html>.

www.iocd.org

CrossRef Invites You to its Labs

Geoffrey Bilder, director of strategic initiatives at CrossRef, announced in October 2009 the creation of CrossRef Labs website, <http://labs.crossref.org>, which will be the home for some of the prototypes and experiments that CrossRef is developing. Bilder wrote: "Here you can find links to various tools and services that either make it easier to use CrossRef services (e.g., Blog/Ubiquity plugins and OpenSearch Description files) or that serve to illustrate a concept that has been of interest to our members (InChI lookup, TOI-DOIs)."

Of particular interest to IUPAC circles is the InChI lookup. The idea is to create a mechanism that would allow CrossRef publishers to record InChIs in their submitted CrossRef metadata. This, in turn, would allow CrossRef to provide a service that allows users to look up the published articles that mention a particular InChI, and look up the InChIs mentioned in a published article.

Users should be aware that the CrossRef Labs home page has the following admonition: "Most of the experiments linked to here are running on R&D equipment in a nonproduction environment. They may disappear without warning and/or perform erratically. If one of them isn't working for some reason, come back later and try again."

CrossRef is a not-for-profit membership association whose mission is to enable easy identification and use of trustworthy electronic content by promoting the cooperative development and application of a sustainable infrastrusture.

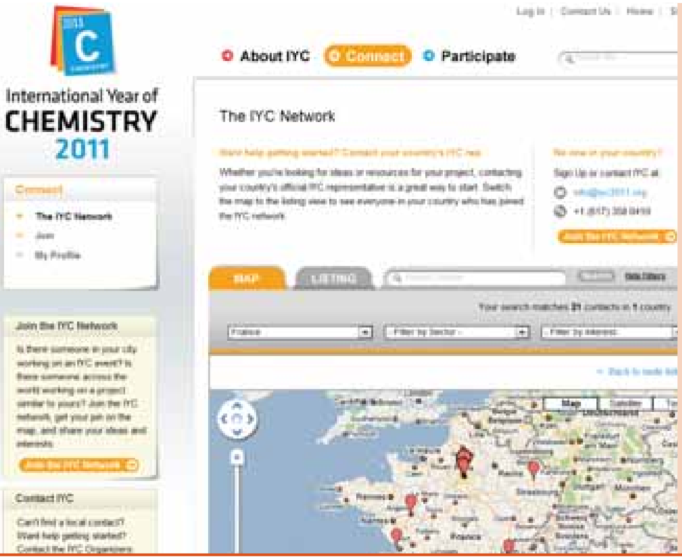
http://labs.crossref.org

Primary Data for Chemistry

In collaboration with the German National Library of Science and Technology (TIB), the scientific publisher Thieme is making primary chemistry data accessible worldwide. Analytical data, from various experiments, is the foundation of research work and scientific papers. From now on, primary data will be registered and made available online via the Thieme eJournals website using digital object recognition in the form of Digital Object Identifiers (DOI). This will enable scientists to easily locate research articles, including accompanying data, and make enhanced use of the scientific content.

Primary data is scientific data gathered from experimental measurements and predominately available in electronic formats. In the field of chemistry, such data is accumulated by a variety of analytical, spectroscopic, or computer simulation methods. Thus far, the vast amount of data lies scattered on the computers of scientists who have produced the information. As no central repository exists, no archival storage is possible at the moment. Scientific results are solely published in journals—but not the primary data from which those results originate. Due to the missing credit that working up such data currently receives, primary data is often poorly documented, difficult to access, and not saved for the long term.

Susanne Haak, the managing editor responsible for chemistry journals at Thieme explains, "Access to primary data is a fundamental condition for research work, particularly in the natural sciences." Therefore, Thieme and experts from TIB have developed a uniform structure for publishing primary



Major Update to IYC Website Completed

If you haven't visited the IYC2011 website lately, you really should stop by and experience the site's dynamic new features, which enable chemists across the globe to connect with one another and share ideas, activities and events related to the international year of chemistry. This phase of the IYC2011 website is a continuation of the technical work initiated in 2009 with the BitGroup, a Boston-based web design company.

www.chemistry2011.org

data. Through structuring and central data registration, a Germany-wide unique service of TIB, valuable knowledge will be harnessed.

"The data will be permanently saved and, by assigning them a DOI, made accessible and searchable, as well as citable and linkable," states Jan Brase from the TIB Registration Agency. An additional positive effect is that authors receive recognition for their research work.

www.thieme-connect.com/ejournals

In Memoriam: Pan Ming Huang (1934–2009)

by Antonio Violante

Longtime IUPAC member Pan Ming Huang, professor emeritus of soil science at the University of Saskatchewan, Saskatoon, Canada, died 13 September 2009 at age 75.

Huang was an eminent scholar, a great educator, a man of vision, and extraordinary leadership. He was a teacher appreciated for his organization and thoroughness, his passion for science, and for his high expectations. Most of his students and colleagues mention the decisive influence he had on their careers. A member of the IUPAC Chemistry and the Environment Division Committee, the Subcommittee on Biophysico-Chemical Processes in Environmental Systems, and earlier of the Commission on Fundamental Environmental Chemistry, Huang was editor of the IUPAC book series *Biophysico-Chemical Processes in Environmental Systems*.

Huang was born in Taiwan on 2 September 1934. After graduating with a degree in agricultural chemistry from the National Chung Hsing University, he moved to the University of Manitoba, Winnipeg, in 1961. It was there that he met Lin, the lovely young woman who was to become his wife. He moved on to the University of Wisconsin at Madison upon completing his Masters in 1962, studying for his Ph.D. with M.L. Jackson, one of the world's most highly regarded soil scientists. Huang and Jackson worked well together, developing a warm friendship that continued for decades. Huang received his Ph.D. degree in Soil Science in 1965 and in the same year traveled to Saskatoon having accepted a position in the Department of Soil Science at the University of Saskatchewan. In 1966, he and Lin were married. Lin has been a wonderful companion and support for him. They have two children: Daniel and Crystal.

Huang was a leading international authority on environmental soil chemistry, with emphasis on mineral colloids and organo-mineral complexes, their reactions with nutrients and pollutants in soils and waters and the impact on ecosystem health. He pioneered extensive chemical, spectroscopic, and ultramicroscopic research on the formation mechanisms of short-range ordered (poorly crystalline) mineral colloids which are extremely reactive in governing the accumulation, transport, and bioavailability of nutrients and pollutants in the environment. He performed groundbreaking work in establishing mineral catalysis mechanisms of transformations of biomolecules such as sugars, phenolic compounds and amino acids, and the resulting formation of humic substances which are essential for maintaining and for enhancing the productivity of the land and are also vital in influencing the dynamics and fate of environmental pollutants. Further, his cutting-edge research has advanced the world's knowledge on the chemistry and behavior of vital and toxic inorganic ions and organic compounds in soils and freshwaters and their impact on agricultural sustainability and ecosystem protection.

His research accomplishments are embodied in over 300 refereed publications, of which nine were published in *Nature*. Furthermore, he has written 2 books, edited 17 books, and successfully trained and inspired Ph.D. and M.Sc. students (more than 60) and postdoctoral fellows (45).

Errata

On page 7 in the Nov-Dec 2009 *CI*, a caption identifying IUPAC Vice President Kazuyuki Tatsumi of Japan is mislabeled and incorrectly lists his country as Korea.

On page 22 in the Nov-Dec 2009 *CI* (last paragraph) it is mentioned that Maximo Baron was accepted as a fellow by The Royal Society of London. This is a mistake and should simply read that he is a Fellow of The Royal Society of Chemistry.

The Project Place

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

Coordination Polymers and Metal Organic Frameworks: Terminology and Nomenclature Guidelines

As is often the case, practice precedes theory and synthesis precedes nomenclature and terminology. This is certainly the case in one of the fastest growing fields of contemporary inorganic chemistry: coordination polymers (CPs) and metal organic frameworks (MOFs).[1] This is an interdisciplinary research field with origins in coordination and solid-state chemistry that is now also attracting the interest of the chemical industry.[2] The porous properties of some of these materials are promising for numerous applications, from gas storage to catalysis.

The diversity in both focus and scientific basis of the researchers involved has lead to numerous terminology suggestions and practices for this class of compounds and of several subgroups within; additionally, a disquieting number of abbreviations are also in use and practices are not consistent among research groups, causing unnecessary conflicts and confusion.

Thus, coordination chemists would normally consider any Lewis base bonded to a metal cation as a coordination compound, whereas some solid-state chemists may want to single out, for example, metal-carboxylates as being different from a valence bond perspective. Some researchers consider the two terms "coordination polymers" and "metal organic frameworks" as equivalent, while others state that MOFs are a porous subgroup. Some view 1D ladder-like coordination polymers as MOFs, whereas others demand that MOFs form three-dimensional networks.

The task group is charged with the delicate task of finding one or more definitions that can gain a broad acceptance within the CP and MOF community, while at the same time not deviating too much from the picture the more general chemical public may have gotten from the many articles this prolific research area has generated in various science news magazines.[3] The term MOF is now also found in basic textbooks.[4]

The task group needs to balance the advantages and drawbacks of basing these definitions on concepts of chemical bonding (coordination, covalent, dative, ionic), on crystal structure information (network formation, dimensionality, and derived properties), and on actual measured physical properties (solubility, porosity as measured by gas sorption isotherms). The task group will evaluate the need to further divide such compounds into subclasses based on properties or structures, and the group may consider the need for topology descriptions of specific networks formed.

Moreover, it has been noted that current IUPAC nomenclature rules for coordination polymers, dating from 1985,[5] do not apply to these classes of compounds and need to be amended or extended.

It is expected that the group will deliver clear guidelines to help researchers communicate with each other, minimize terminology controversies among authors, referees, and journal editors; and enable end users in industry, government, and academia to understand and apply research from this new and important field.

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For more information and comments, contact Task Group Chair Lars Öhrström <ohrstrom@chalmers.se>.

www.iupac.org/web/ins/2009-012-2-200

Provisional Recommendations

Name and Symbol of the Element with Atomic Number 112

A joint IUPAC/IUPAP Working Party (JWP) has confirmed the discovery of the element with atomic number 112 by the collaboration of Hofmann et al. from the Gesellschaft für Schwerionenforschung mbH in Darmstadt, Germany. In accordance with IUPAC procedures, the discoverers proposed a name, **copernicium**, and symbol, **Cn**, for the element. The Inorganic Chemistry Division now recommends these proposals for acceptance.

Comments by 31 January 2010
Prof. John Corish <jcorish@tcd.ie>
University of Dublin,
Chemistry Department, Trinity College
Dublin 2, Ireland

www.iupac.org/reports/provisional/abstract09/corish_310110.html

Internet Connection

Providing brief overviews of helpful chemistry resources on the web.
See also www.iupac.org/links

ChemShow

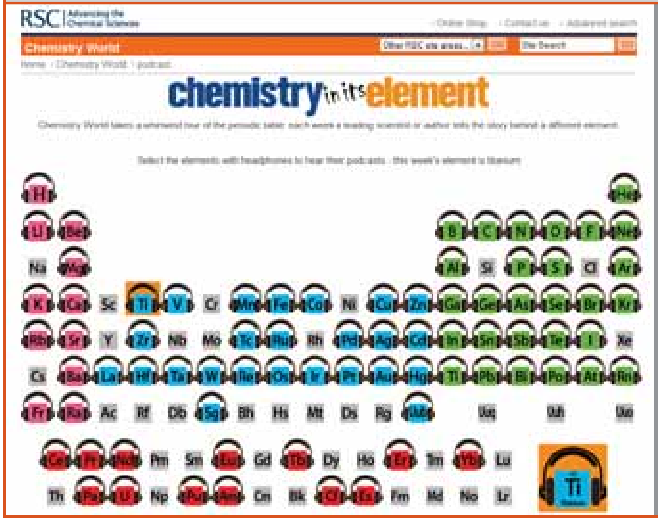
Professors Emeriti of Chemistry Rubin Battino and John J. Fortman of Wright State University in Dayton, Ohio, USA, have been doing chemistry demonstration shows for middle and high school students for about 35 years. They estimate that over one quarter of one million students have seen the live shows. Currently, they do 19 of these free shows each year.

During winter and spring breaks, Battino and Fortman entertain and teach middle and high school students about the wonderful world of chemistry. Now students anywhere can watch these performances at <www.wright.edu/ctl/eventstream/ondemand.html>. A show from 12 December 2008 can be viewed by clicking on the highlights button and then selecting Chemistry Demonstration Show from the menu.

Don't try this at home kids.

Professors Emeriti of Chemistry Rubin Battino and John J. Fortman of Wright State University in Dayton, Ohio, USA, at a recent chemistry demonstration.

www.wright.edu/ctl/eventstream/ondemand.html



Element podcast

Chemistry World takes a whirlwind tour of the periodic table: each week a leading scientist or author tells the story behind a different element.

www.rsc.org/chemistryworld/podcast/element.asp

Bookworm

Books and publications hot off the press.
See also www.iupac.org/publications

Concepts in Toxicology

by John H. Duffus, Douglas M. Templeton, and Monica Nordberg
Royal Society of Chemistry, Cambridge, 2009.
(ISBN 978-0-85404-157-2)

The objective of this book is to give clear explanations of the meaning and usage of key toxicological terms. A need was identified to go beyond glossary definitions (already published in Duffus, Nordberg, and Templeton, 2007)[1] and make plain the underlying assumptions behind terms that are becoming ever more important in communications relating to chemical safety.

With the advent of antibiotics and increasingly effective means of controlling infectious disease, attention turned to adverse health effects resulting from exposure to toxic substances. Prevention of these adverse effects required regulation of potentially harmful exposures. When this was realized, new laws, such as the Toxic Substances Control Act in the USA, were introduced. These laws required assessment of toxicity and legal definitions of what constituted toxicity. Thus, for example, the terms "toxic" and "very toxic" were given quantitative definitions based on the LD_{50}. (LD_{50} is the median dose lethal to 50% of a test population.) As a measure of toxicity, the LD_{50} is, at best, an indication of the ability of a substance to cause death following short-term exposure, usually of four days or less and often at unrealistically high concentrations. It tells us nothing about chronic effects or lethality, or about harmful effects of long-term exposure to relatively low concentrations, an important consideration in the human context where exposure may be for a lifetime of up to 100 years or more. Further, it tells us nothing about toxic effects that may be severely disabling, but are not immediately lethal, such as the malformation of limbs in children whose mothers had been prescribed thalidomide during pregnancy. This kind of effect is covered to some extent in labels and safety data sheets by so-called "Risk Phrases," but it must be remembered that absence of a risk phrase does not mean absence of toxicity. It may simply mean absence of relevant data.

In international negotiations for improved chemical safety management and implementation of harmonized laws, linguistic barriers cause problems in mutual comprehension between nations and even between scientific disciplines. Inadequate understanding of exact usage of terms also leads to considerable wastage of time in achieving a common perception of the nature and significance of problems. It is hoped that this book may help to reduce such waste.

Another consequence of misunderstood concepts in toxicology is misclassification of important substances, either prohibiting their use unnecessarily or permitting their use when the risk involved should have been perceived and avoided. A widely misunderstood concept has been "chemical speciation." This concept is tacitly assumed for organic substances, which are, by definition, chemical species of carbon and always subdivided according to structural differences (e.g., as hydrocarbons, aldehydes, ketones, etc.). Carbon compounds have never been given blanket toxicity classification based upon the reasoning that carbon is the main element present and is fundamental to their structure. There is no branch of toxicology called "Carbon Toxicology." On the other hand, there is a branch called "Metal Toxicology," which has tended to classify toxicity of metals by element rather than by species, although different chemical species of metals have vastly different properties, just as do carbon compounds. Thus, there has been blanket elemental classification of metal compounds that have very different chemical and toxicological activities. For example, nickel compounds, as a whole, have been considered to be human carcinogens, largely because of the excess cancers associated with workers in some nickel refineries. In fact, it is likely that only a limited number of nickel compounds are carcinogenic. In the absence of adequate toxicity data relating to most nickel compounds, it has been assumed that nickel cations will be released from all such compounds and that hydrated nickel cations are carcinogenic. So far, the only toxic effect to humans clearly demonstrated for divalent nickel ions in solution is sensitization leading to skin hypersensitivity and associated inflammation.

The action of IUPAC in providing a precise definition of the concept of chemical speciation (Templeton et al., 2000)[2] was the key to opening up a new area of research. This was one of the factors that persuaded the authors of "Concepts in Toxicology" that there might be a need for explanations of other concepts, and that such explanations might provide a stimulus for work at the interface between chemistry and toxicology. Basic concepts in the chemistry and biochemistry of fundamental life processes also require clarification when a precise understanding of them is factored into mechanistic toxicology and risk assessment. Thus, an IUPAC project (2003-001-2-700) was initiated, and the results were published in *Pure and Applied Chemistry* as an "Explanatory Dictionary of Key Terms in Toxicology (IUPAC Recommendations 2007)."[3] "Explanatory Dictionary of Key Terms in Toxicology, Part II," also supported as an IUPAC project (#2006-020-1-700), will be published in *PAC*.[4] Combining the two publications in the form of a book was a logical development that permitted the relationships between the concepts to be further developed and clarified using concept diagrams. This approach is reflected in the structure of the book, which develops concepts starting with fundamental principles of toxicology and risk assessment through the molecular, cellular, and organismal levels to a culmination in ecotoxicology.

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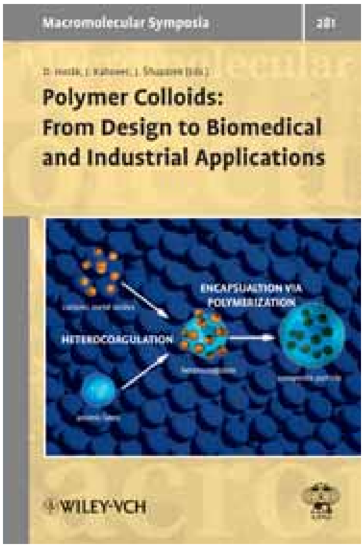
Polymer Colloids: From Design to Biomedical and Industrial Applications

Macromolecular Symposia
Volume 281, pages 1–212 (July 2009)
Daniel Horák, Jaroslav Kahovec, Jaromir Snupárek (editors)
doi:10.1002/masy.200990017

Every summer, the Institute of Macromolecular Chemistry of the Academy of Sciences of the Czech Republic organizes the Prague Meetings on Macromolecules, which are focused on special topics of polymer chemistry and physics. The papers included in this volume of *Macromolecular Symposia* were delivered at the 48th Microsymposium "Polymer Colloids: From Design to Biomedical and Industrial Applications," held 20–24 July 2008 in Prague.



The microsymposium, chaired by D. Horák from the Institute and co-chaired by J. Snupárek from the University of Pardubice, focused on new methods in design, development, modeling, characterization, and application of advanced polymer colloids both in industry and life sciences, such as biomedicine and biomedical diagnostics. Biomedical applications and polymers for drug and gene delivery have become an important issue of the host Institute in Prague. The program coverage was granted by a number of top specialists as keynote and main lecturers. Ten keynote lectures and 14 main lectures were presented by invited speakers, while 40 special lectures and 96 poster presentations were provided by other participants. Selected presentations are now reported in an extended form in this volume.

Self-Healing Materials

by Solar Olugebefola

The **2nd International Conference on Self-Healing Materials** was held from 28 June to 1 July 2009 in Chicago, USA. More than 250 delegates, originating from 21 countries, attended the conference, which was the second in a biennial series. The scientific program featured 3 plenary talks, 9 keynote lectures, 150 contributed lectures, and 31 poster presentations.

Scott White (co-chair) opened the conference with a welcome to delegates. This was followed by the first plenary lecture from Byung-Lip "Les" Lee (Air Force Office of Scientific Research, USA) on "Multifunctional Design Perspectives for Self-Healing and Autonomic Response." The other two plenary talks were "Recent Advances in Self-Healing Concrete for Sustainable Infrastructure" given by Victor Li (University of Michigan, USA) and "Self-Assembling Materials: Hierarchical Structures and Repair Strategies" given by Samuel Stupp (Northwestern University, USA).

The conference was run in four parallel sessions due to the large number of talks and was divided into 10 symposia:

- Self-Healing Cementitious Materials
- Self-Healing Supramolecular Polymers
- Mechanochemically Active Polymers
- Thermally Activated/Thermoplastic Self-Healing
- Self-Healing Fibre-Reinforced Composite Materials
- Self-Healing Metallic Materials
- Self-Healing with Internal Liquid Healing Agents
- Numerical Analysis Tools for Self-Healing
- Experimental Techniques for Assessment of Self-Healing
- Concepts and Limitations in Self-Healing Materials

In addition, a poster session was held on the evening of the second day of the conference.

The overall level of scientific discourse was quite high, and the introduction to new, unpublished, or recently published research in many different areas of self-healing materials systems provided a highly useful snapshot of the state of the field. The 3rd ICSHM will be held in 2011 in the UK.

Solar Olugebefola <solar@illinois.edu> is a professor at the University of Illinois and was a member of the local organizing committee.

think poly.

by Frank Wiesbrock and Franz Stelzer

The **12th European Polymer Congress**, EPF'09, was held 12–17 July 2009 in Graz, Austria, the "Cultural Capital" of Europe in 2003. The biannual congress is one of the main activities of the European Polymer Federation (EPF), the umbrella organization for the national polymer societies in Europe that currently comprises 22 full and 4 associated member countries. Since its start in Lyon, France, in 1986, the congress series has developed to become one of the major events in polymer science.

Franz Stelzer, president of EPF for 2008–2009, was chair of the organizing committee. The international advisory board of 22 full member countries' representatives was supported by internationally renowned researchers from North America (Virgil Percec and Krzysztof Matyjaszewski, both USA) and Asia (Akira Harada, Japan; Der-Jang Liaw, Taiwan; and Jung-Il Jin, Republic of Korea).

Franz Stelzer, president of the EPF and chair of the EPF'09 congress.

The EPF'09 congress hosted around 1000 participants from more than 50 countries for an intense yet relaxed exchange of scientific results and ideas among industrial partners, highly recognized scientists, and young researchers. With 7 leading-edge plenary speakers, 35 keynote and 61 invited speakers, almost 300 oral contributions and around 600 posters, the congress continued to build upon previous meetings.

Following is a listing of the plenary lectures:

- "Biofunctional Materials in Modulating Tissue and Immune Responses," Jeffrey Alan Hubbell (EPFL Lausanne, Switzerland)
- "Macromolecules, Assemblies, Particles—A Discovery Journey in Materials Synthesis," Klaus Müllen (Max Planck Institute for Polymer Research, Germany)
- "Atom Transfer Radical Polymerization: From Mechanisms to Materials," Krzysztof Matyjaszewski (Carnegie Mellon University, Pennsylvania, USA)
- "The Convergence of Top Down and Bottom Up Patterning Applied to Electronics and the Life

Sciences," Christopher Ober (Cornell University, New York, USA)

- "Bioinspired Synthesis of Complex Functional Systems," Virgil Percec (University of Pennsylvania, Pennsylvania, USA)
- "Oleo-Chemistry Meets Supramolecular Chemistry: Design of Self-Repairing Materials," Ludwik Leibler (ESPCI-CNRS Paris, France)
- "From Polymers to Soft Matter Devices," Gero Decher (Louis Pasteur University, France)

The scientific program of the EPF'09 covered all aspects of polymer science, comprising contributions in particular from the pentagon synthesis, characterization, processing, application, and theory. The scientific contributions were organized in six parallel sessions indicative of current research trends: (1) Polymers from Bioresources; (2) Polymers for Medical Applications; (3) Polymers in Electronics, Photonics, and Optics; (4) Micro- and Nanostructured Polymeric Systems; (5) Engineering Polymers and Polymer Technology; and (6) General Topics in Macromolecular Chemistry and Physics.

Poster sessions were held on all remaining evenings during the EPF'09 congress. In each poster session, the five best posters were awarded prizes sponsored by the American Chemical Society (*Biomacromolecules* and *Macromolecules*), the Royal Society of Chemistry (*Soft Matter* and *Journal of Materials Chemistry*), Elsevier, Wiley-VCH (*Macromolecular Journals*), Springer, and Graz University of Technology.

Another milestone of the EPF'09 congress was the celebration of the "Pieter Jan Lemstra Invention Award" ceremony, sponsored by the Dutch Polymer Institute. This year's award winner, Ulrich S. Schubert (Friedrich Schiller University Jena, Germany; formerly Eindhoven University of Technology, The Netherlands), was awarded at a dedicated session chaired by Jacques Joosten, director of corporate technology at DSM, The Netherlands.

An overview of the state-of-the-art research presented at the EPF'09 will be published in a dedicated, peer-reviewed issue of *Macromolecular Symposia* by WILEY-VCH in the near future.

The next European Polymer Congress will take place in Granada, Spain, from 26 June to 1 July 2011.

Franz Stelzer <franz.stelzer@tugraz.at> is head of the Institute for Chemistry and Technology of Materials at the Graz University of Technology and vice rector for research and technology at the Graz University of Technology, Austria.

Novel Aromatic Compounds

by Bruno Bernet

The **13th International Symposium on Novel Aromatic Compounds** (ISNA-13) was held from 19–24 July 2009, in Luxembourg, the home country of the symposium chairman F. Diederich of ETH Zurich, Switzerland. The symposium was attended by 360 participants from 34 countries; most of them from universities and ranging from well-known senior scientists to young Ph.D. Unfortunately, the number of participants coming from industry was lower than hoped due to the financial crisis.

Symposium participants were welcomed by Pierre Decker, the representative of the Luxembourg government; Rolf Tarrach, the rector of the University of Luxembourg; and Raymond Bausch of the National Research Fund of Luxembourg. IUPAC Secretary General David Black addressed the participants to announce that Luxembourg had joined IUPAC on the occasion of this symposium. In a public lecture later in the symposium, Luciënne Blessing, vice rector for research of the University of Luxembourg, informed the audience about the activities of the young university (founded in 2003) and surprised participants with an excellent interlude musical given by a vocal and dance ensemble and a piper.

The 2009 Nozoe Lecturer: A. Osuka of Kyoto University.

The field of aromatic compounds chemistry was presented in 36 invited lectures, 26 oral communications, and 186 poster presentations. In the opening plenary lecture, Nobel Laureate J.-M. Lehn, of the Université de Strasbourg and Collège de France, Paris, discussed expanding research interests from

The organizers of ISNA-13: François Diederich (left) and A. Dieter Schlüter.

supramolecular chemistry to adaptive and evolutive chemistry. A. Osuka of Kyoto University was honored as the ISNA-13 Nozoe Lecturer. The topic of his lecture, Möbius aromatic compounds, was reflected in the logo for ISNA-13, which includes the Möbius strip. A lively discussion starting immediately after this lecture was characteristic of the whole symposium.

A wide range of topics was covered during the week, including the following:

- preparation and analysis of Hückel and Möbius aromatic compounds
- assembly and intermolecular interactions of supramolecular compounds
- synthesis and conformational analysis of polycyclic aromatic compounds and of giant macrocycles
- selective modification and endohedral metallofullerenes, concave aromatics
- purification, selective synthesis, functionalization, and biological interaction of carbon nanotubes
- graphene
- assembly of aromatic compounds on solid surfaces
- molecular switches and motors
- benzene analogues: silabenzenes and 1,2-dihydro-1,2-azoborines
- investigation of electronic properties, fluorescence and luminescence, compounds for photovoltaic applications

The symposium was well organized, scientifically and socially. It gave an excellent overview of the actual research objectives in the field of aromatic systems. The next symposium in the series will be organized by Michael Haley, University of Oregon, and will be held in Eugene, Oregon, USA, from 24–29 July 2011.

B. Bernet <bernet@org.chem.ethz.ch> is a senior scientific coworker of François Diederich at ETH Zurich, Switzerland.

Mendeleev's 175 Anniversary in Tobolsk

by Oleg M. Nefedov, Natalia P. Tarasova, and Stepan N. Kalmykov*

Dmitry Ivanovich Mendeleev (1834–1907) was born in a small village near Tobolsk, the historic capital of Siberia that is nowadays famous for its oil and gas exploration and petrochemical industry. In September 2009, an international conference on **Mendeleev and His Impact on the Development of Science** took place in Tobolsk, now part of the Tyumen Oblast, Russia. The conference was organized and supported by the Russian Academy of Sciences and the Tyumen Oblast government.

Among the nearly 150 attendees at the conference, were scientists from Russia, South Korea, France, Germany, USA, Canada, Switzerland, and Japan. IUPAC was represented by its president, Jung-Il Jin; vice-president, Nicole J. Moreau; and Peter Mahaffy, chair of the Committee on Chemistry Education. The Russian Academy of Sciences was represented by 18 full members and corresponding members, including the president of RAS, academician Yuri Osipov.

The conference featured a ceremony at which a special agreement between the Tyumen Oblast region and the RAS was signed by Tyumen Oblast Governor Vladimir Yakushev and RAE President Yuri Osipov. The agreement covers topics of joint research and development in different areas of chemistry, physics, nanotechnology, and education.

A round table discussion on the first day of the conference, chaired by RAS vice president Sergey

IUPAC representatives at the Mendeleev conferences (from left): Peter Mahaffy, Jung-Il Jin, and Nicole Moreau.

Aldoshin, brought together representatives of RAS, IUPAC, industry, and young scientists. The importance of Mendeleev's discovery of periodic law was addressed Jung-Il Jin. He also pointed out the role that IUPAC plays in modern science by maintaining a common language among chemists. "Imagine if chemists in different countries called the same chemical elements by different names . . ." he said. "This is the role of IUPAC, to unite chemists, to develop their language." The discussion then moved to problems with how science, business, and industry interact in Russia and how this affects the development of an innovative atmosphere.

The conference program included invited presentations by top scientists in different branches of chemistry, nanotechnology, and the history of science. The conference was opened by Osipov, Yakushev, and Jin.

The scientific program started with the presentation by Pavel Sarkisov of the Mendeleev Chemical Technological University in Moscow, who is also the president of the Russian Chemical Society. In his talk, entitled "D.I. Mendeleev and His Contribution to Russian and World Science," he presented many unknown facts and details of Mendeleev's life and scientific career. Next, S.V. Slinkin discussed the life of Mendeleev in Tobolsk. The fist day of the conference ended with a banquet in honor of Osipov and Yakushev.

Mendeleev statue in Tobolsk.

The next day of the conference began with a talk by Sergey Aldoshin of the Institute of Problems of Chemical Physics on nanotechnology applications of photo-shiftable magnets. Nicole Moreau presented results of studies of biological activity screening of different natural and synthetic products. Her talk was followed by academician Yuri Zolotov of Moscow State University, who discussed the scientific and social atmosphere in which Mendeleev lived. He presented many new facts about the teachers and progeny of Mendeleev and how they affected his life and scientific and social career. He showed that Mendeleev also made an impact on economics, physics, natural resource management, geography, and other fields. Armin de Meijere of Universität Göttingen (Germany), who is an expert in organic chemistry, presented a talk entitled "Mendeleev and the Mutual Stimulation of Russian and German Chemistry."

The next session, chaired by academician Boris Myasoedov, dealt with nuclear chemistry, physics, and properties of newly discovered super heavy elements. David Clark of the Los Alamos National Laboratory, USA, presented a lecture on the discovery of plutonium and how that discovery was in complete agreement with the periodicity of properties of chemical elements formulated by Mendeleev. Sergey Dmitriev of the Flerov Laboratory of Nuclear Reactions in Dubna and Heinz Gäggeler of the Paul Sherer Institute in Switzerland showed new data and achievements in the field of synthesis of new super heavy elements and studies of their properties. They demonstrated the similarity in chemical behavior of elements with atomic numbers 112–120 to their lower atomic number group members that completely supports Mendeleev's concept despite the relativistic effects of super heavy element's atoms. This may enable the search for isotopes of super heavy elements from the so-called "island of stability" in the environment. Such a project was started in a low-level underground laboratory in Switzerland. Mark Stoyer of Lawrence Livermore National Laboratory, USA, presented the results of fundamental studies in the field of nuclear physics. David Hobard discussed the history of the Mendeleev Table and showed pictures of different goods (e.g., neckties, mouse pads, tee-shirts) that display images of the periodic table.

The last day of the conference included a presentation by Vladimir Melnikov on cryoscience as it relates to the permafrost zones. The next two presentations, made by Mahaffy and Tarasova, focused on the issue of chemical education and sustainable development. Alexey Postnikov, the director of the Institute of the History of Natural Sciences and Technik in Moscow,

The Tobolsk Kremlin.

and Masanori Kaji of Tokyo Technological University, presented the historical facts concerning Mendeleev's discoveries. Salambek Khadziev, the director of the Topchiev Institute of Petrochemical Synthesis, talked about new techniques for crude oil treatment including deep and integrated processes. Valentin Parmon of the Institute of Catalysis made a presentation describing the recent achievements of the Siberian Branch of RAS. The scientific program ended with a talk by Aslan Tsivadze of the Frumkin Institute of Physical Chemistry and Electrochemistry in Moscow on the latest achievements in supramolecular and nanochemistry at his institute.

The final day of the conference continued onboard a ship that took participants to the spot where the Rivers Irtysh and Tobol meet. The sunset and gypsy songs and dances, together with the exceptional hospitality of Siberian chemists, will stay in the memories of participants forever. As will the great Russian scientist Dmitry Mendeleev.

Natalia P. Tarasova <nptar@online.ru> is the director of the Institute of Chemistry and Problems of Sustainable Development at the D. Mendeleev University of Chemical Technology, Russia. She is an elected member on the IUPAC Bureau and since this Janauary and member on the Executive Committee; she is alos a member of the IUPAC Committee on Chemistry Education.

take note → random news you can use

The Sceptical Chymist is a blog produced by the editors of *Nature Chemistry* that also serves as a forum for readers, authors, and the entire chemical community. The blog discuss what's new and exciting in chemistry, be it in *Nature Chemistry* or elsewhere. For instance, search for **"IUPAC '09"** to access a multitude of blog posts from the IUPAC '09 Congress in Glasgow. The blog authors welcome spirited conversation!

http://blogs.nature.com/thescepticalchymist

Bioluminescence and Chemiluminescence

19–23 April 2010, Lyon, France

The **16th International Symposium on Bioluminescence and Chemiluminescence** (ISBC), to take place 19–23 April 2010 in Lyon, France, will review the latest advances in bioluminescence, chemiluminescence, and related topics.

The ISBC series, which started in 1978 in Brussels, Belgium, and now is held every two years in a different country, was last held in Shanghai, China in 2008. The scope of the symposium will include the following:

Bioluminescent mushrooms: Omphalotus nidiformis.

- biosensors and bioassays
- in vitro and in vivo reporter gene technology
- biochemistry of bioluminescence
- chemistry of chemiluminescence
- electrochemiluminescence and electrogenerated luminescence
- analytical applications
- biology and physiology of luminous organisms
- instrumentation
- imaging
- microarrays, biochips and miniaturized systems
- immunoassays
- applications in medicine, molecular biology, forensic sciences, clinical chemistry, food analysis, and cosmetics
- bioluminescence and chemiluminescence resonance energy transfers
- nucleic acid hybridization assays
- fluorescence of biomolecules

http://isbc2010.univ-lyon1.fr

Plant Lipids

11–16 July 2010, Cairns, Australia

The Australasian Section of the American Oil Chemists' Society is organizing the **19th International Symposium on Plant Lipids**, which will be held 11–16 July 2010 in Cairns, Australia, at the world-class Cairns Convention Centre.

The committee is strongly focused on delivering a cost-effective program that continues the ISPL tradition of highlighting exciting advances in plant lipid research. ISPL-2010 will be placing a special spotlight on the potential major contributions that plant lipids can make to the emerging bio-based economy.

Session topics will include the following:

- lipid biosynthesis and metabolic networks, and their role in seed development
- storage lipids (TAG synthesis and mobilization, sterols, wax esters, isoprenoids)
- surface lipids-structure and function (waxes, suberin, cutin)
- lower plant lipids (algal/fungal and other micro organisms)
- structure, function, and synthesis of membrane lipids (glycolipids, sterols, and phospholipids)
- oxylipins-oxylipin formation/function and lipid oxidation
- fatty acid desaturation and modification
- lipid trafficking and signaling (membrane dynamics, lipid rafts, PIPs, sphingolipids)
- bioinformatics for the lipidome
- lipid biotechnology and metabolic engineering
- genetically modified plant oils (production challenges, crop platforms, regulatory issues)

The meeting organizers hope that delegates will take the opportunity to experience the wonderful scenic beauty of the surrounding World Heritage-listed Wet Tropics Rainforest and Great Barrier Reef.

www.ispl2010.org

Electrochemistry—South-East Europe

6–10 June 2010, Belgrade, Serbia

The second **Regional Symposium on Electrochemistry—South-East Europe** (RSE-SEE) will take place at the SAVA Congress Center in Belgrade, Serbia, from 6–10 June 2010.

The conference will consist of invited speakers' lectures and oral and poster contributions from the more than 200 participants from the region who are expected.

Recognizing the significance of the field to science, technology, and every-day life, electrochemists from this region decided to provide a broad framework for the exchange of knowledge, ideas, and news among themselves and with the international electrochemical and scientific community at large. The first RSE-was held in Rovinj, Croatia in 2008.

The main objectives of the RSE-SEE could be summarized as follows:

- promotion of electrochemistry and its visibility as a part of science and as the basis of a significant part of modern technology
- creation and promotion of international cooperation and personal contacts among electrochemists, and particularly amongt young researchers entering the field of electrochemistry
- establishment and maintenance of high-quality methods and standards in electrochemical research

The RSE-SEE covers fundamental and applied aspects of electrochemistry, including (but not limited to) the following:

- experimental and theoretical methods in electrochemistry
- physical electrochemistry and analytical electrochemistry
- organic electrochemistry
- environmental electrochemistry
- bioelectrochemistry and biomedical applications
- nanoscale and molecular electrochemistry
- energy conversion and storage devices (batteries, fuel, and solar cells, electrochemical capacitors)
- corrosion, passivation, and anodic films
- electrochemistry of functional structures and materials (nanostructures, conducting polymer films, dielectrics, semiconductors)
- electrochemical and electronic sensor devices
- electrochemical synthesis, deposition, electrolysis, and engineering

Belgrade and Serbia have plenty to offer in terms of science, culture, entertainment, fun and good food.

See Mark Your Calendar on page 36 for contact information.

www.rse-see.net

Spectral Line Shapes

6–11 June 2010
St. John's, Newfoundland, Canada

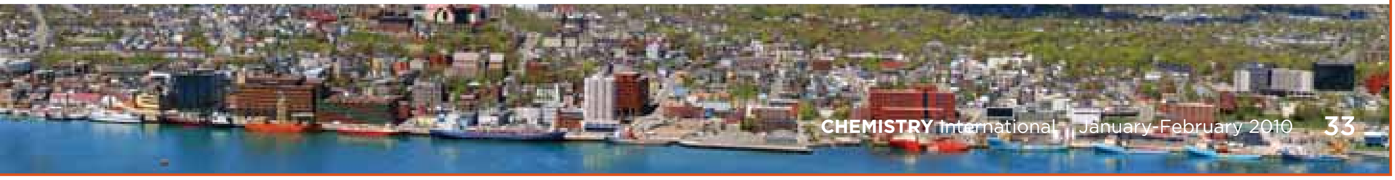
The **20th International Conference on Spectral Line Shapes** (ICSLS 20) will be held 6–11 June 2010 on the St. John's campus of the Memorial University of Newfoundland, St. John's, Newfoundland, Canada.

This biennial conference is a principal international forum for both fundamental and applied works dealing with processes related to the formation of the spectral line profiles and their use for diagnostic purposes. On the fundamental side, the study of the line profiles reveals the underlying atomic and molecular interactions. On the practical side, the line profiles are employed as powerful diagnostic tools for various media, such as neutral gases, technological gas discharges, magnetically confined plasmas for fusion, laser- and Z—pinch-produced plasmas, astrophysical plasmas, and planetary atmospheres.

The ICSLS conferences, which started in 1973 in Paris, France, alternates between Europe and US/Canada. The previous conference was held in Valladolid, Spain, in 2008.

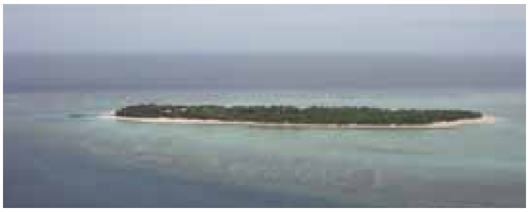
See Mark Your Calendar on page 36 for contact information.

www.icsls20.ca



Reactive Intermediates and Unusual Molecules

10–16 July 2010
Great Barrier Reef, Australia



The fifth **Heron Island Conference on Reactive Intermediates and Unusual Molecules: Synthesis and Mechanism**, which follows the tradition of the previous, highly acclaimed events, will take place from 10–16 July 2010 in the Great Barrier Reef, Australia. The event will host up to 100 participants and accompanying persons (the resort is perfectly positioned for family holidays. Scientific sessions in the mornings and evenings will leave the afternoons free for social and reef activities (snorkelling, diving, reef walking, swimming, fishing), sports, and relaxation. Heron Island is a small coral cay on the reef 72 km northeast of Gladstone and 600 km north of Brisbane in subtropical, sunny Queensland. It is a place of great tranquillity and natural beauty, and the seafood is legendary.

The conference takes place immediately after the 13th RACI National Convention in Melbourne, 4–8 July, held jointly with the 12th IUPAC International Congress of Pesticide Chemistry, and a week before the 39th ICCC (Adelaide, 25-30 July). The number of participants at Heron Island is strictly limited. Payment of the registration fee secures a place.

www.heron5.org

Chemistry for Sustainable Development

26–30 July 2010, Mauritius

The **International Conference on Pure and Applied Chemistry** (ICPAC 2010) will be held 26–30 July 2010 at La Plantation Resort and Spa in Mauritius. The organizing committee has adopted the theme "Chemistry for Sustainable Development" for this event.

Due to progress in science and technology, the world has condensed into a global village. However, many nations are facing crises due to tremendous increases in the demand for energy, food, and water. Chemistry has a crucial role to play in sustaining the development of our planet.

The conference program will feature a wide variety of plenary, invited, and contributed lectures, as well as poster sessions. The topics of the conference will cover all aspects of chemistry. One of the plenary speakers will be Aaron Ciechanover, who is the 2004 Nobel Laureate in chemistry for his work on Ubiquitin-Mediated Protein Degradation. There will also be workshops and symposia conducted by experts. Full papers from participants will be peer reviewed and accepted papers will be collected in a book of proceedings that will be published by Springer.

This conference will provide a platform for participants to share and discuss recent findings of their research covering all topics related to chemistry. It will also be an opportunity for participants to visit the island of Mauritius, famous for its sun, sea, and sand and for its mix of cultures.

The deadlines for abstract submission is 15 March 2010.

www.uom.ac.mu/icpac

International Symposia on Advancing the Chemical Sciences

The International Symposia on Advancing the Chemical Sciences (ISACS) is a new global symposia series organized by the Royal Society of Chemistry, UK. During 2010, the first three symposia will be held on three continents, over three sequential weeks, focusing on distinct subject areas as follows:

Challenges in Organic Chemistry and Chemical Biology (ISACS1)

6–9 July 2010, San Francisco, USA
www.rsc.org/isacs1

Speakers: Carolyn Bertozzi, Stephen Buchwald, Jason Chin, Benjamin Cravatt, Vy Dong, Justin Du Bois, Ben Feringa, Linda Hsieh-Wilson, Christopher Hunter, Eric Jacobsen, David MacMillan, Keiji Maruoka, Takashi Ooi, Andreas Pfaltz, Peter Seeberger, Erik Sorensen, F. Dean Toste, M. Christina White

Challenges in Physical Chemistry and Nanoscience (ISACS2)

13–16 July 2010, Budapest, Hungary
www.rsc.org/isacs2

Speakers: Mike Ashfold, Moungi Bawendi, David Clary, Jianguo Hou Kopin Liu, Daniel Neumark, Michel Orrit, Hongkun Park, Vahid Sandoghdar, Alec Wodtke, Martin Wolf, Toshio Yanagida, Haw Yang, Xueming Yang

Challenges in Inorganic and Materials Chemistry (ISACS3)

20–23 July 2010, Hong Kong, China
www.rsc.org/isacs3

Speakers: Christopher Chang, Chi-Ming Che, Christopher Cummins, Makoto Fujita, Michael Grätzel, Hansjörg Grützmacher, Gregory Hillhouse, Susumu Kitagawa, Jeffrey Long, Tetsuro Murahashi, Daniel Nocera, Philip Power, Manfred Scheer, Jean-Marie Tarascon, Omar Yaghi, Bing Xu, Vivian Yam, Peidong Yang

Each program will feature a single stream of a minimum of 18 plenary lectures, complemented by extensive poster sessions. Submissions for each meeting are due by 29 January 2010.

Organic Chemistry

22–25 June 2010, Beijing, China

As with previous events in this series, the **Eleventh Tetrahedron Symposium**, organized by Elsevier/Tetrahedron, will bring together internationally renowned speakers for a comprehensive and wide-ranging program covering all aspects of organic synthesis; bioorganic, medicinal, and computational chemistry; molecular recognition; and the organic chemistry of materials.

Researchers are invited to submit abstracts for presentation within the large poster sessions on the following topics:

- stereoselective synthesis
- synthesis and property of functional molecules
- total synthesis of natural products
- new reagents, catalysts, and strategies and concepts for organic synthesis
- bioorganic chemistry and medicinal chemistry
- molecular recognition

Attendance at this meeting will enable participants to do the following:

- learn from internationally renowned researchers
- understand the current state of research and the challenges to future discovery
- present their latest research in poster sessions
- gain an understanding of the developments from China and the Asian region
- network with the editors of the Tetrahedron journals, meet with international colleagues, visit the trade stands, and make new alliances

The deadline for submission of oral and poster abstracts is 28 February 2010.

www.tetrahedron-symposium.elsevier.com

Mark Your Calendar

Upcoming IUPAC-sponsored events
See also http://www.iupac.org/indexes/Conferences
for links to specific event websites

2010

🏆 *IUPAC poster prizes to be awarded*

6–9 March 2010 • Chemistry and Industry • Kuwait City, Kuwait 🏆
Kuwaiti Conference of Chemistry
Dr. Abdulaziz Al-Najjar, KCS president, The Kuwait Chemical Society, P.O.Box 39151, Nuzha, 73052 Kuwait
Tel: +965 22510351, Fax: +965 22522096, E-mail: kw_chemical@yahoo.com or kw_chemical@hotmail.com

7–10 March 2010 • Heterocyclic Chemistry • Gainesville, Florida, USA
11th Florida Heterocyclic and Synthetic Conference
Prof. Alan R. Katritzky, University of Florida, Department of Chemistry, Gainesville, FL 32611-7200, USA
Tel.: +1 352-392-0554, Fax: +1 352-392-9199, E-mail: katritzky@chem.ufl.edu

7–10 April 2010 • POLYCHAR 18 • Siegen, Germany 🏆
18th International Conference on Polymer Characterization; World Forum on Advanced Materials
Professor Werner Mormann, Universität Siegen, FB-8, Makromolekulare Chemie, Adolf Reichwein Strasse 2
D-57068 Siegen, Germany
Tel.: +49 271 740 4713, Fax: +49 271 740 2226, E-mail: mormann@chemie.uni-siegen.de

5–11 June 2010 • Spectral Line Shapes • St. John's, Newfoundland, Canada
20th International Conference on Spectral Line Shapes
Prof. John K. C. Lewis, Memorial University of Newfoundland, Department of Physics and Physical Oceanography, St. John's, NL A1B 3X7, Tel.: + 709 737 8849, Fax: + 709 737 4569, E-mail: court@mun.ca

6–10 June 2010 • Electrochemistry • Belgrade, Serbia
2nd Regional Symposium on Electrochemistry: Southeast Europe
Prof. Vesna B. Miškovic-Stankovic, University of Belgrade, Faculty of Technology and Metallurgy, Karnegijeva 4, 11000, Belgrade, Serbia, Tel.: + 381 11 330 3488, Fax: +381 11 337 0387, E-mail: vesna@tmf.bg.ac.rs

4–8 July 2010 • Pesticide Chemistry • Melbourne, Australia 🏆
12th IUPAC International Congress of Pesticide Chemistry
Dr. Elizabeth Gibson, RACI, 1/21 Vale Street, North Melbourne, VIC 3051, Australia
Tel.: +61 0 3 9328 2033, Fax: +61 0 3 9328 2670, E-mail: elizabeth@raci.org.au

5–8 July 2010 • Polymer-Solvent Complexes • Strasbourg, France
8th International Conference on Polymer-Solvent Complexes and Intercalates
Prof. Jean-Michel Guenet, Université de Strasbourg, Institut Charles Sadron—CNRS, 23, Rue de Loess
F-67034 Strasbourg, Tel.: + 33 038 841 4087, Fax: + 33 038 841 4099, E-mail: guenet@ics.u-strasbg.fr

11–15 July 2010 • Phosphorus • Wroclaw, Poland
18th International Conference on Phosphorus Chemistry
Prof. Paweł Kafarski, Department of Bioorganic Chemistry, Faculty of Chemistry, Wroclaw University of Technology, Wybrzeže Wyspianskiego 27, 50-370 Wrocław, Poland
E-mail: pawel.kafarski@pwr.wroc.pl

11–16 July 2010 • Macromolecules • Glasgow, UK 🏆
43rd International Symposium on Macromolecules—IUPAC World Polymer Congress (Macro 2010)
Prof. Peter A. Lovell, School of Materials, The University of Manchester, Grosvenor St. Manchester, M1 7HS, UK
Tel.: +44 (0) 161-306-3568, Fax: +44 (0) 161-306-3586, E-mail: pete.lovell@manchester.ac.uk

11–16 July 2010 • Photochemistry • Ferrara, Italy 🏆
XXIII IUPAC Symposium on Photochemistry
Prof. Franco Scandola, Dipartimento di Chimica, Università di Ferrara, Via L. Borsari 46, I-44100 Ferrara, Italy
Tel.: +39 05 32 455 160, Fax: +39 05 32 240 709, E-mail: snf@unife.it

25–30 July 2010 • Solubility Phenomena • Leoben, Austria 🏆
14th International Symposium on Solubility Phenomena and Related Equilibrium Processes
Prof. Heinz Gamsjäger, Montanuniversität Leoben, Lehrstuhl für Physikalische Chemie,
Franz Josef Strasse 18, A-8700 Leoben, Austria
Tel.: +43 (0) 3842 402 4804, Fax: +43 (0) 3842 402 4802, E-mail: heinz.gamsjaeger@mu-leoben.at

25–30 July 2010 • Coordination Chemistry • Adelaide, Australia
39th International Conference on Coordination Chemistry
Dr. Christopher Sumby, University of Adelaide, School of Chemistry & Physics, Adelaide, SA 5005, Australia
Tel.: +61 8 8303 7406, Fax: +61 8 8303 4358, E-mail: christopher.sumby@adelaide.edu.au

1–6 August 2010 • Chemical Thermodynamics • Tsukuba, Japan
21st International Conference on Chemical Thermodynamics
Prof. Kazuya Saito, Department of Chemistry, Graduate School of Pure and Applied Sciences, University of Tsukuba, Tsukuba, Ibaraki 305-8571, Japan
Tel.: +81 29 853 4239, Fax: +81 29 853 6503, E-mail: kazuya@chem.tsubuka.ac.jp

1–6 August 2010 • Organic Synthesis • Bergen, Norway
18th International Conference on Organic Synthesis
Prof. Leiv K. Sydnes, Department of Chemistry, University of Bergen, Allégaten 41, N-5007 Bergen, Norway
Tel.: +47 55 58 34 50, Fax: +47 55 58 94 90, E-mail: leiv.sydnes@kj.uib.no

1–6 August 2010 • Carbohydrate • Chiba, Japan
25th International Carbohydrate Symposium
Prof. Yukishige Ito, RIKEN Advanced Science Institute, 2-1 Hirosawa, Wako, Saitama 351-0198, Japan
Tel.: + 81 48-467-9430, Fax: + 81 48-462-4680, E-mail: yukito@riken.jp

8–13 August 2010 • Chemical Education • Taipei, Taiwan
21st International Conference on Chemical Education—Chemistry Education and Sustainability in the Global Age
Prof. Mei-Hung Chiu, National Taiwan Normal University, No. 88, Ding-Zhou Road, Section 4, Taipei, 116, Taiwan
Tel.: + 886 2-2932-2756, Fax: + 886 2-2935-6134, E-mail: mhc@ntnu.edu.tw

15–19 August 2010 • Green Chemistry • Ottawa, Canada
3rd IUPAC Conference on Green Chemistry (ICGC-3)
Prof. Philip Jessop, Department of Chemistry, Queen's University, 90 Bader Lane, Kingston, ON, K7L 3N6, Canada
Tel.: +1 613-533-3212, Fax: +1 613-533-6669, E-mail: info@icgc2010.ca

22–27 August 2010 • Physical Organic Chemistry • Busan, Korea
20th International Conference on Physical Organic Chemistry
Prof. Dae-Dong Sung, Department of Chemistry, Dong-A University, Saha-Gu, Busan 604-714, Korea
Tel.: +82 51 200 7243, Fax: +82 51 200 7259, E-mail: ddsung@dau.ac.kr

14–18 September 2010 • Biotechnology • Rimini, Italy
14th International Biotechnology Symposium and Exhibition
Prof. Fabio Fava, Università di Bologna, Via Terracini, 28, I-40131 Bologna, Italy
Tel.: +39 051 209 0330, Fax: +39 051 209 0348, E-mail: fabio.fava@unibo.it

19–23 September 2010 • Heavy Metals in the Environment • Gdansk, Poland
15th International Conference on Heavy Metals in the Environment
Prof. Jacek Namiesnik, Department of Analytical Chemistry, Gdansk University of Technology, G. Narutowicza 11/12, PL-80 233 Gdansk, Poland, Tel.: +48 58 347 1345, Fax: +48 58 347 2340, E-mail: chemanal@pg.gda.pl

6–9 October 2010 • Vanadium • Toyama, Japan
7th International Symposium on the Chemistry and Biological Chemistry of Vanadium
Tatsuya Ueki (V7 Symposium General Secretariat), Department of Biological Science, Graduate School of Science, Hiroshima University, Higashi-Hiroshima, Hiroshima 739-8526, Japan
Tel.: +81 82 424 7437, Fax: +81 82 424 7437, E-mail: secretariat@vanadiumseven.com

6–10 October 2010 • Eurasia Chemistry • Amman, Jordan
11th Eurasia Conference on Chemical Sciences
Dr. Amal Al-Aboudi, Chemistry Department, University of Jordan, Amman 11942, Jordan
Tel.: +962 6 535 5000, Fax: +962 6 535 5522, E-mail: alaboudi@ju.edu.jo

11–14 October 2010 • Novel Materials • Wuhan, China
6th International Symposium on Novel Materials and their Synthesis
Prof. Yu-Ping Wu, Department of Chemistry, Fudan University, No. 220 Handan Road, Shanghai 200433, China
Tel.: +86-21-6564-2141 +86-21-5566-4223, Fax: +86-21-5566-4223, E-mail: nms@fudan.edu.cn *or* wuyuping99@yahoo.com

International Union of Pure and Applied Chemistry

Advancing the worldwide role of chemistry for the benefit of Mankind

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