

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

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112

Cn

Copernicium

Copernicus Honored with Element 112



A Century of pH Measurement
IUPAC as a Science NGO



CHEMISTRY International

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

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By now, you have seen the logo of the 2011 International Year of Chemistry. It is simple, and for good reason. Chemistry is so many different things and if one tries to brand it to a single image, many chemists will quickly say “that’s not chemistry.” Chemistry today is no longer a simple beaker. It is much more than a molecular model. It is also



more than just green chemistry, or materials, or drug design. It is all of these things and more—a multitude of simple and complex challenges.

The French academician Pierre Potier, once said “la chimie est à la biologie ce que le solfège est à la musique” (i.e., “chemistry is to biology what musical notation is to music.”) One does not need to be a musician to appreciate the relevance of that expression.

So, back to the IYC logo; since it was decided to keep it simple, the chosen logo is just a “C” for chemistry. It looks like the carbon element in the periodic table, and also like a page of a daily calendar, recalling 2011 as the year to celebrate.

I wear the logo as a pin and when asked what it is, I am ready to answer. If my interlocutor frowns at my first answer, I add that C is for Celebrate and also for Curie, as in Marie Curie. After all, in 2011 we will be celebrating the 100th anniversary of her Nobel Prize in Chemistry. I could also say that C is for Curious (aren’t we all?), which works well with the kids and intrigues them. While meeting recently with a colleague from the International Union of Crystallography, I suggested that he claim the C is for Crystals. Crystallographers have good reasons to celebrate: in 2012, they will commemorate the 100th anniversary of the Bragg’s Law.

C is for Challenges, for Creativity, or for Changes. Whatever your preference on any given day, there is plenty to Celebrate under the C of Chemistry. If you are a music aficionado like Potier, and if your challenge is to convince others that being a Chemist is a bit like being a Composer, then you know that “Do” in Romance languages is just “C” in English.

Think C and happy IYC planning.

Fabienne Meyers

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P.S.: Last month, chemists welcomed a new element to their cherished periodic table while paying tribute to Nicolaus Copernicus’ lifetime contributions to science. Element 112 now has a proper name: copernicium. The name copernicium—don’t forget the “i” in the ending—is consistent with the 2002 IUPAC recommendations on the naming of elements which suggest, for linguistic consistency, that the names of all new elements should end in “-ium”. (*Pure Appl. Chem.* 74(5), 787–791, 2002). Read more on page 16.

Cover: The Nicolaus Copernicus Monument in Warsaw, Poland. Designed by Bertel Thorvaldsen in 1822, the bronze statue of the Polish astronomer was completed in 1830.

Contents

CHEMISTRY International March-April 2010 Volume 32 No. 2

Officer's Column

- IYC 2011 Update—*Here We Go!* by John M. Malin 2

Features

- A Century of pH Measurement** by Maria Filomena Camões 3
IUPAC as a Science NGO by Colin Humphries 8
IUPAC in Glasgow, Scotland: Division Roundups, Part III 12
CHEMRAWN: Chemical Research Applied to World Needs
by Leiv K. Sydnes 12
Division VIII: Chemical Nomenclature and Structure
Representation by Ture Damhus 13
Committee on Chemistry and Industry by Mike Booth 14
Committee on Printed and Electronic Publication by Bohumir Valter 14
Division III: Organic and Biomolecular Chemistry by Pietro Tundo 15



IUPAC Wire

- Happy Birthday Copernicus 16
Terrence Renner Appointed IUPAC Executive Director 16
David Moore Named 2009 LANL Fellow 17
Molly Stevens Receives *Polymer International*-IUPAC
Award 2009 17
Materials Chemistry: a Stronger Role within IUPAC 18
International Year of Biodiversity 19
In Memoriam—Itaru Mita 19



The Project Place

- Categorizing Halogen Bonding and Other Noncovalent
Interactions Involving Halogen Atoms 20
Risk Assessment of Effects of Cadmium on Human Health 21
Regional Drinking Water Quality Assessment in the
Middle East: An Overview and Perspective 22
New Drugs for Neglected Diseases in Latin America 24



Bookworm

- Antarctic Climate Change and the Environment 25

Conference Call

- High Temperature Materials Chemistry by Alexandra Navrotsky 27
Soil Science by Jianming Xu 28
Novel Materials by Yuping Wu 29

Where 2B & Y

30

Mark Your Calendar

32



Stamps International, 7

Officer's Column

IYC 2011 Update— Here We Go!



by John M. Malin

It's a pleasure and a privilege to be working with IUPAC and its International Year of Chemistry Management Committee to organize the International Year of Chemistry 2011. In late 2009, our committee held a meeting at the IUPAC Secretariat at Research Triangle Park, North Carolina, USA, to assess progress. We were delighted to learn of the many excellent plans and activities brought forward by national chemical societies around the world and international federations in Europe, Latin America, and Asia. Websites of local, national, and regional organizations are coming online to describe the many creative activities and inspirational events being proposed.

But our main interest was focused on the plans by IUPAC and its partners for international activities. Full information is now available on our newly released website <www.chemistry2011.org>. You can join the IYC Network, which already includes over 900 contacts in 94 countries, get information about IYC 2011 activities, list your own plans, and share ideas with peers all over the world. The Ideas forum is especially interesting. It suggests projects involving the making of chemistry videos, developing new courses, learning about industrial chemistry, finding new ways to visualize climate change, understanding how chemistry helps sustainable development, employing virtual reality to understand chemistry, developing new visual aids for instruction, and planning activities to interest students and the general public. It's a list that's hard to read without stopping for breath, but I believe we have just scratched the surface of the chemistry community's creativity.

You should know that three major **Cornerstone Events** are being planned so far. The IYC 2011 opening event is scheduled to be held 27–28 January 2011 at the Paris headquarters of UNESCO, our co-organizer. The

overall program will include discussions of chemistry's historical perspective, the contributions of women in chemistry, and global trends. In August, there will be the 2011 IUPAC Congress in Puerto Rico, which will feature a number of International Year activities with the special participation of some seven Nobel Laureates. The IUPAC General Assembly, held concurrently with the Congress, will include a special World Chemistry Leadership Conference that will focus on chemistry and sustainability. The year's closing event will take place in December in Brussels, Belgium. Under the primary auspices of SOLVAY SA, the meeting will celebrate chemistry as the "solutions provider" to many of humankind's major challenges.

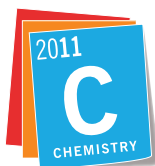
I believe we have just scratched the surface of the chemistry community's creativity.

Special events are also being planned for the PACIFICHEM 2010 meeting of Pacific Basin societies in Honolulu, Hawaii, USA, (December 2010) and the January 2011 congress of the South African Chemical Institute/Federation of African Societies of Chemistry, which will take place in Johannesburg, South Africa.

As chemists, we know that our fundamental understanding of the nature of our world is grounded in chemistry. The molecular transformations we study and manage are basic to the production of foodstuffs, medicines, fuels, and materials—essentially all manufactured and extracted products. We rely on this science to maintain a sustainable, wholesome environment for all the earth. IYC 2011 is a unique opportunity for everyone to celebrate the central contributions of chemistry. Many more events are being planned. I urge you to watch the IYC 2011 website and this magazine for information about these new activities, and to get involved either through IUPAC or your national chemical society or federation.

John Malin <jmalin023@verizon.net> is the chair of the IYC Management Committee; he recently retired from the American Chemical Society after 25 years as administrator of International Activities and Awards and as a grants administrator with the Petroleum Research Fund. In IUPAC, in recent years, Malin has been chair of the CHEMICAL Research Applied to World Needs (CHEMRAWN) Committee.

 www.chemistry2011.org



International Year of
CHEMISTRY
2011

A Century of pH Measurements

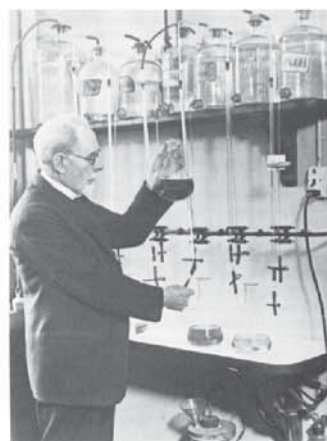
Brewing and science, especially chemistry, have been intertwined throughout history. In fact, the pursuit of better beer and better methods for making it, have led to many scientific breakthroughs. One of the most important of these from a chemistry perspective was Søren Peder Lauritz Sørensen's introduction of the concept of pH, a quantity that is a measure of acidity and basicity. In 1909, Sørensen (1868–1939), a Danish biochemist and director of the research laboratories (Holter 1976)* of Carlsberg Breweries in Copenhagen, developed a pH numerical scale as a simple way of expressing hydrogen ion concentrations, which he had realized played a key role in enzymatic reactions.

Nowadays, most of the things we use on a daily basis, like tap water, food and beverages, cosmetics, and medicines, are tested for pH. And, of course, many chemical and biochemical processes are pH dependent. With the 100th anniversary of the introduction of the concept of pH, it is interesting to look back at the development of this important concept.

by Maria Filomena Camões

In 1884, Svante Arrhenius (1859–1927) affirmed his Theory of Electrolytic Dissociation and produced the first definition of an acid based on its chemical composition and on its ability to dissociate in aqueous solution with the production of hydrogen ions, H^+ (Arrhenius, 1912). For the first time, a base was considered to be a substance that dissociated in water into hydroxyl ions, OH^- , and not simply to be a substance that opposed the effects of an acid. Concentration of hydrogen ions (c_H) may span over several orders of magnitude, from relatively high values, (e.g., above 1 mol dm^{-3} [$= 10^0 \text{ mol dm}^{-3}$]), as is the case with concentrated solutions of strong mineral acids, to low values expressed in terms of powers of 10 with a negative exponent (e.g., $10^{-12} \text{ mol dm}^{-3}$ for concentrated solutions of strong bases).

Even before defining pH, Sørensen had conducted pioneering research on the synthesis of aminoacids, on the preparation of reference buffer solutions, and on the colorimetric assessment of acidity (Sørensen



Pedr Sørensen titrating using an original set of buffer solutions and indicators.

1907). For practical reasons, Sørensen defined p c_H as the negative logarithm of hydrogen ion concentrations. This negative exponent, $c_H = 10^{-p c_H}$, is numerically the same as the decadic logarithm of hydrogen ion concentration, $p c_H = -\lg c_H = -\lg 10^{-p c_H}$. The choice of "pH" was simply because it stood for *pondus Hydrogenii*, although in other languages it could stand for power, potenz, potence, etc.

Most often, concentration values lie between 1 mol dm^{-3} and $10^{-14} \text{ mol dm}^{-3}$, with defined pH values of 0 and 14, respectively. Nevertheless, and despite the relatively common misconception that there are only values of pH above 0, negative pH values can be found in nature (e.g., in extremely acidic mine waters).

While conducting research on the effect of ion concentrations in the analysis of proteins, Sørensen noticed a color change of some acid-base indicators, produced in the presence of proteins, suggesting a pH shift, usually toward more alkaline values. (Rosenfeld 1999). This "protein error" allows protein detection by means of paper strips impregnated with buffered indicator: with constant pH, the indicator presents one color in the absence of proteins and a different one in their presence. For this reason and because many physiological processes depend upon pH, it is not sur-

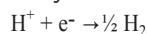
* Complete references for this article can be found at <www.iupac.org/publications/ci/2010/3202/1_mfcamoes.html>.

A Century of pH Measurement

prising that the first survey article on pH, published by L. Michaelis, mentioned the importance of hydrogen ion concentration and its measurement for biology (Michaelis 1914).

Having a conceptual definition of pH is one thing, but having an experimental realization of the defined quantity and the assignment of a pH value to a certain solution is another matter. As Sørensen and others found, colorimetric detection with color indicators does not allow sensitivity to pH changes better than 0.5, making the method unsuitable for demanding chemical objectives.

Together with his definition, Sørensen proposed an electrometric procedure for the evaluation of this quantity based on the measurement of the potential, $E_{\text{H}^+/\text{H}_2}$, of the platinum-based, Pt,H₂, (or palladium-based, Pd,H₂) hydrogen gas electrode, sensitive to hydrogen ions (H⁺) that had been developed by LeBlanc (LeBlanc 1893). A thin foil of platinum electrolytically coated with a finely divided deposit of platinum or palladium metal, in solutions saturated with hydrogen gas, catalyzes the electrode reaction:



This Pt-based (or Pd-based) hydrogen gas electrode is universally accepted as the primary standard, SHE, with which all other electrodes are compared. This is because it meets the requirements of revers-

ibility and reproducibility (Hills 1961) for an arbitrary reference point of a numerical scale of potentials in aqueous media ($E_{\text{H}^+/\text{H}_2}^0 = 0 \text{ V}$, at all temperatures and for standard conditions of hydrogen gas pressure and hydrogen ion composition).

In practice, no single electrode potential can be independently assessed and only differences of potential between two electrodes can be calculated. Sørensen proposed that the pH of an unknown solution (X) is obtained from the potential, E (measured in potentiometric conditions; i.e., null current) of a cell previously developed by Bjerrum (Bjerrum 1906), represented below in terms of conventional notation:



formed by combining two half-cells, one containing the platinum-based hydrogen-gas electrode (Pt,H₂), interfacing with a solution containing hydrogen ions, and the other one based on a calomel electrode (Hg,Hg₂Cl₂) sensitive to chloride ions (Cl⁻) present in the solution it interfaces with, introduced by Ostwald (Ostwald 1894). A salt bridge establishes electrolytic contact between the solutions of the two half cells.

The empirical Nernst equation was used as the analytical law:

$$E_1 - E_2 = - \frac{RT}{F} \ln \frac{(c_{\text{H}})_2}{(c_{\text{H}})_1} = - \frac{RT \ln 10}{F} \lg \frac{(c_{\text{H}})_2}{(c_{\text{H}})_1}$$

E_1 and E_2 are the cell potentials at concentrations $(c_{\text{H}})_1$ and $(c_{\text{H}})_2$ respectively. R is the gas constant, F is the Faraday constant, and T is the absolute temperature. There is a linear relation between potential, E , and pH; the slope of the straight line, $RT \ln 10/F$ (change of potential when the concentration changes by tenfold) is known as the Nernst slope, equal to 59.16 mV at 25 °C (Szabadváry 1993).

Analytical laws, that relate the measured signal with the concentration of the envisaged analyte, namely the theoretical Nernst equation for the hydrogen ion, are strictly observed for ideal systems. Hence, in practical terms, deviations are likely to occur due to interactions between the species present in the systems. With the development of Gibbs Thermodynamics and Lewis's concept of activity of a chemical species, a_i , it became apparent that analytical laws, which relate a measured signal with the concentration of the envisaged analyte, are strictly observed in ideal systems (Lewis 1908). Both quantities, activity and concentration, are related through a conversion factor, the activity coefficient, γ_i ,

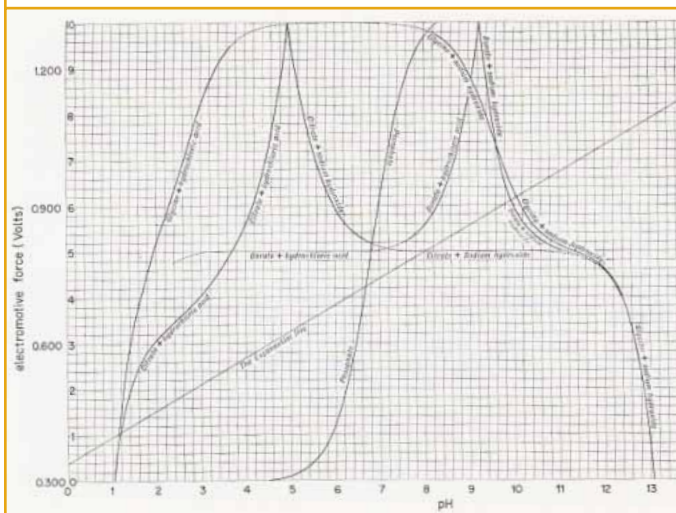


Chart of Sørensen buffer systems, which for many years acted as the standard for the definition of pH. The system consists of a succession of paired solutions, mixed in the quantities indicated by the ordinates to the right and left. The pH values of the resulting mixtures are given on the abscissa.

A Century of pH Measurement

concentration and matrix dependent. Potentiometric measurements are capable of supplying activity coefficients from certain well-defined experiments; in cases where concentration is known, comparisons between calculated and measured Nernst potential have been used to assess activity coefficients. Sørensen redefined $\text{pH} = -\lg a_{\text{H}^+}$.

The new formulation of the Nernst equation and the awareness of the contribution of unknown liquid-liquid junction potentials made Sørensen and K. Linderstrøm-Lang recognise that the proposed experimental procedure did not lead to $\text{pH} = -\lg c_{\text{H}^+}$, nor to $\text{pH} = -\lg a_{\text{H}^+}$, but to some other quantity— $\text{p}_\text{s}\text{H}$ —that, although merely convenient, was widely accepted by the scientific community.

With the hydrogen electrode immersed in 1 mol dm^{-3} HCl, with H_2 bubbling at 1 atm and 18°C, Sørensen reported a cell potential of 0.338 V against which an extensive number of buffer solutions had their $\text{p}_\text{s}\text{H}$ values assigned from the measured corresponding potential, E

$$\text{p}_\text{s}\text{H} = \frac{E - 0,338}{0.05916} \quad (\text{at } 25^\circ\text{C})$$

The concept of pH corresponds only to a notional definition and is unique in the sense that it involves a single ion quantity, the activity of the hydrogen ion (Sørensen 1924), which does not exist on its own and is therefore immeasurable by any thermodynamically valid method. Its evaluation requires extra-thermodynamic conventions.

The procedure conventionally adopted to assign primary standard pH values ($\text{pH}[\text{PS}]$) to primary standard pH buffer solutions (PS) is based on the cell without transference, which is known as the Harned [Harned, 1958] cell:



It is composed of the Pt-based (or Pd-based) hydrogen gas electrode and the silver-silver chloride electrode, immersed in the reference buffer solution under study, with added potassium chloride ($m_{\text{KCl}} = 0.005; 0.01; 0.015 \text{ mol kg}^{-1}$) in order to ensure proper working conditions of the silver-silver chloride electrode (figure 1). It was developed by R.G. Bates and collaborators (Bates 1973) at the U.S. National Bureau of Standards (later changed to the National Institute of Standards and Technology). It has been slightly modi-

fied by national metrological institutes around the world to comply with the requirements of a primary method.

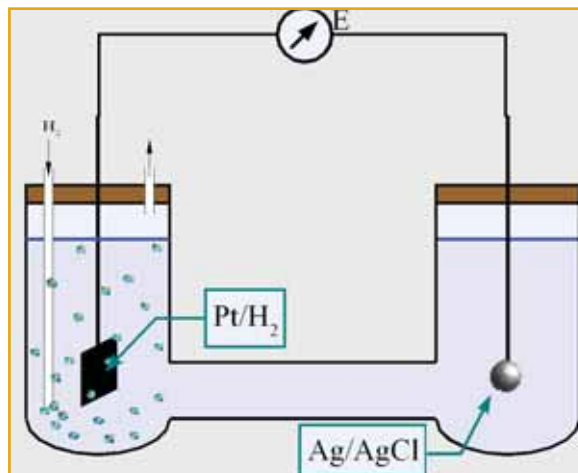
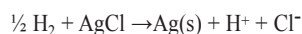


Figure 1. Schematic representation of the Harned Cell (Adapted from Petra Spitzer/PTB, Germany).

The application of the Nernst equation to the spontaneous cell reaction



and to the cell potential, E , is the starting point of a conventional procedure which, in an intermediate step, defines an acidity function, $\text{p}(\text{aH}^+\gamma_{\text{Cl}})$, in terms of experimentally accessible quantities that are still free from assumptions. This is the reason why it is often reported and used in comparative studies. The adoption of the Debye-Hückel model of ionic interaction in electrolytic solutions (Debye 1923) led to the final assignment of the conventional pH value. This was made possible by the introduction of the Bates-Guggenheim convention for the activity coefficient of the chloride ion (Bates 1960), with an assigned uncertainty of 0.01 in pH. Determination of activity coefficients, γ_i , may also be calculated by means of the Pitzer theory (Pitzer 1991) in which specific ion interactions are taken into account enabling the calculation of pH values, and related quantities, for more complex media.

Quantitative interpretation of measured pH values is limited to dilute aqueous solutions of simple solutes. This requirement presents limitations to the nonaqueous media, suspensions, colloids, and aqueous solutions of ionic strength greater than 0.1 mol kg^{-1} , for which further considerations are necessary.

A Century of pH Measurement

The definition of this procedure as the primary method of measurement has permitted the designation of a set of seven primary standard solutions for pH, pH(PS), (Bates 1973) from among those with the “highest metrological” quality (VIM 3, 2008).

The Potentiometric Method using the Pt- (or Pd-) based hydrogen gas electrode is the method for the assignment of pH values accepted by research and laboratory work necessitating accurate and precise pH measurements (except in those cases where the presence of certain classes of substances in the solution interfere with the measurement of the potential of the half-cell containing the hydrogen gas electrode). Despite the merits of the hydrogen gas electrode, it is certainly not practical for routine measurements. The discovery by Cremer, in 1906, of the selectivity of the reliable and accessible glass electrode toward H^+ (Cremer 1906) was a significant milestone for the practical measurement of pH.

A glass electrode is usually made by sealing a bulb about 0.2 mm thick of a silica glass containing metal oxides that break the structure of the glass at some points, and then fusing it onto a stem of electrically insulating glass. For many years, the best H^+ responsive glass available was composed of Na_2O (21.4 mol%), CaO (6.4%), and SiO_2 (72.2%), known as Corning 015 glass, whose potential followed the Nernst equation between pH 1 and 9. Several changes have been introduced in glass compositions in order to enhance desirable properties of the glass electrode, but no glass electrode yet constructed has the theoretical response in all types of solutions and over the entire practical pH range. On soaking the glass bulb in water, further breaking of the structure occurs and the open spaces are filled with water molecules from the solution, producing observable swelling. A gel-layer with hydrogen ions is created, which sets up a difference in potential across the glass-solution boundary, thereby developing a hydrogen function of the glass.

Other hydrogen ion sensors have been developed, but none surpass the glass electrode as demonstrated by Hughes' comparative studies between glass and hydrogen gas electrodes (Hughes 1922). Deviations occur for both the acidic region and for the alkaline region, which is the consequence of selectivity to alkaline and alkaline-earth cations (Eisenman 1967; Camões 1974).

The glass bulb has two surfaces. The outer surface is in contact with the solution whose pH is to be measured. The inner surface is kept in contact with a solution of constant pH, $0.1 \text{ mol dm}^{-3} \text{ HCl}$, in which an

internal silver-silver chloride electrode is immersed, providing electrical connection and a stable potential during measurements. Measurements of cell potentials also require an external reference electrode, usually silver-silver-chloride, $Ag, AgCl$. Combination electrodes (figure 2) in which the glass electrode and the external reference electrode are assembled together are commercially available and extensively used. Owing to the high electric resistance of glass, on the order of $M\Omega$, measurements of potentials required a detecting element operating on a very small current that depended on the development of current amplifiers. The first commercially successful electronic pH meter was invented by Beckman (Beckman 1950). This set the foundation for the potentiometric determination of pH by combination glass electrodes and microprocessor pH meters currently in use (Covington 1985).

Glass electrode | buffer solution || $KCl \geq 3.5 \text{ mol dm}^{-3}$ | $Ag, AgCl$

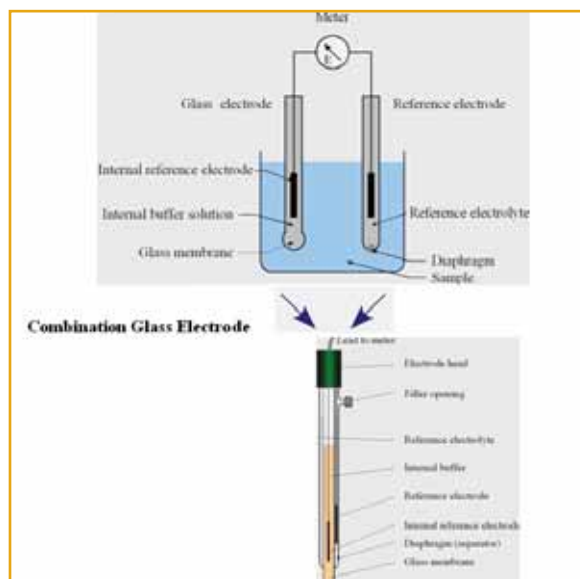


Figure 2. Glass electrode assembly (Adapted from Petra Spitzer/PTB, Germany).

Practical pH measurements generally use these working cells with liquid junctions that are practical, but have greater uncertainties associated with the results.

To use a glass electrode to measure pH of unknown solutions requires calibration. This is done by prior measurement of the working cell potential in pH standard buffer solutions of known pH, such as the typical NBS/NIST, or others specifically recommended for the particular characteristics of the sample (e.g., physiological fluids and seawater).

A Century of pH Measurement

The hierarchical approach to measurements facilitates (Buck 2002) laboratory calibrations to achieve specified target uncertainties that are self consistent within the uncertainty budgets (De Bièvre 2009). This way, and despite the conventional definition of pH, values will become traceable to the internationally accepted SI system. This is a vexing problem that the scientific community has had difficulty solving.

Everyday chemical and biochemical processes are controlled via pH measurements. It is most likely the most measured chemical parameter and the one most people hear or talk about. The fact that pH meters are widely available at relatively low cost and that measurements are quite straightforward, even for those with no professional training, has resulted in the misconception that all is known and clear about pH. In fact, beyond the simple process of measuring pH, there is poor understanding of the concept, the basis for its derivation, and limitations of its applicability.

Despite the various fundamental drawbacks, potentiometric pH measurements are popular, easy, sensitive, reliable, important, and useful, and will continue to be performed. Educational approaches regarding this topic should be improved, particularly at the introductory school level.

As we celebrate the centenary of Sørensen's first definition of pH, the following quote is worth considering:

"pH measurement is often deceptively easy . . . pH measurement can also be exasperatingly difficult."

—G. Mattock, 1963 🐝

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 www.iupac.org/web/ins/2004-005-2-500

Stamps International

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

Giant Sulfur Bacteria

A remarkable discovery, an unknown bacterium about 100 times larger than most common bacteria and big enough to be seen with the naked eye, was made in oxygen-depleted marine sediments off the coast of Namibia in Southeastern Africa in April 1997. A true giant among unicellular microorganisms, *Thiomargarita namibiensis* was found forming delicate strings of pearly spheres, some growing up to three-quarters of a millimeter in diameter. In addition to its abnormal size, this fascinating microbe is unusual in several other ways, including its ability to accumulate large quantities of nitrate ions within the cell, sometimes in concentrations 10 000 times higher than in the surrounding seawater. Significantly, nitrate is used to oxidize sulfide ions derived from the degradation of organic matter by sulfate-reducing bacteria, a process that constitutes the key source of energy for the cells and nicely links the natural cycles of nitrogen and sulfur.

The stamp illustrated in this note is part of a set issued by Namibia in 2003 to celebrate recent biological discoveries in the country, including a new species of catfish and an insect long thought to be

extinct. The stamp features a photomicrograph of three cells of *Thiomargarita*, each about 0.2 mm in diameter, and is similar to the one depicted on the cover of the 16 April 1999 issue of *Science*, where the finding was initially disclosed. The small yellow dots are globules of elemental sulfur formed by the oxidation of sulfides and are deposited only in the thin outer layer of the cell—comprising only 2 percent of the cell's volume—that surrounds the large central reservoir of nitrate ions. Although a proposal to use *Thiomargarita* in the future to clean up pollution caused by agricultural nitrate-rich effluents may be far fetched, it is clear that the role that such sulfur bacteria play in the ecology of coastal waters should not be underestimated.

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



IUPAC as a Science NGO

by Colin Humphris

What is an NGO? There is a story about one wit who simply asked of a group: "Are you in any way organized?" "Well, yes," was the response. "Are you a government?" he followed up. "No," the group replied. "Well, then you are obviously a nongovernmental organization!" he declared.

Views on the work of NGO's tend to be polarized. Many are considered very responsible and highly regarded (e.g., in the UK the Royal Society for the Protection of Birds, others much less so, such as the more extreme animals rights movements). There is a broad spectrum of organizations and behaviors. The key features of effective NGOs are their ability to reach and engage the wider community and to influence decision and policy makers in relation to their specific interest(s). These interests are typically narrow and quite specific. To be effective, NGOs have to be recognized by the appropriate authorities and to have the production of "attention grabbing" communications as a core competence.

By the flippant definition above, IUPAC is, of course, an NGO and it does have a single interest: to promote the interests of pure and applied chemistry globally, especially as this relates to sustainable development and the UN's agenda in this regard. When Matthew Gubb of the UN Environment Programme (UNEP) and the SAICM Secretariat invited IUPAC to help bridge science and policy within the UN's Strategic Approach to International Chemicals Management (SAICM), he was asking IUPAC to take the role of a science NGO in support of the SAICM implementation process. Since then, IUPAC has been seeking ways to effectively and efficiently engage in this global policy initiative.



The Strategic Approach to International Chemicals Management (SAICM)

SAICM is directly relevant to the future of applied chemistry. It is a policy framework to promote chemical safety around the world, one which emphasizes chemical safety as a key issue for sustainability. SAICM has the overall objective of achieving sound management of chemicals throughout their life cycles so that, by 2020, chemicals are produced and used in ways that minimize significant adverse impacts on

human health and the environment. This "2020 goal" was adopted by the World Summit on Sustainable Development in 2002 as part of the Johannesburg Plan of Implementation. SAICM is an initiative of the UN, implemented through UNEP and the World Health Organization (WHO). It provides an overarching framework encompassing the existing international chemical conventions and protocols: Montreal (ozone depleting chemicals), Rotterdam (transport and use of hazardous pesticides and industrial chemicals), Stockholm (persistent organic pollutants), Basel (hazardous waste), and the Chemical Weapons Convention.

The SAICM website (www.saicm.org) sets the context for SAICM as follows. *"The consumption of chemicals by all industries and modern society's reliance on chemicals for virtually all manufacturing processes make chemicals production one of the major and most globalized sectors of the world economy. Acknowledgement of the essential economic role of chemicals and their contribution to improved living standards needs to be balanced with recognition of potential costs. These include the chemical industry's heavy use of water and energy and the potential adverse impacts of chemicals on the environment and human health. The diversity and potential severity of such impacts make sound chemicals management a key cross-cutting issue for sustainable development."*

Formally, SAICM comprises the Dubai Declaration on International Chemicals Management (February 2006), expressing high-level political commitment to SAICM, along with an Overarching Policy Strategy that sets out its scope, needs, objectives, financial considerations, underlying principles and approaches, and implementation and review arrangements. The Declaration and Strategy are accompanied by a Global Plan of Action that serves as a working tool and guidance document to support implementation of SAICM, including stakeholder networks, the program of three yearly International Conferences on Chemicals Management (ICCM), and the Quick Start Programme, which is a funding mechanism for projects that directly support SAICM.

A key objective in the Overarching Policy Strategy is to promote information exchange and scientific cooperation. Science is seen as particularly important to SAICM implementation in terms of risk reduction, knowledge and information, and capacity-building and technical cooperation. It is also likely to be relevant to the objectives relating to effective governance and reduction of illegal international trade. During the

World Chemistry Leadership meeting at the IUPAC General Assembly in Torino in 2007, IUPAC was invited to help strengthen this scientific component as SAICM moves into the implementation phase.

IUPAC Involvement

IUPAC undertook a preliminary scoping project to assess a potential science contribution. As a result, a proposal for science support to SAICM was developed jointly with SETAC (the Society for Environmental Toxicology and Chemistry). This proposal outlined the following potential contributions of the science community to developing policy:

- ensuring a firm scientific basis for policy development
- reinforcing education and capacity building in relation to chemistry and its safe and responsible application
- identifying and mitigating emerging issues of concern to health and the environment as early as possible
- providing a balanced scientific perspective when considering new or emerging issues

Putting issues into perspective is essential to proper management of chemicals for the following reasons:

- Perceptions of issues of concern may or may not be founded on the best available knowledge. Science can bring new insights, understanding, and a sense of proportion when emerging issues are identified, thereby providing the ability to judge priorities for action.
- Scientists, and in this case chemists and environmental toxicologists, will often have an appreciation of potential issues before they reach the public and political domain, thereby providing early warning.
- Scientists are well placed to develop both an understanding about possible risks to human and environmental health and the possible mitigation of these risks, including practical measures to minimize exposure.

The proposal recognized, however, that full engagement as a formal component of the SAICM process could be highly resource-intensive for organizations such as IUPAC and SETAC, given the volumes of paperwork, networks, and regular regional meetings this would entail. Therefore, the proposal called for an arms-length relationship modelled on the support that



The Centre International de Conférences, Geneva, Switzerland, site of ICCM2, held 11-15 May 2009.

IUPAC provides to the Chemical Weapons Convention. The science community would:

- take responsibility for establishing a scientific committee that would organize purely scientific meetings to initiate, develop, and monitor collaboration with the SAICM process
- be accountable for ensuring the scientific integrity of the process
- peer review and publish the proceedings

The proceedings would comprise perspectives and recommendations relating to emerging issues for consideration by the wider SAICM community within the implementation process. The meeting would be held a year in advance of each ICCM to give the SAICM community the opportunity to consider the proceedings. The first meeting would therefore be held in 2011, linking this with the ambitions of the International Year of Chemistry (IYC) and encouraging further the engagement of the SAICM community in IYC.

The authors of the proposal foresaw considerable value for IUPAC through involvement in SAICM as it could:

- assume the role of a “science NGO” to facilitate the promotion of chemistry in a major global policy domain of importance to UN and directly relevant to sustainable development
- underline the value of the IUPAC contribution to industry, to intergovernmental organizations (IGOs) such as WHO and UNEP, to NGOs, and to governments
- provide a context for promoting the International Year of Chemistry through practical demonstration of the benefits of chemistry to our life and our future
- create awareness of IUPAC and its capabilities within the SAICM community, facilitating financial support for future projects (e.g., capacity-building projects funded under the SAICM Quick Start Programme)



IUPAC as a Science NGO

The Second International Conference on Chemicals Management (ICCM2)

The key step in IUPAC's engagement with SAICM, was the presence of an IUPAC team at ICCM2, held 11–15 May 2009 at the Centre International de Conférences, Geneva. IUPAC was represented by President Elect Nicole Moreau, Leiv Sydnnes, John Duffus, Paul LeClair, Mark Cesa, and Safety Training Program fellow Fabian Benzo.

ICCM2 was the first opportunity to review progress in the implementation of SAICM since its adoption in 2006 and the first time the ICCM performed its official functions as a high-level international forum for multistakeholder and multisectoral discussion and exchange of experience on chemicals management issues.

ICCM2 evaluated SAICM implementation so far by considering the following:

- steps to address emerging policy issues, including specific actions in nanotechnology, chemicals in articles, lead in paint, and electronic waste
- long-term financing of SAICM
- strategic decisions on the future direction of SAICM and, in particular, the linkages between health and chemicals management
- future periodic reporting arrangements
- outstanding institutional matters relating to cooperation between IGOs and other stakeholders
- improving the exchange of scientific and technical information
- planning the budget and activities for the next intersessional period leading up to ICCM3 in June 2012

Within this context IUPAC sought to accomplish the following:

- present a proposal jointly with SETAC and IUTOX for science support for SAICM as it relates to new emerging issues
- focus IUPAC education and capacity-building activity in support of SAICM
- raise the science profile of IUPAC across the SAICM community and engage with senior representatives of governments and the main intergovernmental and nongovernmental organizations involved in chemicals management work

ICCM2 was a large meeting attended by 750 delegates representing 147 governments, 20 IGOs, and 58 nongovernmental organizations. Of the delegates, 78 were from industry, underlining the importance

of SAICM to the chemical, agrochemical, and metals industries. Sixty-four delegates were from NGO's campaigning on a range of health, environmental, and developmental issues. Science was represented by, among others, IUPAC, IUTOX, SETAC, and a fledgling group, the International Panel on Chemical Pollution.

The meeting included plenary sessions, a high-level segment for formal statements and commitments of support, thematic round tables, and an exhibition area. Technical briefings on the emerging issues and meetings of regional and other groups were held on 11 May 2009. An extensive series of side events and exhibitions were held throughout the week including two organized jointly by IUPAC and SETAC with participation by IUTOX, the first on science and the second on capacity building. Members of the team attended the technical briefings, the plenary sessions and the High Level Segment and a major industry side event. IUPAC mounted an exhibition stand to showcase IUPAC activities and competencies and to promote the International Year of Chemistry.

Conclusions and Lessons Learned

IUPAC succeeded in raising its profile by participating in ICCM2. The Union's involvement was generally well received by many countries, by industry, and especially by the IGOs/UN agencies. Through its participation, IUPAC demonstrated its credentials and established a good basis for future joint work with IUTOX and SETAC, providing a basis for future applications for project funding under the Quick Start Programme.

A clear need was established for extensive educational and capacity building in support of SAICM implementation and this fits well with IUPAC competencies. The side event on capacity building was attended by over 50 delegates and addressed the question of what makes truly effective capacity building. It built on the practical experience of both SETAC (regional workshops) and IUPAC (the Safety Training Program) approaches that attracted considerable interest from African and South American delegations.

Science also had a reasonable hearing. Again, over 50 delegates attended the side event that discussed SETAC's experience in relation to PBTs and POPs and heard from John Duffus about the importance of chemical speciation—knowing what you are talking about in relation to toxicology, which was demonstrably not always the case in the ICCM2 technical sessions. The role of science in particular in emerging issues was underlined and accepted and IUPAC was

IUPAC as a Science NGO

able to show how an arms-length approach modelled on its support to the Chemical Weapons Convention could provide an efficient and effective scientific input to the evolving policy agenda.

One of the key objectives from IUPAC's point of view was to build consensus for a single science community view among IUPAC, SETAC, and IUTOX together with other relevant science bodies that would be present at ICCM2. The IUPAC representatives at ICCM2 had worked with SETAC to build this consensus and brought IUTOX into this during private discussions early at ICCM2. The three organizations presented this proposal at the ICCM2 general session. However, several organizations, in particular the WHO's Intergovernmental Forum on Chemical Safety and IPCP, presented alternative proposals for providing the science input to the policy framework in which, unlike IUPAC, their organizations would be an integral part of the SAICM structure. While none of these organizations has yet established its future contribution to the SAICM process, the mechanism for inclusion of scientific input was therefore clouded.

Above all, however, it is important to recognize that ICCM2 was a political meeting. Most of the country delegates to ICCM2 were diplomats or policy makers from environment ministries, many with responsibilities for chemicals regulation. Others had economic development or health interests. The potential role of science was, therefore, not a top priority for delegates working to establish the policy framework; it was decided to build and clarify the scientific input role through deliberations during the intersessional period between ICCM2 and ICCM3.

The IUPAC science proposal was not formally adopted despite support from a number of delegations. It is possible that there was a lack of recognition among some delegations that IUPAC, SETAC, and IUTOX were not seeking to be part of the formal SAICM structure. Major influential groups were keen not to establish special standing for any groups within the SAICM structure. Some delegations seemed to be keen to play on IUPAC's supposed "industry links." Other developing countries and NGOs may have seen the science proposal as competing with their interest or priorities or for the limited funding which is designated from donor countries within the SAICM structure. It underlines the fact that IUPAC does not have a high profile within this policy community yet. This is important feedback given the relevance of SAICM to the future sustainable development agenda, the objectives for IYC 2011, and the effectiveness of IUPAC as a science NGO.

Follow Up

SAICM is simply too relevant to the future of applied chemistry and the chemistry educational and capacity building needs of the developing world for IUPAC to ignore. However, IUPAC needs to reconcile the political nature of the ICCM process with the value IUPAC offers with respect to the scientific underpinning of sound policy.

The SAICM Secretariat remains eager for IUPAC involvement and presented its thoughts for activities during IYC during the Glasgow General Assembly. In particular, the interest remains within the UN institutions for practical but informal mechanisms for science support to SAICM, and an active discussion of how best to achieve this has begun.

A key for IUPAC to become better known and more influential in the SAICM process is simply to illustrate, through example, what IUPAC does, its highly evolved procedures for ensuring objectivity and consensus, and how these might be applied within the developing SAICM policy framework. Successful projects in collaboration with the Quick Start Programme, and a successful science meeting relevant to SAICM during IYC, would carry a great deal of weight in this regard if the activities and results are well communicated.

Therefore, IUPAC will pursue one or more projects within the Quick Start Programme. Expansion of the scope of the Safety Training Program is a possible project already being worked on within IUPAC and the Committee on Chemistry and Industry.

Key players within IUPAC have had discussions about holding a meeting during IYC that is relevant to the science behind SAICM or to capacity building needs, but that is independent of the SAICM process. This meeting could be organized within the CHEMRAWN remit and would probably be best held in Africa; either in Kenya in association with UNEP (headquartered in Nairobi) or Ethiopia. It is recommended that this is developed with ICSU and interested unions such as IUTOX and that the SAICM Secretariat is invited to join the organizing committee. The peer-reviewed proceedings from this meeting would then be available for ICCM3. 🏠

Colin Humphris (UK) <cjhumphris@btinternet.com> is the incoming chair of the Royal Society of Chemistry's IUPAC Committee. He is a member and secretary of the IUPAC Committee on Chemistry and Industry and an elected member of the Bureau. He represents the International Council of Chemical Associations on the IYC Management Committee.

👉 www.iupac.org/web/ins/2009-003-2-020

IUPAC in Glasgow, Scotland

Division Roundups, Part III

CHEMRAWN: CHEMICAL Research Applied to World Needs

by Leiv K. Sydnes, CHEMRAWN chair

The CHEMRAWN Committee had a hectic program during the General Assembly (GA) in Glasgow. In addition to its biannual meeting, the committee was heavily involved in a symposium on ethics as part of the 43rd IUPAC Congress. The Ethics, Science, and Development symposium came about after the committee chair was challenged by organizations and individuals, as well as the congress program committee, to organize such a meeting. The symposium, part of the CHEMRAWN series of meetings (CHEMRAWN XVIII), was held over two half days and gathered quite a few participants in spite of the fact that a considerable number of other events and sessions took place at the same time (see www.iupac.org/web/ins/2009-013-1-021 for more details about the symposium).

The most important agenda item at the biannual meeting was undoubtedly the discussion of global and regional problems that can be understood and solved in a sustainable fashion only if scientists with competence in the chemical sciences become engaged. This was particularly important because there were, in essence, no new conference ideas in the CHEMRAWN pipeline when the GA in Torino ended (August 2007). Discussions in Glasgow centered around possible themes that arose from the off-year meeting held in Puerto Rico in July 2008. Each of these ideas was

presented by a committee member who had been given the task of developing the idea further.

The discussions were lively and very constructive, and it was most encouraging to see that several young observers and others who joined in contributed in a creative fashion.

The committee deemed two ideas to be of particular importance and ripe enough to be explored further with the purpose of generating themes for new CHEMRAWN conferences in two to four years. Their working titles are *Biofuels* and *Herbal Medicines*. The former topic is especially significant since the current drive to produce biofuels from biomass, including certain food crops, has resulted in a biofuel-food-environment triangle that some have coined a "trilemma." Soon Ting Kueh from Malaysia volunteered to chair a task group to work on this issue.

The second potential conference theme is closely related to the fact that modern pharmaceuticals are, and will remain, out of reach for a large proportion of the human population for the foreseeable future. This has gradually created an appreciation of the need to use alternative and traditional medicines, largely herbal in nature, against diseases. However, to facilitate such a development, a number of chemical and other problems have to be analyzed, discussed, and resolved. A task group, to be chaired by Mohammed Mosihuzzaman from Bangladesh, was appointed in Glasgow to look into this challenge.

Compared to previous GA CHEMRAWN meetings, there were two new items on the agenda in Glasgow. One was a report about the joint COCI/CHEMRAWN involvement in the Second Session of the International Conference on Chemical Management (ICCM2), held in May 2009 in Geneva, which dealt with the implementation of the Strategic Approach to International Chemicals Management (SAICM). The IUPAC delegation was involved in plenary and group discussions, and, in close cooperation with the Society of Environmental Toxicology and Chemistry, COCI and CHEMRAWN were engaged in two side events, one about effective capacity building in a scientific



Leiv Sydnes addresses the Ethics, Science, and Development symposium.



Bernard West of Toronto, Canada, discusses "Industrial Awareness and Responsible Care."



perspective and another entitled "Science in Support of SAICM." IUPAC participated in the conference to help ensure a scientific basis for policy development, to nourish capacity building in relation to chemistry and its application, and to identify emerging issues of concern to health and the environment (see feature on page 8).

The second item was a report from Zafra Lerman about the Malta IV Conference, "Frontiers of Chemical Sciences: Research and Education in the Middle East," which is nicknamed as such because the first two meetings were held on the island of Malta in 2003 and 2005. The fourth conference, held in Amman, Jordan, in November 2009, was the first to be run under the CHEMRAWN umbrella (see IUPAC project 2008-044-1-020; www.iupac.org/web/ins/2008-044-1-020). The meeting format is unique in the sense that it is probably the only event where scientists from 14 countries in the Middle East meet for days for scientific discussions and where almost all lectures are delivered by Nobel Laureates. As reported by Lerman, joint projects involving scientists from Israel and neighboring countries are now under way. During the meeting in Amman, progress reports were presented in several workshops. (for earlier Malta reports see May-June 2008 *CI*, pp. 31-34 and Mar-Apr 2009 *CI*, pp. 9-11.)

A final point raised during the discussion was whether it would be a good idea to establish closer formal contacts between the CHEMRAWN Committee and the Union's divisions. This idea was supported by everyone in attendance, and it will be proposed that each division appoint a liaison to the CHEMRAWN Committee as soon as possible.



Sospeter Muhongo, director of the ICSU Regional Office for Africa, talks about "Science, Ethics, and Development: Africa's Perspective."

The committee acknowledged the service of several members who stepped down after years of involvement; they were all thanked for their dedicated service. In particular, Stanley Langer from the UK, the committee's secretary for several years, deserves special thanks. Langer is succeeded by Gary van Loon from Canada. The complete membership is available at www.iupac.org/web/ins/021.

Division VIII: Chemical Nomenclature and Structure Representation

by Ture Damhus, division secretary

The main activity at the annual Division VIII Committee meeting is to review publications and current and prospective projects. The nomenclature and structure representation area is quite active, with around 15 ongoing projects (about half of these jointly with Division IV, the polymer division) and 8-10 new ones in preparation.

A prominent and rather widely publicized current project is concerned with coding and disseminating the IUPAC *International Chemical Identifier* (InChI). The division heard from Steve Heller on the latest progress and, in particular, on the formation of the InChI Trust, whose main purpose is to provide continuing funding for further work on the InChI code. The work will continue to be directed by the InChI subcommittee of Division VIII. The InChI developments have been featured on the IUPAC website and here in *CI*, and further articles are underway for *CI* and for *Pure and Applied Chemistry*. A website is also being configured at www.inchi-trust.org (see also www.inchi.info). The shorter InChIKey for online searching requires a look up table to identify the corresponding structure. ChemSpider <http://inchis.chemspider.com> aims to provide such a table.

Another important endeavor is the preparation of a second edition of the popular IUPAC introductory book *Principles of Chemical Nomenclature*. A working group headed by Jeff Leigh has produced a draft that will hopefully, after final editing, reach the publisher during the year 2010.

Other business of the division is to manage its membership and its contacts with and representatives in other IUPAC bodies, such as the other divisions, and the various standing committees. As far as membership and *personalia* are concerned, at this meeting, we recorded with sadness the passing of Alan Sargeson, former chairman of the Commission for Nomenclature of Inorganic Chemistry and Val Metanovski, who had very many IUPAC assignments over a period of many years and was one of the authors of the first edition of the *Principles* book mentioned above.

Like all other IUPAC bodies meeting in Glasgow, Division VIII brainstormed about activities for IYC 2011, and shared our ideas with the Committee for Chemistry Education.

IUPAC in Glasgow, Scotland

Committee on Chemistry and Industry (COCI)

by Mike Booth, former committee secretary

The turnout at the Committee on Chemistry and Industry (COCI) annual meeting from 2-3 August 2009 exceeded all previous records, with 11 COCI members, 4 Safety Training Program Fellows, the president and vice president of IUPAC, 3 divisional representatives, and 10 observers and invited participants in attendance. The meeting focused on the committee's role and strategic priorities, organizational structure, programs, accomplishments, and plans. Prior to the meeting, members of the committee took the opportunity to interact with members of the divisions at their respective meetings to foster and continue the collaborations started at the General Assembly in Torino in 2007.

COCI is actively involved in the International Year of Chemistry through the participation of COCI Chair Mark Cesa, Colin Humphris, and Michael Droescher on the IYC Management Committee and its subcommittees. COCI hopes to be an active participant in raising funds from industry for events organized by IUPAC around the world and in contributing to cornerstone events.

COCI has been instrumental in obtaining NGO status for IUPAC in the Strategic Approach to International Chemical Management (SAICM). The IUPAC delegation at the International Conference on Chemicals Management (ICCM2) in Geneva in May 2009 included IUPAC Vice President Nicole Moreau, CHEMRAWN Chair Leiv Sydnes, Paul LeClair of the IUPAC Secretariat, Safety Training Program Fellow Fabián Benzo, John Duffus from Division VII, and Mark Cesa. IUPAC presented information on its capabilities, sponsored a booth at the exhibition, and offered to hold a science event in conjunction with the IYC and in advance of ICCM3 (see feature on page 8). It was clear that additional effort will make IUPAC more familiar to SAICM participants. However, there appear to be opportunities for our involvement as a science body in the SAICM "QuickStart" program and in discussions on the role of science in SAICM. Due to the work of Colin Humphris, IUPAC continues to enjoy the benefits of our association with the International Council of Chemical Associations.



Mike Booth addresses the Safety Training Program Workshop.

Through the efforts of Bernard West, a case study on the "Responsible Handling of Chemicals" has been submitted for publication as part of the project on the safe handling of chemicals (see project 2006-047-1-022; www.iupac.org/web/ins/2006-047-1-022). West also participated in the Congress Symposium on Ethics coordinated by Chemrawn, vide supra, p. 12.

The Safety Training Program arranged training for an Indian chemist in Denmark in 2008. There is no shortage of trainees wishing to participate in the program, and host companies continue to be sought. A Workshop on the STP, in which six trainees presented their experiences on how they had used their training in their home countries, formed part of the Glasgow Congress. An Internet-based safety training course started in Uruguay by Fabián Benzo, has reached the point that the course will be distributed in South America in 2010 to promote better safety at universities.

During the COCI East Asia Regional Workshop earlier in 2009 in Tokyo, new projects were proposed based on deliberations with representatives of companies and national chemistry societies from China, Taiwan, Korea, and Japan. Internships with Company Associates, life-cycle analysis, and success stories with technology transfer were discussed for future development. At the COCI meeting in Glasgow, David Evans also reported on the proposal to hold a CHEMRAWN on Biofuels in 2011.

A number of longstanding members, Alan Smith, Akira Ishitani and Secretary/Treasurer Mike Booth, will be leaving COCI at the end of 2009. Their contributions to the committee over many years were recognized with certificates of appreciation. The attendees welcomed the new leadership of COCI for 2010-2011: Michael Droescher as chair and Colin Humphris as secretary.

Mike Booth <caiainfo@iafrica.com> is director for Information Resources at Chemical & Allied Industries' Association in Auckland Park, South Africa. He has been a member of COCI since 1992, and secretary from 2006 to 2009.

Committee on Printed and Electronic Publication (CPEP)

by Bohumir Valter, former committee secretary

The Committee on Printed and Electronic Publications (CPEP) has responsibility for the publications of IUPAC, including its journal *Pure and Applied Chemistry* (PAC), the online *Compendium of Chemical Terminology*



Division Roundups, Part III

(the Gold Book <<http://goldbook.iupac.org>>), and the IUPAC website and printed books.

PAC has grown in impact in recent years with its emphasis on publishing conference material and also because a full archive of the journal from its inception in 1960 was made freely available online <www.iupac.org/publications/pac>. Many Nobel Prize winners in Chemistry have published in PAC <www.iupac.org/publications/pac/nobelists>. An under-recognized feature of PAC content is its citation stamina with high and growing citation levels for some of the older volumes in this survey. Perhaps this is an early augury of the salutary effects of a comprehensive website archive and adherence to open access practice. Much credit for the continued strength of PAC must go to its scientific editor, James Bull.

Important developments on the website (apart from the improved access to PAC noted above) include an upgrade to the Gold Book, with important interactive features, and a general improvement to appearance and access. These changes are the responsibility of CPEP titular members from the Czech Republic (Bohumír Valter and Miloslav Nič) and their colleagues (principally Bedřich Košata). Further improvements and developments are anticipated, including the inclusion of other Color Books online. Many enhanced capabilities of the website are due to it being moved to a server at FIZ-Chemie, Berlin, generously provided through the auspices of René Deplanque.

The Royal Society of Chemistry published the third edition of the Green Book (*Quantities, Units and Symbols in Physical Chemistry*) in 2007. The committee plans to produce this in XML format for web publication.

Have you visited PAC online lately?

Check out <www.iupac.org/publications/pac> for ASAP articles, latest issues, full archives, quick and advanced searches, full references via CrossRef doi and cited by feature, most cited articles and authors, multiple RSS feeds, and more.



Division III: Organic and Biomolecular Chemistry

by Pietro Tundo, division past president

The Organic and Biomolecular Chemistry Division meeting, held 1-3 August 2009, was attended by 15 members and 5 observers.

The division elected new officers for the 2010-2011 biennium: Gerrit-Jan Koomen will be president, Pietro Tundo will become immediate past-president, Krishna Garnesh will be vice president, and Mary Garson will be secretary. The committee also welcomed a number of new titular and associate members and national representatives.

Division III is characterized by a large number of subcommittees, which are very active in six specific sectors. They organize international conferences and workshops, promote and manage projects, and publish the results in special issues of *Pure and Applied Chemistry*. The subcommittees met in Glasgow and each provided ideas for new projects for the next biennium. The ideas will be formulated into draft project proposals.

The committee currently has about 15 projects in progress, including projects led by other IUPAC divisions to which Division III is contributing. At the Glasgow meeting, the division allocated its remaining project funds for the biennium to three new projects:

- Translation into Greek and dissemination of a monograph for secondary schools on Global Climate Change.
- Evaluation of measurement methods and QA/QC for PCDD/F, PCB and PAHs in environmental matrices (air quality, soil, sediments and wastes) used in estimation of global pollution.
- Green Chemistry: Sustainable Education and Environmental Development in Latin America.

Division III administers two important prizes. The first, the CHEMRAWN VII prize for Atmospheric and Green Chemistry (USD 5000) will be awarded every two years to a young investigator from a developing country. Its inaugural presentation will be at the 3rd Green Chemistry Conference to be held in Ottawa, Canada, from 15-19 August 2010. The second prize, sponsored jointly by Georg Thieme Verlag and IUPAC, is the Thieme-IUPAC Prize in Synthetic Organic Chemistry. The prize is presented every two years and will next be awarded at the International Conference on Organic Synthesis, which will take place in Bergen, Norway, from 1-6 August 2010. 🏆

Happy Birthday Copernicus

On February 19, Nicolaus Copernicus' birthday, IUPAC released the official approval of the name copernicium, with symbol Cn, for the element of atomic number 112. Priority for the discovery of this element was assigned, in accordance with the agreed criteria, to the Gesellschaft für Schwerionenforschung (GSI) (Center for Heavy Ion



Nicolaus Copernicus
(1473–1543).

Research) in Darmstadt, Germany. The team at GSI proposed the name copernicium, and IUPAC has now approved this after a period of review of public comments. Sigurd Hofmann, leader of the GSI team, stated that the intent was to “salute an influential scientist who didn't receive any accolades in his own lifetime, and highlight the link between astronomy and the field of nuclear chemistry.”

The name proposed by the GSI lies within the long tradition of naming elements to honor famous scientists. Nicolaus Copernicus was born on 19 February 1473, in Torún, Poland and died on 24 May 1543, in Frombork/Frauenburg, also in Poland. His work has been of exceptional influence on the philosophical and political thinking of mankind and on the rise of modern science based on experimental results. During his time as a canon of the Cathedral in Frauenburg, Copernicus spent many years developing a conclusive model for complex astronomical observations of the movements of the sun, moon, planets, and stars. His work published as *De Revolutionibus Orbium Coelestium, Liber Sixtus* in 1543 had very far reaching consequences. Indeed, the Copernican model demanded major changes in the view of the world related to astronomy and physical forces, and it had theological and political consequences. The planetary system introduced by Copernicus has been applied to other analogous systems in which objects move under the influence of a force directed towards a common center. Notably, on a microscopic scale this is the Bohr model of the atom with its nucleus and orbiting electrons.

The Recommendations are published in the March 2010 issue of the IUPAC journal *Pure and Applied*

Chemistry (doi:10.1351/PAC-REC-09-08-20). Priority of claims to the discovery of the element of atomic number 112 was determined by a joint working party of independent experts drawn from IUPAC and the International Union of Pure and Applied Physics. The group's report was published in July 2009 (*PAC*, Vol. 81, No. 7, pp. 1331-1343; doi:10.1351/PAC-REP-08-03-05). The Joint Working Party will issue a second report, dealing with claims for the discovery of elements with atomic numbers in the range 113 to 118, in the near future.

Terrence Renner Appointed IUPAC Executive Director

On 1 February 2010, Dr. Terrence A. Renner became the new executive director of the International Union of Pure and Applied Chemistry. Renner succeeds Dr. John W. Jost who headed the Secretariat for almost 13 years since its move to Research Triangle Park (RTP), North Carolina, from Oxford, UK, in 1997.

Renner comes to the IUPAC post from NanoInk, Inc., where he was director of applied science. He obtained his B.S. degree in chemistry at DePaul University in Chicago, Illinois. Thereafter, as a National Science Foundation Graduate Fellow, he completed his Ph.D. in physical chemistry at Yale University in New Haven, Connecticut, as a student of Philip A. Lyons. Renner's working career has encompassed the fields of nuclear, environmental, physical, organic, surface, materials, process, and petroleum chemistry. More recently, in the realm of nanotechnology, his experience expanded to include the interface of chemistry with biology, biochemistry, and pharmaceutical chemistry at the nanoscale. Renner is an accomplished executive who understands the importance and relevance of both pure and applied science within the practical context of business and product development. He has represented companies globally in discussions and negotiations with academics, business leaders, and government officials at all levels to attain mutually beneficial objectives.

IUPAC Past President Jung-Il Jin pointed out that Renner's appointment comes as the Union prepares for the International Year of Chemistry in 2011. Jin expects that Renner will play a major role as IUPAC leads the world chemical community into the International Year of Chemistry.



The IUPAC staff at the Secretariat (from left to right): (front) Terry Renner, Linda Tapp, and Enid Weatherwax, and (back) Paul LeClair, Bryan Pearson, and John Jost.

To ensure continuity, Jost will remain as a consultant to Renner until he formally retires on 31 August 2010. Jost will continue to be the managing editor of IUPAC's journal, *Pure and Applied Chemistry*.

"During my visit to IUPAC on January 13," said Renner, "it was my first opportunity to meet all of the staff of the Secretariat at one time. The enthusiasm, dedication, and genuine camaraderie of everyone were readily evident. It is my intention to maintain the high standard of service and cooperation that the members of this team provide to our worldwide organization and its diverse activities. I am extremely privileged to become a colleague of the members of IUPAC and anticipate meeting many of you in person over the course of time."

David Moore Named 2009 LANL Fellow

In November 2009, commendations for exemplary scientific research were bestowed upon Los Alamos National Laboratory researcher David S. Moore by the Laboratory Fellows organization. Moore received the 2009 Laboratory's Fellows Prize for research after being selected by a committee of five Laboratory Fellows. The Fellows organization includes some of the Laboratory's most prominent scientists.

The Fellows Prize for Outstanding Leadership in Science or Engineering commends individuals who stimulate the research interests of talented younger laboratory staff members and who encourage junior researchers to make the personal sacrifices necessary to become effective leaders. The committee selected

Moore for "his inspirational technical leadership in the fields of shock physics and the science of explosives detection." Moore has worked to develop the next generation of scientists in this field by mentoring students at all levels, from high school to graduate- and post-graduate institutions. Many of these students have become laboratory staff members. Additionally, according to the prize committee, Moore is a nationally recognized leader in explosives detection and "is an exemplary citizen to the laboratory, to the international scientific community, and to the nation."

Moore has been involved with IUPAC for many years and was one of the very first U.S. young observers in the 1980s to attend IUPAC General Assemblies. He began his engagement with the Commission on Spectrochemical analysis, eventually becoming a titular member of the Analytical Chemistry Division, of which he became division vice president and then president (2002–2003). Among his many contributions to IUPAC was the successful transformation of the Orange Book into an online resource. *CI* congratulates David for his achievements at LANL and for his "international citizenship."

Molly Stevens Receives Polymer International-IUPAC Award 2009

In January 2010 the Executive Editorial Board of *Polymer International* and the IUPAC Polymer Division announced that the second *Polymer International-IUPAC Award for Creativity in Applied Polymer Science or Polymer Technology* was awarded to Professor Molly Stevens of the Institute of Biomedical Engineering, Imperial College London, UK.

As the prize winner, Stevens receives USD 5000 and the opportunity to present her award winning keynote lecture at the IUPAC World Polymer Congress—MACRO 2010, 11-16 July 2010.

Professor Stevens has developed novel approaches to tissue engineering that are likely to prove very powerful in the engineering of large quantities of human mature bones as well as other vital organs. She formerly held a postdoctoral position in the field of tissue engineering at the Massachusetts Institute of Technology, USA, with Robert Langer.

 www.iupac.org/web/nt/2009-03-16_PI-IUPAC_Award

Materials Chemistry: a Stronger Role within IUPAC

In the wake of the reorganization of IUPAC in 2000, the most far-reaching consequences of which were the abolition of commissions and the removal of all nomenclature activities to a new nomenclature division, it was soon evident that many of the remaining activities of the subject divisions related to the chemistry underlying the structures, properties, and applications of materials. Recognizing that the world of scientific publication and external bodies such as the Royal Society of Chemistry (UK) had already identified the burgeoning importance of materials chemistry, a subcommittee composed mainly of members of the Inorganic Division but with representation from the Physical and Biophysical and Polymer Divisions has devoted itself for almost a decade to giving structure and definition to the pursuits of those who would identify as materials chemists, and to advancing their interests within the divisional structures of IUPAC.



Participants at the October 2009 materials chemistry meeting at Cornell (from left): Chris Ober, Angela Wilson, Len Interrante, Dick Jones, Tony West, and Michel Rossi.

A working definition for Materials Chemistry as comprising “the application of chemistry to the design, synthesis, characterization, processing, understanding and utilization of materials, particularly those with useful, or potentially useful, physical properties” has recently been advanced in an IUPAC Project report [*Pure Appl. Chem.* 1707-1717 (2009); see also May-June 2009 *CI*, pp. 4-8]. Furthermore, a number of interdivisional projects that fall within this definition have been or are being advanced by various IUPAC task groups, such that, at the meeting of the subcommittee that took place during the recent General Assembly in Glasgow, it was agreed that representa-

tives of divisions with obvious concerns in the area of materials chemistry should meet to discuss the way forward. This meeting took place at Cornell University on 17 October 2009, hosted by Chris Ober, the president of the Polymer Division, with two representatives each from the Inorganic (Len Interrante and Tony West), Physical and Biophysical (Michel Rossi and Angela Wilson), and Polymer (Dick Jones and Chris Ober) Divisions.

Although the Inorganic Division’s Subcommittee on Materials Chemistry has served its purpose well, it is a loosely structured group which lacks the authority to coordinate future activities or to position IUPAC for leadership in the area of materials chemistry. This arrangement does not respond adequately to the size and reach of the materials chemistry community, which is presently far in advance of the current situation in IUPAC. At the Cornell meeting it was agreed that a stronger structure that emphasized the interdivisional nature of the subcommittee’s purposes was essential. Henceforth, until possibly such time as an even more influential profile can be developed, it would be identified as the Interdivisional Subcommittee on Materials Chemistry (ISMC), with an expanded membership drawn from across IUPAC. It was recognized that high-profile activity in Materials Chemistry could lead to greater recognition of IUPAC among younger chemists, and enhance its role in advancing international cooperation in chemical science and technology. Accordingly, approval would be sought from the IUPAC Council to confirm a remit to oversee all aspects of materials chemistry and act as an IUPAC voice, contributing to congresses as appropriate and coordinating new cross-disciplinary projects. The interdivisional subcommittee would maintain an IUPAC Materials Chemistry website with links from all of the participating divisions which, in addition to reporting its structure and activities, would provide access to materials chemistry educational resources. Meetings would take place annually, at General Assemblies and also in the so-called off-years. In order to implement the proposal, the ISMC’s membership would at first be based on those present at the Cornell meeting, but wider involvement would be canvassed without delay. Representatives of other interested groups or individuals within IUPAC who wish to be involved should contact the acting chair, Leonard Interrante <interl@rpi.edu>. The next meeting will take place in Zurich on 23 April 2010.

 www.iupac.org/web/ins/205

International Year of Biodiversity

The United Nations declared 2010 to be the International Year of Biodiversity. It is a celebration of life on earth and of the value of biodiversity for our lives. The world is invited to take action in 2010 to safeguard the variety of life on earth.

We are all an integral part of nature; our fate is tightly linked with biodiversity: the huge variety of other animals and plants, the places they live and their surrounding environments, all over the world. We rely on this diversity of life to provide us with the food, fuel, medicine, and other essentials we simply cannot live without. Yet, this rich diversity is being lost at a greatly accelerated rate because of human activities. This impoverishes us all and weakens the ability of the living systems, on which we depend, to resist growing threats such as climate change.

In recognition of 2010 as the International Year of Biodiversity, people all over the world are working to safeguard this irreplaceable natural wealth



and reduce biodiversity loss. This is vital for current and future human well-being.

UNESCO is tackling the root causes of biodiversity erosion and loss due to unsustainable development. During the Year, UNESCO will lead several activities to educate and raise public awareness about the reasons for conserving biodiversity, to fill the gaps in our knowledge and to catalyze further international action.

 www.cbd.int/2010/welcome

In Memoriam—Itaru Mita

by Kaz Horie

Longtime IUPAC member Itaru Mita, professor emeritus of polymer chemistry at the University of Tokyo (UT), Japan, died on 1 November 2009 at the age of 80.

Mita was a prominent chemist whose scientific pursuits focused on kinetics and the mechanism of polymer reactions, including living anionic polymerization, degradation and stability of thermostable polymers,

molar-mass effects on rate coefficients of elementary reactions in polymerization, intra- and inter-macromolecular reactions, and reactions in polymer solids.

Mita served many years in the Society of Polymer Science, Japan; chairing several committees, one after another, and then serving as president in 1990–1992. He played important roles in organizing IUPAC International Symposia on Macromolecules in Tokyo (MACRO '68) and Kyoto (MACRO '88).

Mita started his IUPAC activities in 1977 as a member of the Commission on Macromolecular Nomenclature. He was an associate member from 1977–1979 and 1989–1991 and a titular member from 1979–1989. He contributed in preparing “Source-Based Nomenclature for Copolymers” and other IUPAC recommendations compiled in the first edition of the Purple Book (1991).

The Institute of Science and Technology at UT, of which Mita was a member since 1956 experienced four complete reorganizations during 32 years. He spent some tough years as the head of the department when it was the Institute of Interdisciplinary Research. This was during the period of “scrap and build” in national universities after the Second World.

It is worth noting that Itaru's wonderful personality created a positive environment for bright young students, 12 of whom later married and will undoubtedly forward his spirit to the coming generations.

After his retirement from UT in 1990, Mita worked as a president in the Dow-Corning Asia Research Center, Ltd. for five years and continued to be involved in SPSJ and IUPAC. His most recent contribution was the proposal of “Generic Source-Based Nomenclature for Polymers,” which is compiled in the second edition of the Purple Book (2009). He also served until March 2009 as the chairman of the Plastic Terminology Commission in Japan for the International Organization for Standardization.

Mita is survived by his wife, Hisako, a son and a daughter, and four grandchildren. We have lost a great scientist, a sympathetic and respected partner in discussions, a good friend, and an ambassador for science and culture for his country.

Kaz Horie, professor emeritus of the University of Tokyo, is a member of the IUPAC Polymer Division Subcommittee of Polymer Terminology.



Itaru Mita.

The Project Place

Categorizing Halogen Bonding and Other Noncovalent Interactions Involving Halogen Atoms

The purpose of this two-year project is to take a comprehensive look at intermolecular interactions involving halogens as electrophilic species, and to classify them. The electron density around the halogen nucleus is highly anisotropic so that halogens can serve both as electron-acceptors and donors.¹

While the task group acknowledges that the terminology used to name noncovalent interactions given by halogen atoms has to be as unifying as possible, it is the group's opinion it has always to be in keeping with the electrophile/nucleophile role the halogen atom plays.

First descriptions of systems involving halogen atoms as electrophilic "sticky" sites in self-organisation processes can be traced back to the mid-nineteenth century, when $\text{NH}_3 \cdot \text{I}_2$ and pyridine•alkyl iodides adducts were isolated.² About 60 years ago, Benesi and Hildebrand published their seminal work describing the distinct spectral (UV-Vis) changes that accompany the spontaneous complexation of various aromatic hydrocarbons with I_2 in nonpolar solvents such as CCl_4 , C_6H_{14} , etc.³ Shortly thereafter, these studies were extended to include Br_2 , Cl_2 , and interhalogens,^{4,5} and provided experimental basis for the development of Mulliken's theory of charge-transfer complexes.⁶ About the same time, X-ray crystallographic measurements of Br_2 complexes with dioxane and benzene reported by Hassel and co-workers provided evidence that these intermolecular complexes involve close contacts between electron-donor and acceptor molecules (with interatomic separation significantly shorter than the sum of their van der Waals radii).⁷ In his 1970 Nobel lecture, Hassel unequivocally stressed the importance of intermolecular interactions involving halogen atoms as electrophilic species for directing molecular self-assembly phenomena.⁸

The term *halogen bonding* has been introduced for describing any noncovalent interaction involving

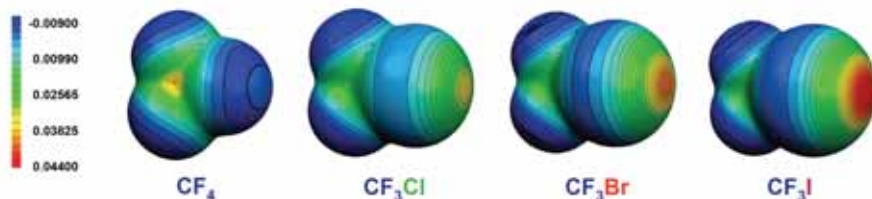
halogens as acceptors of electron density.⁹ The general scheme $\text{D} \cdots \text{X}-\text{Y}$ thus applies to halogen bonding (XB), wherein X is the halogen (Lewis acid, XB-donor), D is any electron-donor (Lewis base, XB-acceptor), and Y is carbon, halogen, nitrogen, etc.¹⁰ The term *halogen bonding* itself sheds light on the nature of XB, which possesses numerous similarities with hydrogen bonding (HB), wherein hydrogen functions as the acceptor of electron density.

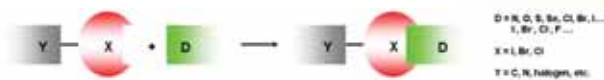
In our opinion, the use of the term *halogen bonding* has to be limited to those interactions wherein halogens function as acceptors of electron density. Use of this term to address interactions in which halogen atoms function as electron-donors is conceptually misleading and contrasts with the clear tendency, well-documented in the literature, to differently name interactions such as $-\text{H} \cdots \text{X}-\text{Y}$ (typically named hydrogen bonds).

This project will attempt to give a modern definition of *halogen bonding* that is as inclusive as possible, and takes into account all current experimental and theoretical pieces of information on both gaseous and condensed halogen-bonded systems in chemical and biological systems. After a reviewing process, the definition will eventually be submitted as Recommendations for *Pure and Applied Chemistry*, and will hopefully be included in the *IUPAC Gold Book*.

The whole community of researchers dealing with the study and use of intermolecular interactions will be called to be involved in this project. A dedicated website www.halogenbonding.eu will be set up as a public discussion forum for consideration of public comments. The project will be advertised in major meetings relevant to related fields (e.g. the 26th European Crystallography Meeting in Darmstadt, 29 August–2 September 2010 and the XXII General Assembly and Congress of the International Union of Crystallography (IUCr) to be held in Madrid, Spain, 22–29 August 2011). In the second year of the project, an international symposium open to the public will be organized for consideration of public comments, presentation, and dissemination of results.

The kick-off meeting of the project will be organized in Milan next 7 May 2010, where the Politecnico di Milano will host the 2nd International Workshop on Halogen Bonding.





The members of the task group are all leaders in their respective fields: Gautam R. Desiraju, Bangalore, India (supramolecular chemistry); Pui Shing Ho, Colorado, US (biophysical chemistry); Lars Kloo, Stockholm, Sweden (inorganic chemistry); Anthony C. Legon, Bristol, UK (physical chemistry); Roberto Marquardt, Strasbourg, France (quantum chemistry); Pierangelo Metrangolo, Milan, Italy (materials chemistry); Peter Politzer, Ohio, US (theoretical chemistry); Giuseppe Resnati, Milan, Italy (organic chemistry); and Kari Rissanen, Jyväskylä, Finland (structural chemistry).

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For more information and comments, contact Task Group Chairs Pierangelo Metrangolo <pierangelo.metrangolo@polimi.it> and Giuseppe Resnati <giuseppe.resnati@polimi.it>.

 www.iupac.org/web/ins/2009-032-1-100

Risk Assessment of Effects of Cadmium on Human Health

Cadmium is a metal that occurs generally in low concentrations of various chemical species in the ecosystem, with high concentrations in some areas.

Dispersion into the environment occurs from multiple sources including inadequate disposal of electronic waste. Sources in industrialized countries have been better controlled recently, but in many areas exposures exceed those that occurred before industrialization.

Cadmium accumulates in humans because of its very long biological half time in human tissues, particularly in the kidneys (10–30 years). In high exposure areas in Japan a clinical disease—Itai-itai disease—occurs. This disease is characterized by multiple fractures of bones, and damaged kidneys. Recent epidemiological studies have reported less severe cadmium-related effects on kidneys and bones among humans exposed to cadmium species in the environment of countries such as China, Belgium, Sweden, UK, and USA, sometimes in areas without obvious excessive exposure. Subgroups such as diabetics may be particularly affected. Cadmium is classified as carcinogenic to humans by the International Agency for Research on Cancer, based on studies of occupational exposures. A few recent publications have reported such effects following environmental exposures.

It is important to consider all published information in a risk assessment of the effects on human health from cadmium species. This is the task of the present project. The European Food Safety Authority (EFSA) has recently reviewed cadmium. Their report will prove valuable, but only considers exposure through food. Likewise, a report from the Joint Expert Committee on Food Additives (JECFA) is due in June 2010, and will be available to the task group by the time of its second working meeting.

Task group members will compile and evaluate all relevant literature, and write a manuscript for publication in *PAC*. Focus will be on health risks related to cadmium exposure at low level exposures. References will be made to existing risk assessment documents from WHO/IPCS, WHO/FAO/JECFA, ATSDR, USEPA, EU-RAR, EFSA, and others. The Chemistry and Human Health Division can provide guidance on risk assessment methodology and, as appropriate, provide assessments of risks to human health from chemicals of exceptional toxicity. This project should provide a model for such activities conforming to current best practice.

For more information and comments, contact Task Group Chair Gunnar F. Nordberg <gunnar.nordberg@envmed.umu.se>.

 www.iupac.org/web/ins/2009-034-2-700

The Project Place

Regional Drinking Water Quality Assessment in the Middle East: An Overview and Perspective

The increased pressure on scarce water resources, coupled with inadequate treatment of point and nonpoint sources of pollution, have caused a rapid degradation of chronically depleted water resources, contributing significantly to the ongoing conflicts in the region in general and to the Palestinian-Israeli conflict in particular. Further, transboundary movement of pollutants from one entity to another endangers the shared water bodies, which without adequate treatment pose a health risk to the population who are dependent on these resources for their drinking water.

Accordingly, the aim of the project is to conduct, under a multinational collaborative effort, an assessment of current and prospective deficiencies in water quality, providing an account of water quality conditions, treatment, risk assessment, and prospects for alleviation and mitigation of poor water quality, and environmental degradation.

The proposed geographical area for the planned study is shown in the map below.

Objectives

- study and evaluation of critical water resources and water quality issues of relevance to the defined working area, as a whole
- evaluation of water quality control strategies, regarding domestic water supplies and wastewater collection and treatment
- conservation of aquifers and ecosystems, as well as reuse of wastewater
- treating specific critical issues and relevant case studies
- recommendation of uniform and applicable water quality standards, enabling regional water management and valid comparison of water quality data across the region

Methodology

- data collection, review and data credibility
- water quality control
- environmental impact assessment
- management factors
- best engineering and other practical means for improvement
- regional interaction and cooperation
- dissemination

Work Plan and Organization Chart

The project was approved at the end of 2008, and initiated in 2009. The first meeting of the group was held in Amman, Jordan, the 15–17 November 2009.

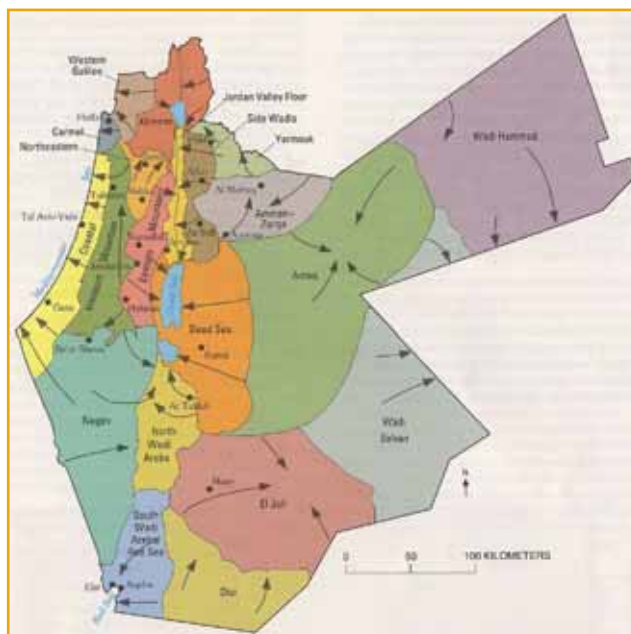
Anticipated Impact

- establishment of a regional alliance of scientists and engineers to work and advise on environmental issues of regional importance
- review of regional water quality issues and evaluation of specific case studies
- recommendations to policy makers and other stakeholders on water quality management strategy and technological development options
- contribution to coexistence in the region

The Working Group

The group comprises 17 scientists from the region supported by other U.S. and European members of the Chemistry and the Environment Division and CHEMRAWN. The group is divided into four sub-groups, each dealing with the compilation and evaluation of data of each entity before integration and assimilation of the data into a regional report. The working group composition is given on the project web page.

Twelve members of the working group and two invited guests—Liev Sydnes, IUPAC past president and currently chair of CHEMRAWN; and Nicola Senesi, president of the Chemistry and the Environment



Groundwater basins and directions of groundwater movement under study in this project.

The Project Place

Division—were able to attend the meeting, which was part of the Malta IV Conference “Frontiers of Chemical Sciences: Research and Education in the Middle East.” The meeting aimed to overcome prejudices and antagonisms among people and enable cooperation among individuals despite their political differences.

Scientists from 14 different countries, including several Nobel Laureates, participated in the workshops, which were related to air and water quality, and were well attended, with more than 40 participants. A range of oral presentations and poster sessions provided participants with an overview of current efforts to characterize regional environmental issues, and develop management strategies. Regional air and water issues, and potential mitigation strategies and technologies, were presented, and drew interested workshop participants beyond the working group members. These included:

- Abdelrahman Tamimi: “The Regional Experience in Pollution Monitoring”
- Miriam Waldman and Yehuda Shevah: “Water Resources and Water Quality Management—The Israeli Perspective”
- Nadia Kandile: “The Impact of Human Activities on Wastewater Quality”
- Yehuda Shevah: “IUPAC Water Quality Working Group Project”
- Yousef Abu-Mayla: “Water Quality in Gaza-Palestine”
- Venice Gouda and Hassan Moawad: “Role of Chemistry in Solving Issues Related to Energy and Water Shortage”

The working group also presented a seminar by Heinz Hoetzel of the University of Karlsruhe, entitled “Improving the Availability of Water Resources for Arid and Semiarid Areas by Means of Integrated Water Resources Management,” which reviewed the hydrology, water usage and water quality issues facing the region.

In addition to the formal workshop activities, the task group held a series of planning meetings to refine:

- scope and objectives of the project
- collection of water quality data for Jordan, the Palestine Authority, and Israel
- work plan and time schedule
- additional funding required to implement tasks focused on data collection, data analyses, and development of policy options.



Participants at the Malta IV Conference in Amman, Jordan, 14–19 November 2009.

Conclusions

Environmental Impacts of Desalination Activities

The fast-increasing desalination activities in the region may threaten the environmental quality of coastal and marine ecosystems, as well as degrade marine water quality. The creation of a collaborative, multi-disciplinary research group is suggested to evaluate the impact of thermal discharges, brine disposal, and other desalination process emissions on coastal and marine water quality.

Atmospheric Deposition on Water Bodies

Meeting attendees proposed a study of the impact of air quality water quality in the eastern Mediterranean region. Such research would evaluate primary air pollution emissions from cities, industries, and agricultural activities, and ambient air-quality data across the region.

Project Expansion

- The initial “Phase 1” study area is to be expanded to the north to include Lebanon and Syria, which share many of the same water sources.
- Results of the initial study would be disseminated to motivate “Phase 2” studies that include Egypt, Libya, and Sudan to the west and Iraq, Kuwait, Saudi Arabia, and the Gulf states to the east.

The progress achieved by this collaborative activity during Malta IV should provide the momentum necessary for its continued success in addressing the acute crises of clean drinking water and ways to build bridges over transboundary waters.

Further information on the progress of the ongoing regional water quality assessment project, and issues associated with the project, may be obtained from Yehuda Shevah <ysheva@gmail.com>.

 www.iupac.org/web/ins/2008-003-3-600

The Project Place

New Drugs for Neglected Diseases in Latin America

A new project initiated by the Subcommittee on Medicinal Chemistry and Drug Development has been initiated to raise awareness of neglected diseases in Latin America, and encourage researchers to select them as subjects for new drug research.

In Latin America and the Caribbean regions, at least 210 million people live below the poverty line. This is approximately 40 percent of the population. These impoverished and marginalized populations are heavily burdened with neglected tropical diseases (NTDs). While many of the NTDs do not directly cause high rates of morbidity, they contribute to an enormous rate of morbidity, and a drastic reduction in income for the most poverty-stricken families and communities.¹ Based on their prevalence, and on healthy life years lost from disability, hookworm infection, other soil-transmitted helminth infections, and Chagas disease are the most important NTDs in Latin America and the Caribbean, followed by dengue, schistosomiasis, leishmaniasis, trachoma, leprosy, and lymphatic filariasis.²

The solutions to this situation do not just depend on having appropriate drugs, but are complex, involving public health, disease control, education, and the political will. Even so, having appropriate drugs would be very helpful. There are some drug programs. For example, Novartis has established the Novartis Institute for Tropical Diseases in Singapore, which is focused especially on dengue fever, tuberculosis, and malaria. Another example is the Institute for One World Health, which is a nonprofit pharmaceutical company founded in 2000 to develop safe, effective, and affordable new medicines to treat infectious diseases in the developing countries; it is especially supported by the Bill & Melinda Gates Foundation. Two drugs were under development³ to treat Chagas disease in Latin America. These were K777, a cysteine protease inhibitor from Celera Genomics, and a series of sterol biosynthesis inhibitors licensed from Yale University and the University of Washington. The compound K777, however, was hepatotoxic and its development was abandoned. The Yale/Washington compounds were also abandoned.

The new project aims to identify chemistry researchers and testing laboratories, and their equipment and facilities, currently working in Latin America to discover new drugs to treat NTDs. The project chair, Antonio Monge (Centre for Investigation in Applied Pharmacobiology, University of Navarra, Pamplona, Spain), has many contacts in Latin America, and visits the subcontinent several times each year. He is very well placed to lead this effort. There is also a website that has been set up for Neglected Diseases (Enfermedades Olvidadas), sponsored by the Spanish Academy of Pharmacy (Real Academia Nacional de Farmacia de España), in collaboration with all the Latin American Academies of Pharmacy: www.malaria2.enfermedadesolvidadas.com (in English: www.enfermedadesolvidadas.com/english.html)

The next stage will be to stimulate other medicinal chemists in Latin America to conduct research in this area, and make contacts between them and the testing laboratories. Thus, the project will be promoting self-help. By creating such a network of researchers it should also be possible to tap into some of the philanthropic funding available.

Candidate drugs for possible development could be offered to local pharmaceutical laboratories, or one might seek the assistance of the Institute for One World Health.

If the project succeeds it would serve as a model for similar efforts in other areas of the world⁴ (e.g., India and Southeast Asia).

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For more information and comments, contact Task Group Chair Antonio Monge Vega <cifa@unav.es>.

 www.iupac.org/web/ins/2009-033-1-700

Bookworm

Antarctic Climate Change and the Environment

Edited by Turner, J., Bindschadler, R.A., Convey, P., Di Prisco, G., Fahrbach, E., Gutt, J., Hodgson, D.A., Mayewski, P.A., and Summerhayes, C.P.
Published in Cambridge by SCAR, 2009

ISBN 978-0-948277-22-1

In December 2009, the Scientific Committee on Antarctic Research (SCAR) released the first comprehensive review of the state of Antarctica's climate and its relationship to the global climate system. *Antarctic Climate Change and the Environment* presents the latest research from the icy continent, identifies areas for future scientific research, and addresses the urgent questions that policy makers have about Antarctic melting, sea-level rise, and biodiversity.

Dr. Colin Summerhayes, executive director of the Scientific Committee on Antarctic Research said,

"Antarctica is an unrivalled source of information about our planet. This review describes what we know now and illustrates how human activity is driving rapid climate change. By integrating this multidisciplinary evidence into a single source we will help scientists and policy makers understand the distinction between environmental changes linked to the Earth's natural cycles, and those that are human induced. The work is

particularly important because it puts Antarctic climate change into context and reveals the impact on the rest of the planet."

Professor John Turner of the British Antarctic Survey was the lead editor of the review. He said, "For me, the most astonishing evidence is the way that one man-made environmental impact—the ozone hole—has shielded most of Antarctica from another—global warming. Understanding the complexities surrounding these issues is a challenge for scientists—and communicating these in a meaningful way to society and to

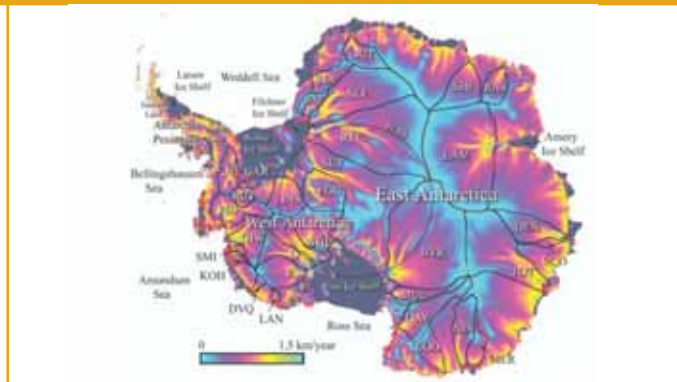


Figure 1.6 from the report shows balance velocity, calculated at any point as the velocity (averaged over the thickness) required to balance upstream accumulation, to illustrate the spatial pattern of ice flow that is required to maintain the ice sheet shape in the present climate (Rignot and Thomas, 2002).

policymakers is essential. There is no doubt that our world is changing and human activity is accelerating global change."

Following production of the Arctic Climate Impact Assessment report in 2005, SCAR decided that a southern hemisphere equivalent was required, and set about producing it. One hundred scientists from 13 countries contributed as authors, and the manuscript was produced by an editorial team of 9, headed by Turner.

Elements of the report have already been published as scientific papers in *Reviews of Geophysics* (January 2009) and in the December 2009 issue of the *Antarctic Science Journal*. Annual reviews of the science of climate change in the Antarctic, based on the ongoing work in the report, have been presented to the Antarctic Treaty Consultative Meetings and the associated Committee on Environmental Protection.

The report is available from the ACCE page of the SCAR website.

 www.scar.org/publications/occasionals/acce.html

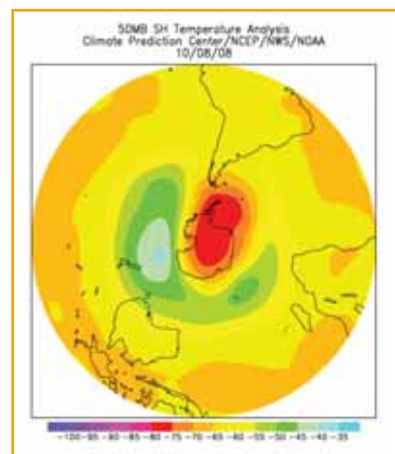


Figure 1.13 from the report, shows the polar vortex above Antarctica in midwinter (August).



18th International Conference on Organic Synthesis

Bergen Tourist Board/Willy Haraldsen



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Jan E. Bäckvall, Sweden
Martin Banwell, Australia
Valery V. Fokin, USA
Karl A. Jørgensen, Denmark
Nobel Laureate Robert H.
Grubbs, USA
Paul Knochel, Germany
Steven Ley, UK
Johann Mulzer, Austria
Samir Zard, France
Dieter Seebach, Switzerland
Victor Snieckus, Canada
Michinori Suginome, Japan

Conference chair:

Leiv K. Sydnes
University of Bergen
leiv.sydnes@kj.uib.no

Invited speakers:

Varinder K. Aggarwal, UK
Helen E. Blackwell, USA
Christian Bochet, Switzerland
David Y.-K. Chen, Singapore
Karol Grela, Poland
Antonio Guarna, Italy
Henk Hiemstra, The Netherlands
Ari M. P. Koskinen, Finland
Mark Lautens, Canada
Anita Maguire, Ireland
Vakhid A. Mamedov, Russia
José L. Mascareñas, Spain
Frank E. McDonald, USA
Hans Reissig, Germany
Dieter Schinzer, Germany
Tony K. M. Shing, Hong Kong
Snorri Th. Sigurdsson, Iceland



Bergen Tourist Board/Jan M. Lillebø

Phil S. Baran, recipient of the
2010 Thieme–IUPAC Prize will
give the Prize Lecture.

www.thieme-chemistry.com

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Conference Call

High Temperature Materials Chemistry

by *Alexandra Navrotsky*

The 13th IUPAC Conference on High Temperature Materials Chemistry (HTMC XIII), held 14–18 September 2009 at the University of California, Davis, was the 13th conference in a series of triennial meetings, with the previous two held in 2003 in Tokyo (Japan) and in 2006 in Vienna (Austria).

The conference, under the sponsorship of IUPAC, was organized by the Peter A. Rock Thermochemistry Laboratory and Nanomaterials in the Environment, Agriculture, and Technology Organized Research Unit of the University of California, Davis. Financial assistance was provided by NASA, SGTE, SETARAM, NETZSCH as well as by the University of California, Davis.

More than 75 participants from 14 countries worldwide came to Davis to present their research in the field of high-temperature materials chemistry and to interact with each other in a lively scientific setting. Of these participants, nearly 20 percent were women and nearly 10 percent were from underrepresented countries in the scientific community. A considerable number of scientists had an opportunity to attend the HTMC conference for the first time, due to financial support by the local organizers through waived or reduced registration fees. These young scientists were able to network with peers and senior colleagues from around the world.

The program covered a wide variety of scientific topics including high-temperature geologic processes, high-pressure transitions, metals and alloys, carbides, and energy related materials. The following sampling of plenary lectures reflects the diversity of the field:

- “Calorimetric Measurement of the Interface Energy Using Nanoparticles” by Ricardo Castro (United States and Brazil)
- “Ni-Base Superalloys: When Basic Knowledge Meets Applications” by Susana Fries (Germany)
- “Pressure and Temperature Effects on the Structure of Oxide Melts” by Jonathan Stebbins (United States)
- “Post-Perovskite Transition and Magnetic and Charge Transport Properties of the Correlated 4d Post-Perovskite CaRhO_3 ” by Kazunari Yamaura (Japan)

In addition to plenary lectures, the conference included topic-focused lectures and a poster session. The conference was sponsored by IUPAC and organized by the Peter A. Rock Thermochemistry Laboratory and Nanomaterials in the Environment, Agriculture, and Technology Organized Research Unit of the University of California, Davis. The local organizing committee was chaired by Alexandra Navrotsky. Financial assistance was provided by NASA, SGTE, SETARAM, NETZSCH, and the University of California, Davis.

The social program included an excursion to historic Old Sacramento followed by a banquet in the Firehouse Restaurant. Tours were given of the Peter A. Rock Thermochemistry Laboratory.

The HTMC XII was a success in that it provided an open environment of collaboration for scientists from the fields of chemistry, geology, and materials science who are working in the area of high-temperature phenomena in solid and liquid materials. Many of the participating attendees greatly anticipate attending HTMC XIV, which will be held in 2012 in Beijing, China.

Alexandra Navrotsky, a distinguished professor at the University of California, Davis, was chair of the local organizing committee.



Left: Conference participants gather in front of Giedt Hall at the University of California, Davis. Top: Attendees at the conference banquet in Old Town Sacramento.

Conference Call

Soil Science

by *Jianming Xu*

The **International Symposium of Molecular Environmental Soil Science at the Interfaces in the Earth's Critical Zone** (ISMESS 2009), which was IUPAC sponsored, was held on 10–14 October 2009 at Zhejiang University in Hangzhou, China. Two hundred and sixty-six participants from 21 countries attended the conference.

Zhejiang University, founded in 1897, is a key comprehensive university whose academic and research endeavors cover eleven disciplines. Soil Science at Zhejiang University is one of China's National Key Disciplines.

This was the first time that an international symposium on the subject was held in China. The conference identified, and built on, the need to view and understand the critical zone at the molecular level. It provided a novel interface that facilitated the integration of contributions from traditionally separate disciplines. In addition, the symposium added a molecular and nanoparticle dimension to a field of endeavor that has traditionally been viewed on a different scale (dimension).

This symposium provided a forum for the interactions and communication of soil chemists, mineralogists, microbiologists, and physicists with allied scientists, including pure chemists, biologists, environmental scientists, ecologists, and ecotoxicologists. This symposium helped identify gaps in knowledge and future research directions.

The scientific program featured 2 plenary lecturers, 19 invited lecturers, 29 oral presentations, and 65 poster presentations. Donald L. Sparks, University of Delaware, USA, delivered the first plenary lecture on the topic of "Advances in the Use of Synchrotron Radiation to Elucidate Environmental Interfacial Reaction Processes and Mechanisms in the Earth's Critical Zone." The second plenary lecture, on "Microbial Role in Global Biogeochemical Cycling of



Opening ceremony at the International Symposium of Molecular Environmental Soil Science at the Interfaces in the Earth's Critical Zone.

Metals and Metalloids at the Interfaces in the Earth's Critical Zone," was delivered by Geoffrey M. Gadd, University of Dundee, UK.

The main symposium topics were as follows:

- The Role of Mineral Colloids in Carbon Turnover and Sequestration and the Impact on Climate Change
- Biogeochemical Interfacial Reactions and the Transformation, Transport and Fate of Vital and Toxic Elements
- Anthropogenic Organics, Crop Protection, and Ecotoxicology
- Environmental Nanoparticles: Distribution, Formation, Transformation, Structural and Surface Chemistry, and Biogeochemical and Ecological Impacts
- Environmental Processes and Ecosystem Health

A special session was dedicated to the late Pan Ming Huang, cochair of ISMESS 2009, for his great contributions to the symposium and to the advancement of soil and environmental sciences.

Major knowledge shared during the symposium included the following:

1. The concept of the critical zone was highlighted, which is a system of coupled chemical, biological, physical, and geological processes operating together to support life at the Earth's surface.
2. Further efforts require scientists to cross disciplines for the study of the interactive processes in the critical zone and their impact on the

Conference participants gather for a group portrait at Zhejiang University in Hangzhou, China.



Conference Call

globe and humankind, ranging in scale from the environmental mineral-organism-humus-water-air interfaces.

3. Discussion on carbon turnover furthered understanding of the role of mineral colloids in carbon transformation, dynamics, and sequestration and their impact on climate change in the environment.
4. Microbes participate in important natural biogeochemical processes relating to metal-mineral transformations, element cycling, bioweathering, biocorrosion, bioremediation, revegetation, phytoremediation, and containment of pollution in the terrestrial critical zone
5. The importance of nanoscience as a new frontier in soil science was emphasized.
6. Some new advanced methods and approaches (e.g. synchrotron radiation, SIP-DNA) have improved our understanding of the environmental interfacial reaction processes and mechanisms in the Earth's critical zone.

Two challenging areas were also identified: 1) How, and to what extent, are the interfacial reaction processes affected by environmental nanoparticles and by the soil microbes, especial at the molecular level? and 2) What are the physical, chemical, and biological interfacial interactions at the molecular level that define the fate of ions, chemicals, and microbes as they are transported through soil systems?

A book entitled *Molecular Environmental Soil Science at the Interfaces in the Earth's Critical Zone* was published jointly by Springer Verlag and Zhejiang University Press. The book, edited by Jianming Xu and Pan Ming Huang, contained 108 accepted, extended abstracts. Another book composed of accepted papers by plenary and invited lecturers will be prepared and published by Springer Verlag. A special issue composed of accepted papers by other participants will also be prepared and published by the *Journal of Soils and Sediments*.

At the closing ceremony, IUPAC Representative Nicola Senesi, introduced the last program and discussed the work of IUPAC. He stated that the symposium was a great success.

More information and full details of the symposium program are available on the symposium website.

Jianming Xu <jmxu@zju.edu.cn> is director of and professor in the Institute of Soil and Water Resources and Environmental Science, Zhejiang University, Hangzhou, China.



Yuping Wu's laboratory members from Fudan University, who helped staff the conference, with some symposium participants.

Novel Materials

by Yuping Wu

The **International Symposium on Novel Materials and Synthesis (NMS)** was initiated in 2005 in Shanghai. Since then, it has been jointly held with International Symposium on Fine Chemistry and Functional Polymers, which was first held in 1985 in China. The IUPAC-sponsored **5th NMS** took place 18–22 October, 2009 at Fudan University in Shanghai, China.

The joint symposium, which attracted 423 participants including 310 from overseas, focused on innovative catalytic and other synthetic methods, innovative polymer materials, energy systems, nanomaterials, ceramic materials, and other novel materials and synthesis related to the environment, medicine, and analysis. Lectures were given by a number of prominent scientists, including Robert Huber (Nobel Laureate of Chemistry in 1988), Klaus Muellen (President of the German Chemical Society), Shixue Dou (member of the Australia Academy of Engineering), Hans-Joachim Knölker (Germany), Hasuck Kim (South Korea), Kimihisa Yamamoto (Japan), Masahiro Yamashita (Japan) and Limin Wu (China), Heinz Berke (Switzerland), and Makoto Shimizu (Japan). Speakers from industry also discussed the latest developments in novel materials.

For the first time, IUPAC Poster Prizes were awarded at the symposium. The winning posters were from Poland, South Korea, and Japan. In addition, the 2009 Distinguished Award for Novel Materials and their Synthesis was granted to Makoto Shimizu (Japan) and Klaus Kurz (Germany).

The next Symposium on Novel Materials and Synthesis and Fine Chemistry and Functional Polymers will be held in Wuhan, China, 11–14 October 2010.

Yuping Wu is a professor in the Department of Chemistry and the Shanghai Key Laboratory of Molecular Catalysis and Innovative Materials at Fudan University, Shanghai, China.

Where 2B & Y

Inorganic Materials

12–14 September 2010, Biarritz, France

The **Seventh International Conference on Inorganic Materials** is the latest in a series of interdisciplinary conferences devoted to all aspects of inorganic materials research. Following the success of previous events in the series, the meeting will provide an opportunity to highlight recent developments, and to identify emerging and future areas of growth in this exciting field.

Abstracts are invited by 30 May 2010 for oral and poster presentations exploring the following six main themes of this conference:

- solid-state chemistry (oxides and intermetallics)
- materials for energy conversion and storage
- multiferroic materials
- multifunctional materials
- new high T_c superconductors
- nanomaterials (focusing on nano-effects)

The conference chairs are Claude Delmas of L'Institut de Chimie de la Matière Condensée de Bordeaux, France, and Antoine Maignan of the Laboratoire de Cristallographie et Science des Matériaux, ENSICAEN, France.

 www.im-conference.elsevier.com

Coordination Chemistry

25–30 July 2010, Adelaide, Australia

The **39th International Conference on Coordination Chemistry** (ICCC39) will bring together the world's leading coordination chemists to showcase the latest developments in this field. Topics from fundamental coordination chemistry will be combined with chemistry topics that specifically address the pressing concerns of the 21st century (such as energy, environmental, and medicinal chemistry) to give comprehensive coverage in parallel streams.

There will be a full range of plenary, keynote, and contributed lectures, poster presentations, and excel-

lent opportunities to network with fellow participants at the various social events. Confirmed plenary speakers include Polly Arnold (Edinburgh), Susumu Kitagawa (Kyoto), Nils Metzler-Nolte (Bochum), Daniel Nocera (MIT), David Parker (Durham), Vivian Yam (Hong Kong), and the Burrows awardee of the Royal Australian Chemical Institute.

The conference program will be structured around current and emerging themes of coordination chemistry, including the following:

- inorganic materials chemistry
- metals in synthesis and catalysis, including metal extraction
- new challenges: energy and the environment
- supramolecular chemistry
- metals in biology
- werner complexes

ICCC39 will be held in Adelaide, which is known as Australia's festival city. Adelaide offers a cosmopolitan variety of cafes, shopping, and entertainment, and is the gateway to some of Australia's finest wine regions. The conference venue will be the Adelaide Convention Centre, located in the city center, and surrounded by conference hotels and similar accommodation.

See **Mark Your Calendar** on page 33 for contact information.

 <http://iccc2010.eventplanners.com.au>



Biotechnology for the Sustainability of Human Society

14-18 September 2010 Palacongressi,
Rimini, Italy



The Alma Mater Studiorum University of Bologna is organizing the **14th International Biotechnology Symposium and Exhibition** (14th IBS) to be held at the new Palacongressi di Rimini, the largest and most technologically advanced conference center in Italy.

Under the auspices of IUPAC, the IBS series is a premier international biotechnology event, held every two years on a different continent. The 14th IBS is promoted by the Italian and European Technology Platforms of the Life Sciences area, together with EuropaBio, EFB, ISEB, and ESEB.

The overall aim of the 14th IBS is to explore the advances, frontiers, and applications of biotechnology for a healthier, more sustainable future, and a knowledge-based international bio-economy. IBS also aims to strengthen relations between industry, research laboratories, government agencies, the private sector, and universities, concerning strategic issues for human sustainability.

Participants from the international biotechnology industry, a dynamic and R&D-oriented program, and highly qualified speakers from academia, governmental institutions, and industry, will be some of the major features of this event. There will also be sessions organized to promote international R&D cooperation and the establishment of industry-academia consortia suitable for European Framework Program applications, oral presentations selected from submitted abstracts, and special issues of relevant journals published by Elsevier, which is helping to organize the event.

Low registration fees, awards for excellent young scientists, low accommodation costs in Rimini, and



post-conference activities such as excursions to major Italian cities, will facilitate the participation of all motivated colleagues and actors in the international biotechnology sectors.

The symposium will include the following sections:

- systems biology for biotechnological innovation (jointly with SBH)
- medical and pharmaceutical biotechnology
- animal biotechnology
- industrial biotechnology (jointly with ESEB)
- biotechnology for bioenergy
- food biotechnology
- plant biotechnology
- forest biotechnology
- environmental biotechnology (jointly with ISEB)
- contribution of chemistry to develop a biotechnology-based economy

See **Mark Your Calendar** on page 33 for contact information.

 www.ibs2010.org

Visas

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

How to Apply for IUPAC Sponsorship

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

www.iupac.org/symposia/application.html

Mark Your Calendar

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

2010 (later than 1 July)

 *IUPAC poster prizes to be awarded*

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 • Wrocław, Poland

18th International Conference on Phosphorus Chemistry

Prof. Paweł Kafarski, Department of Bioorganic Chemistry, Faculty of Chemistry, Wrocław University of Technology, Wybrzeże Wyspiańskiego 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 Sumbly, University of Adelaide, School of Chemistry & Physics, Adelaide, SA 5005, Australia

Tel.: +61 8 8303 7406, Fax: +61 8 8303 4358, E-mail: christopher.sumbly@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

15–20 August 2010 • Supramolecular Architectures and Materials • Montego Bay, Jamaica

5th International Symposium on Macro- and Supra-molecular Architectures and Materials

Professor Ishenkumba A. Kahwa, Faculty of Pure and Applied Sciences, University of the West Indies, Mona Campus, Kingston 7, Jamaica, Tel.: +1 876 927 1910, Fax: +1 876 805 5580, E-mail: MAM-10@uwimona.edu.jm

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

13–17 September 2010 • Hyperfine Interactions and Nuclear Quadrupole Interactions • CERN, Switzerland

Joint International Conference on Hyperfine Interactions and International Symposium on Nuclear Quadrupole Interactions

Professor Reiner Vianden, Universität Bonn, Helmholtz Institute für Stahlen und Kerphysik (HISKP), Nussallee 14-16, D-53115 Bonn, Germany, Tel.: +49 228 733 355, Fax: +49 228 732 505, E-mail: vianden@hiskp.uni-bonn.de

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

20–23 September 2010 • Polymer Behavior • Lodz, Poland

4th International Conference on Polymer Behavior

Professor Andrzej Galeski, Centre of Molecular & Macromolecular Studies, Polish Academy of Sciences, PL-90 363 Łódź, Poland, Tel.: + 48 426 803 250, Fax: +48 426 803 261, E-mail: andgal@cbmm.lodz.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

24–29 October 2010 • Polymer Science • Hersonissos, Greece

8th Hellenic Society Symposium on Polymer Science and Technology

Professor Marinos Pitsikalis, Department of Chemistry, University of Athens, Panepistimiopolis, Zografou, GR-15771, Greece, Tel.: +30 210 727 4440, Fax: +30 210 722 1800, E-mail: pitsikalis@chem.uoa.gr

20–23 November 2010 • Chemistry in Africa • Luxor, Egypt

11th International Chemistry Conference in Africa

Professor Ahmed El-Saghier, University of Sohag, Department of Chemistry, Sohag, 82542 Egypt
Tel.: +20 128 307 176, Fax: +20 934 601 159, E-mail: africaconf2010@yahoo.com



International Union of Pure and Applied Chemistry

Advancing the worldwide role of chemistry for the benefit of Mankind

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

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The Royal Academies for the Sciences and Arts of Belgium (*Belgium*)
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Bulgarian Academy of Sciences (*Bulgaria*)
National Research Council of Canada (*Canada*)
Sociedad Chilena de Química (*Chile*)
Chinese Chemical Society (*China*)
Chemical Society located in Taipei (*China*)
Croatian Chemical Society (*Croatia*)
Sociedad Cubana de Química (*Cuba*)
Czech National Committee for Chemistry (*Czech Republic*)
Det Kongelige Danske Videnskabernes Selskab (*Denmark*)
National Committee for IUPAC (*Egypt*)
Chemical Society of Ethiopia (*Ethiopia*)
Suomen Kemian Seura—Kemiska Sällskapet i Finland (*Finland*)
Comité National Français de la Chimie (*France*)
Deutscher Zentralausschuss für Chemie (*Germany*)
Association of Greek Chemists (*Greece*)
Hungarian Academy of Sciences (*Hungary*)
Indian National Science Academy (*India*)
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