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The News Magazine of IUPAC

January-February 2012
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MAKING MEASUREMENT MATTER

INTERNATIONAL UNION OF
PURE AND APPLIED CHEMISTRY

The Formation of IACS ►
Reports from San Juan ►

CHEMISTRY International

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

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From the Editor

This year is a turning point in IUPAC history, which is reflected in the composition of this year's Bureau—the responsible body directly below the Council. For the first time, the Bureau counts eight women among its members, the greatest number of women on record: three elected members (out of 10), three Division presidents (out of eight), one standing committee chair (out of three), plus the Union's past president (i.e., one officer out of five).

This surely is a nice coincidence, with the efforts put forth in 2011 during the International Year of Chemistry to celebrate the contributions of women in science worldwide. For IUPAC, this is a long-overdue transformation. Who knows, we may remember it as a legacy of IYC. In this very column, in July 2005, I marveled that IUPAC had not had a woman president yet, and at that point in its history only a couple of division presidents had been women. While, admittedly, IUPAC is not setting a trend, it is rather pleasing to see that this is a development broadly experienced in chemistry communities worldwide.

With this new year, IUPAC enters a new biennium in which the baton will be passed to new officers who will, invariably, set the sails in new directions while safeguarding the course of ongoing projects. In the following pages, President Kazuyuki Tatsumi presents his views of the Union and the tasks before him. Then, on page 12 one can browse the first series of committee and division reports following their most recent meeting at the 2011 General Assembly in San Juan.

Despite what is planned and written, a new year is symbolically an opportunity to innovate and to question the establishment. With four goals clearly set by the president—coping with the world's needs, increasing IUPAC visibility and relevance, reforming IUPAC, and planning for the future—the opportunities are plentiful for volunteers to come forward, step in, and contribute. So, may this year be the year you voice your idea!

Wishing you all the best for 2012.

Fabienne Meyers
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Cover: Triple quadrupole mass spectrometer used for liquid chromatography isotope dilution mass spectrometry (image supplied by LGC, courtesy of Andrew Brookes, www.abstill.co.uk). See the feature "Making Measurement Matter" on page 4.

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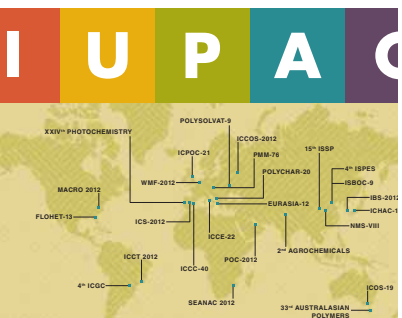

Planning for the Future of IUPAC Based on the Success of IYC2011

by Kazuyuki Tatsumi

The International Year of Chemistry 2011 has been an immense success. This owes much to the initial strategy planning led by Peter Mahaffy, the efforts of the IYC Management Committee headed by John Malin, and the leadership of successive IUPAC Presidents Bryan Henry, Jung-Il Jin, and Nicole Moreau, along with Secretary General David Black and Treasurer John Corish. It goes without saying that the success is also due to many devoted and active IUPAC members, to name quite a few, who were involved with the planning and execution of events and activities. The Global Water Experiments and the IYC competitions such as "Chemistry Cartoons," "A World without Polymers," and "Global Stamps," which were featured in *Chemistry International (Nov-Dec 2011)*, are typical examples.

An important aspect of IYC2011 is that it has drawn the attention of chemists and young people worldwide. According to the IYC website, 170 countries/regions have participated in IYC activities, and over 8800 individuals have registered on the IYC network. In addition to the three Cornerstone Events, around 1400 activities have been listed on the IYC web; inclusion of IYC programs independently organized by the chemical societies of the world would more than double this number. It should be emphasized that more than 100 countries/regions, which do not have NAO or ANAO recognition by IUPAC, have taken part in these activities, and that some of them have established their own official IYC websites, which show vitality and enthusiasm. These include Andorra, Columbia, Costa Rica, Ecuador, Gabon, Guatemala, Haiti, Iceland, Latvia, Lebanon, Morocco, Oman, Paraguay, Peru, Syrian Arab Republic, and Venezuela. The participation of these non-NAO organizations is an encouraging sign for the future of IUPAC because it elevates the visibility of chemistry and the reputation of the Union. It also strengthens the link between IUPAC and chemical communities worldwide, as well as providing opportunities for increasing the Union's membership.

Although IYC2011 came to an official end at the closing ceremony in Brussels in early December, IYC activities will still continue into 2012. And the enthusiasm of chemists about IYC2011 and the momentum of IUPAC as a world-leading organization should be maintained, and enhanced. Thus, the overarching theme for my presidential term will be "to pave the way to carry over the momentum created by IYC2011 to the next step."

Based on my two previous columns as vice president (Nov-Dec 2010 and Jul-Aug 2011 *CI*), I presented my Vice President's Critical Assessments at the IUPAC Council Meeting in San Juan, Puerto Rico. I feel we have four important missions, which need immediate action.

Coping with the World's Needs

There is no question that the power of chemistry is a prerequisite for a sustainable solution to human health and environmental problems. Therefore, IUPAC should respond promptly and properly to these global interests and urgent necessities, and I am confident that IUPAC will be able to do it, with the cooperation of ICSU, UNESCO, and other UN agencies.

Increasing Visibility and Relevance of IUPAC

The importance of IUPAC activities ought to be recognized widely. In this regard, we should target three specific areas, namely the leading chemical circles, chemical communities in emerging countries, and the general public. In addition, I wish to develop even closer ties between IUPAC and the International Organization of the Chemistry Olympiads.

Reforming IUPAC

Both Chemistry as a scientific discipline and IUPAC as an international union are facing challenges. The key issue for us is to continue to make innovative changes to the IUPAC structure as well as its relationship with chemistry communities. Furthermore, we must aim at augmenting participation and increasing the number of National Adhering Organizations.

Planning for the Future

We must continue to address the current needs of the world community through the development of

Chemistry. IUPAC will soon be looking forward to its Centennial Celebration in 2019. It is not too early to start planning now for the 100th anniversary of IUPAC, which will provide us with a very specific landmark and a wonderful opportunity to celebrate the role of IUPAC in the achievements of chemistry.

In conjunction with the above key issues, IUPAC should obtain NGO status from the United Nations as quickly as possible. We should also update the existing *History of IUPAC* from 1999 to the centenary year. And, let's target the aforementioned aim of increasing membership and reaching 100 NAOs by our centennial in 2019.

During the IUPAC General Assembly held last year in San Juan, I visited division and committee meetings. It was quite encouraging for me to witness the enthusiasm of our expert members in planning and conducting various challenging projects. This is where the activities of IUPAC really come from. We have seen recent reforms to IUPAC structures, functions, and governance, which have improved operational efficiency. Now we must work to encourage the positive attitude, enthusiasm, and devotion of our members toward IUPAC activities. My intention as president is to continue to promote reforms while maintaining a positive and harmonious atmosphere in which we may take pride in working together for IUPAC.

I am very much looking forward to working with all the IUPAC members in the next biennium, targeting our centennial celebration in 2019. Any advice or ideas are very welcome, either from the IUPAC body or other groups.

Kazuyuki Tatsumi's <i45100a@nucc.cc.nagoya-u.ac.jp> term as president of IUPAC began on 1 January 2012. Previously, he served as vice president of IUPAC and vice president and president of the Inorganic Chemistry Division. Tatsumi is a professor at Nagoya University and is a member of the Science Council of Japan (NAO for Japan).

IUPAC strives to become the global leader in advancing knowledge and understanding of chemistry worldwide. Over the next decade IUPAC will continue its effort to increase membership by building partnerships among scientists around the world. Our goal is to celebrate IUPAC's centennial in 2019 with a truly global membership base of at least 100 countries. Best wishes for a happy and successful 2012 from the IUPAC Officers and Secretariat!

How Do You Know Your Results Measure Up?

by Gavin O'Connor and Louise Dean

Measurement affects almost every aspect of our daily lives, from the fuel in our cars and the quality of the air we breathe, to the safety of our food, water, healthcare, and our cosmetic products. Chemical and bioanalytical measurements in particular underpin the enforcement of regulations. Every day, thousands of chemical measurements support decisions on food safety, health, and environmental protection. It is therefore critical that organizations producing or using measurement data have confidence in the results obtained.

Today's global economy highlights more than ever the need, both nationally and internationally, for confidence in measurement results. A key step in achieving this is to ensure that results can be related to suitable, internationally recognized references. "Metrological traceability"[1] is the property of a measurement result whereby the result can be related to a recognized reference through a documented unbroken chain of calibrations, each contributing to the measurement uncertainty.[2] To enable comparison of measurement results over time and distance it is often beneficial for the reference to be a base unit of the International System of Units (SI). The availability of suitable measurement standards for calibration is fundamental to ensuring traceable results.

Figure 1: Traceability Chain Linking a Laboratory Result to the Definition of a Measurement Unit.

The international infrastructure for measurement was initially developed for physical measurements of quantities such as mass and length. Primary international and national measurement standards exist which are used as the references on which to base the traceability of measurement results. We take for granted that items can be weighed accurately, or that we can find out the time anywhere in the world. In the physical model, traceability is achieved by comparisons or calibrations which lead directly to a defined unit, for example, the international prototype kilogram. Figure 1 shows a schematic of a "traceability chain" linking a laboratory result to the definition of a measurement unit. A similar infrastructure has been developed for chemical measurements, but the situation is often more complex than that for physical measurements.

Chemical measurements encompass a vast number of elements and compounds in a diverse range of sample types. There is therefore a requirement for a wide range of different measurement standards[2] to be able to establish the traceability of chemical measurements. In addition, to be able to measure the amount of a particular chemical entity, test samples often require significant pre-treatment to separate the analyte(s) of interest from the sample matrix. Measurement procedures used in chemical analysis are therefore frequently multistage, each measurement step potentially introducing factors which could influence the result. Chemical measurements may therefore involve a number of measurement standards for physical quantities such as mass and volume, and certified reference materials for establishing the traceability of amount of substance.

A certified reference material is a material of known homogeneity and stability and is accompanied by documentation providing one or more specified property values with associated uncertainties which have been obtained using reference measurement procedures.[2] In chemistry, these materials are typically classified as either pure substances (which can be used for the preparation of calibration solutions) or matrix materials (used, for example, to evaluate measurement bias as part of method validation). It is imperative that laboratories have access to well characterized matrix reference materials that are a good match to real test samples. One of the reasons why such materials are so sought after for chemical measurements is that the

sample matrix often has a significant effect on method performance.

The National Measurement Institutes (NMIs) around the world develop and maintain national measurement standards. LGC, the UK's designated NMI for chemical and bioanalytical measurement, supports the measurement infrastructure in the UK by producing reference materials that enable other laboratories to ensure the traceability of their chemical and biological measurement results through instrument calibration and method validation. At the heart of the measurement infrastructure is the ability of the NMIs to characterize the amount of substance for well-defined measurands[2] (analytes) using reference measurement procedures that can provide measurement results deemed fit for purpose with a direct and unbroken link to a base unit of the SI.

Exact Matching Isotope Dilution Mass Spectrometry, a "higher order" reference measurement procedure, is an iterative process for providing measurement results with an unbroken traceability chain to the SI. Here, certified reference materials go some way to fulfilling the role of primary standards in the metrological framework. The huge variation in potential matrices and measurand concentration levels mean that there is no shortage of need for new reference materials.

Measurement Challenges Facing the Clinical Sector

Although traceability in chemical and physical measurement is well established, the biological measurement field is at a much earlier stage in its development, and clinical measurements in particular present their own set of unique problems. Poor-quality clinical measurements can lead to misdiagnosis or incorrect prescription of medicine for patients. It is therefore essential that certified reference materials are available for manufacturers to establish the traceability of values assigned to calibrators supplied with diagnostic equipment, and for medical and clinical laboratories to validate their methods. The *In Vitro Diagnostic Medical Devices Directive* (EC IVDD, 98/79/EC) stipulates "the traceability of values assigned to calibrators and/or control materials must be assured through available reference measurement procedures and/or available reference materials of a higher order." This ensures harmonization of standards across Europe, which in turn provides a high level of health protection for patients. It is therefore necessary that high-accuracy, low-uncertainty reference materials are produced to satisfy the objectives of the directive. At present, the number of IVD devices and potential measurands vastly exceeds the number of higher-order reference materials available. The NMIs are now addressing this problem by developing such materials to help IVDD compliance. However, it is not unusual for different analytical platforms, calibrated using different reference materials, to be used for the same measurand. There is therefore a need across the clinical community for commutable reference materials that ensure traceable measurement results, independent of the analytical platform used.

The following examples demonstrate how LGC is supporting the clinical sector in ensuring sound measurement practice to underpin clinical efficacy, quality assurance, and patient safety.

IYC Activity at LGC

LGC played its part in helping to celebrate the International Year of Chemistry 2011 by highlighting the achievements of chemistry and its contributions to the well-being of humankind.

From hosting an open evening, during which interested members of the public were invited into the laboratories at its London based headquarters, to writing articles for the general scientific press and generating an online blog, LGC has spent 2011 spreading the word of chemistry to old and young, professional and non-professional alike.

IYC 2011
International Year of CHEMISTRY

LGC's blog, *LGC Science* provides short, bite-sized articles highlighting how chemistry, in particular chemical measurement, impacts upon our everyday lives. It discusses some of LGC's latest research and demonstrates how the company and its scientists apply their research to ensure "Science for a safer world."

The *LGC Science* blog highlights some of the most exciting research projects, enlightens readers about what goes on behind the scenes in LGC's forensics teams, discusses some of the cases solved through LGC's unique Government Chemist function, and describes cutting edge research from other teams across LGC.

www.chemistry2011.org/participate/activities/show?id=1063

Measurement Traceability for Routine Health Screening

Immunoassays and spectroscopic or enzymatic techniques are highly desirable for high-throughput screening methods due to the high speed and relative low cost of the technology. However, it has been well documented that these routine methods can suffer from interferences that result in measurement bias. In order to reduce the possibility of poor-quality clinical measurements, and to assist manufacturers in satisfying the objectives of the IVDD, LGC has developed a primary ratio measurement procedure,[2] exact matching IDMS, for assigning reference values to a number of certified reference materials for routine health screening. The reference materials, aimed at the clinical sector, cover steroids and therapeutic drugs.

Measurement Traceability for Therapeutic Drug Monitoring

The production of certified reference materials for a therapeutic drug poses different challenges. Many therapeutic drugs have a narrow therapeutic range. The dose given to patients is often regulated by the amount of drug substance circulating in the blood. Therefore, accurate measurement has a direct impact on clinical intervention.

Tacrolimus is an immunosuppressant drug given to patients after an organ transplant. Once an organ is transplanted, a complex therapeutic regimen is undertaken to prevent rejection of the allograft and to allow a foreign body to remain functional within the recipient. Due to the narrow therapeutic range of tacrolimus, routine therapeutic drug monitoring of a patient's blood is essential to prevent acute rejection and ensure long-term survival of both the patient and the allograft.

Tacrolimus is measured by a variety of liquid chromatography mass-spectrometric (LC-MS) and immunoassay-based methods, which are all independently calibrated, but without agreement to a common reference or to an accepted reference method or standard tacrolimus reference material. This means that mass concentration values may not be comparable between methods or laboratories, posing potential risks to patients undergoing therapeutic drug monitoring. In severe cases this can lead to the patient either receiving an insufficient dosage and rejecting the organ, or receiving a high, toxic dose.

This lack of traceability has been identified by medical laboratories and diagnostic kit manufacturers as an issue when trying to achieve consistent measurement comparability and in setting reliable therapeutic levels. In response, researchers from LGC collaborated with manufacturers, proficiency-testing-scheme providers, and clinicians to develop the first commutable, matrix of clinical reference material for tacrolimus in whole blood. This reference material will improve confidence in measurement, irrespective of the analytical platform used and will enable clinicians to set and maintain optimal patient dosage to the benefit of their patients and the healthcare system. Experience gained here is now being translated into the development of a pure and matrix reference material for sirolimus, another immunosuppressant drug particularly used in liver transplants.

Achieving Large Biomolecule Traceability—The Big Challenge

Diagnostic measurement challenges are rapidly progressing from small molecule analytes (e.g., cholesterol and glucose) toward larger, more analytically challenging and complex biomolecules (e.g., protein markers relevant for therapeutic intervention and some disease-state biomarkers). However, development of reference measurement procedures for these complex biomolecules is necessary to enable in vitro diagnostic and clinical measurement comparability. Due to their complexity and large size, achieving metrological traceability to the SI for protein biomarkers is not a trivial task.

In a major step forward, under the European Metrology Research Programme, several NMIs are collaborating to develop an international standardization framework for complex biomolecules. This research is focused on establishing reference measurement procedures capable of providing results that are traceable to the SI in order to generate a more thorough understanding of issues related to measurand description, reference material commutability, and the possible impact of establishing metrological traceability to the SI for protein biomarkers. Human growth hormone was used as a test case to investigate these new approaches.

Human growth hormone (hGH) is widely used in the diagnosis of disorders of children with short stature, management of disorders that lead to nutritional deficiency, and to monitor growth hormone replacement therapy. Therefore, there is a need for reliable and comparable measurements. In order to achieve this, routine measurement results need to be made traceable to a stable reference.

In order to begin to determine the concentration of a protein in serum, such as hGH, the protein was initially "broken down" into peptides. By choosing a number of peptide sequences unique to hGH, and by employing IDMS approaches, the concentration of the protein could then be accurately determined. In this case, the standards used were peptides and the concentration of the standard peptide solutions was determined by amino acid analysis (figure 2). This establishes a firm anchor to the amount of substance of the amino acids, while maintaining specificity to the hGH molecule, hence providing a unbroken link for the measurement results to the SI.

However, small differences in the primary structure of hGH may be expected due to differences in the genetic makeup of the host, such as the person in which the protein resides. These differences may give rise to a different chemical molecule due to the different sequence of amino acids. However, as many proteins are identified by function alone, the generic identity of the protein may remain unaltered. Consideration of this may be needed for the future production of commutable reference materials. In addition, transient changes to a protein's secondary, tertiary, or quaternary structure may affect protein function and disease state. This means that it is not necessarily the total amount of the protein's primary sequence that is important, but the amount of a protein in a particular structure or folding state. Many of the routine measurement methods used for protein biomarkers are immunoassay based where the specific binding of proteins can be structurally dependent. The key challenge for comparability of protein measurement results is not just the "amount of substance," but the "function/activity" of the protein. There is therefore a need to develop an understanding of the effects that protein structure may have on the traceability of measurement results.

Advanced mass spectrometry-based techniques such as hydrogen deuterium exchange experiments and ion mobility coupled to mass spectrometry enable interrogation of protein structure under physiological conditions, thereby providing a measure of the different structural forms of the protein present. Monitoring the rate of exchange of hydrogen atoms present on a protein with deuterium provides information on the structural differences between different preparations of the same protein. Hydrogen atoms on the outside of the protein molecule will have a higher rate of exchange than hydrogen atoms in the protein folds, thereby providing a mechanism by which to follow

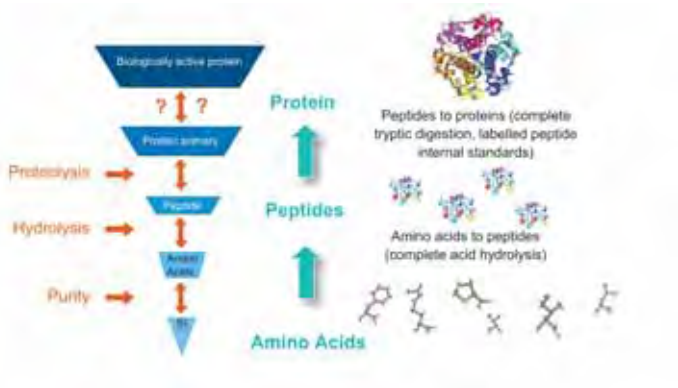

Figure 2: Basic concept of the traceability for protein IDMS methods

structural change. This can be performed in the presence of specified ligands, enabling the determination of binding constants and the degree of activity. Ion mobility separates ions on the basis of collisional cross sections, which enable proteins of the same mass but different folding states to be separated. During the research, a number of different, standard protein preparations of recombinant hGH were investigated. Knowing the difference in protein structures, the relative amounts of these structures, and the interaction of these structural forms with detection antibodies will be an important factor in establishing the suitability of reference materials to standardize measurements.

The ultimate aim of standardization in clinical chemistry is to ensure comparability of routine measurements in order to achieve equivalence between results obtained by different methods. This research demonstrates the first steps towards developing a biometrology framework that aims to encompass both metrological rigor in developing SI traceability and the real concerns of the clinical community that measurements must be relevant and commutable, independent of the analytical platform used.

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www.lgc.co.uk

References

1. Note on terminology. The full term "metrological traceability" is used in international guides and standards to distinguish this concept from other forms of traceability such as traceability of samples, documents, or supply chains. In this article the term "traceability" should be understood as referring only to metrological traceability.
2. ISO/IEC Guide 99-12:207, *International Vocabulary of Metrology*

The Formation of the International Association of Chemical Societies

by Brigitte Van Tiggelen and Danielle Fauque

Under the theme "Chemistry—Our Life, Our Future," the International Year of Chemistry 2011 emphasized that chemistry is a creative science essential to solving many global challenges. Just as important, IYC 2011 was also a celebration of the history of chemistry and its many contributions to the well-being of humankind. Fittingly, the year coincided with two symbolic anniversaries in the history of the science: the centennials of Marie Curie's Nobel prize in chemistry and the founding of the International Association of Chemical Societies (IACS), which was succeeded by IUPAC a few years later.

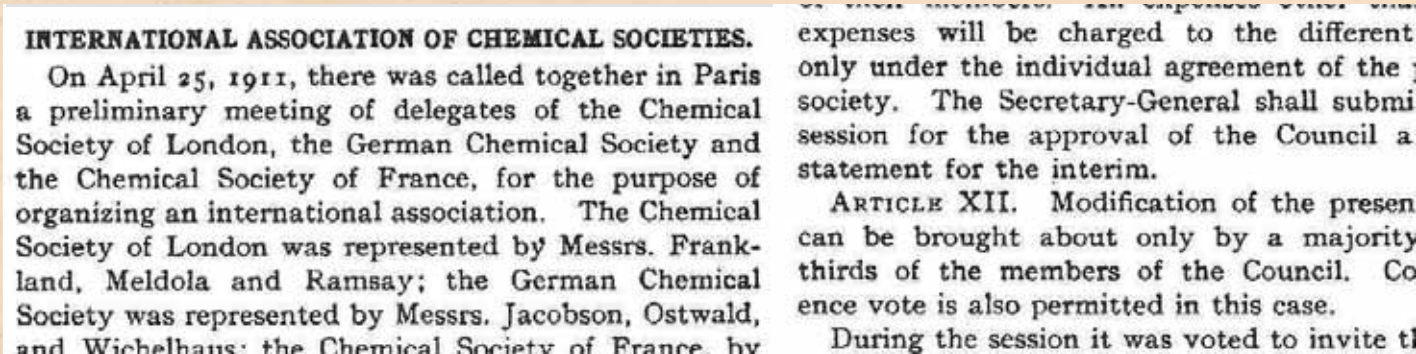
At the end of the 19th century, chemists already had a long record of international gatherings. One such early meeting was the infamous Karlsruhe meeting (see Nov-Dec 2010 *CI*, pp. 10–14). Though chemists were indeed exchanging ideas and undertaking sometimes heated discussions through journals and correspondence, the need for an agreement on writing chemical formulas and using the same scale for atomic weights prompted the young August Kekulé to gather chemists from all over Europe in early September 1860. With the help of his friend Carl Weltzien, and the support of reputed chemists such as Adolphe Wurtz, Robert Bunsen, Carl Fresenius, Jean-Baptiste Dumas, Stanislao Cannizzaro, Lothar Meyer, and Dimitri Mendeleev, Kekulé launched a call for delegates of all countries to gather in Karlsruhe. At that time, he was 31 years old and had been recently appointed professor of chemistry at the University of Ghent in Belgium.

The outcome of the ensuing debates at Karlsruhe surpassed the goal of standardization since during the meeting, the Italian chemist Stanislao Cannizzaro convinced most participants to adopt the fruitful distinction between atoms and molecules that had been suggested by Amadeo Avogadro almost half a century before. This first professional congress of chemistry was followed by a few others occurring on an irregular base and often with international fairs in the following 20 years (1867 in Paris, 1872 in Moscow, 1873 in Vienna, 1876 in Philadelphia, 1878 in Paris, 1880 in Düsseldorf, and 1889 in Paris).

By the end of the 19th century, chemists were attending other kinds of international meetings, such as the Congress of Pure and Applied Chemistry initiated in 1894 by the Belgian Chemical Society, a tradition that has continued to this day under the guidance of IUPAC (see Jul-Aug 2011 *CI*, pp. 11–14). They also attended more general meetings like those organized on the occasion of a universal exhibition or a world fair. Chemists also participated in regular meetings at the regional and national level, often organized by the national chemical societies, as well as international meetings on specific topics inside the wide domain of chemistry. National chemical societies made it a point of honor to send one or more delegate(s) to those meetings, so as to keep their members informed about advances in the field.

It is on such an occasion, in September 1910, that a French chemist, Albin Haller, then president of the Société Chimique de France, took part in a meeting of the Société Suisse de Chimie (Switzerland) and came up with the idea of an international association of chemistry. The concept was met with enthusiasm by Wilhelm Ostwald with whom Haller discussed the idea. Before sending an open call to all chemical societies to join, Haller wanted to secure the official support of two of the most important countries in chemistry at that time: Germany and Great-Britain. He contacted

Report of the Foundation of the IACS in The Journal of Industrial and Engineering Chemistry (August 1911, p. 614): Statutes and Decision of the American Chemical Society to join (see full page online at www.iupac.org/publications/ci/2012/3401/1_vantiggelen.html).



INTERNATIONAL ASSOCIATION OF CHEMICAL SOCIETIES.

On April 25, 1911, there was called together in Paris a preliminary meeting of delegates of the Chemical Society of London, the German Chemical Society and the Chemical Society of France, for the purpose of organizing an international association. The Chemical Society of London was represented by Messrs. Frankland, Meldola and Ramsay; the German Chemical Society was represented by Messrs. Jacobson, Ostwald,

expenses will be charged to the different
only under the individual agreement of the
society. The Secretary-General shall submi
session for the approval of the Council a
statement for the interim.

ARTICLE XII. Modification of the presen
can be brought about only by a majority
thirds of the members of the Council. Co
ence vote is also permitted in this case.

During the session it was voted to invite t

	Date of entry.	Number of members.
Deutsche Chemische Gesellschaft	April 25, 1911	3356
The Chemical Society (London)	April 25, 1911	3202
Verein Österreichischer Chemiker	October 28, 1911	1050
Société Chimique de Belgique	August 6, 1913	510
Kemisk Forening, Kjöbenhavn	January 23, 1912	155
Sociedad Española di Fisica y Quimica	April 10, 1912	353
American Chemical Society	October 6, 1911	6091
Société Chimique de France	April 25, 1911	1023
Nederlandsche Chemische Vereeniging	July 14, 1911	515
Società Chimica Italiana	January 11, 1912	654
Tokyo Chemical Society	March 18, 1912	567
Polyteknisk Forenings Kemikergruppe, Kristiania	October 27, 1911	125
Russian Chemical Society	October 22, 1911	410
Schweizerische Chemische Gesellschaft	August 3, 1911	367
The following Societies, not represented on the Council, each sent one delegate in an advisory capacity only to the meetings in Brussels, September, 1913.		
Deutsche Bunsen Gesellschaft für Angewandte Physikalische Chemie	June 19, 1911	777
The Faraday Society (London)	April 30, 1912	202
Société de Chimie Physique	June 15, 1911	225
		19,582

List of Affiliated Societies in 1913, as published in Journal of the American Chemical Society (36, 1914), p. 83.

the respective chemical societies with his plan for the formation of an International Committee that would consider questions of nomenclature and other matters in order to facilitate the comprehension of chemical literature. To IUPAC members this must sound familiar!

Following an enthusiastic response from London and Berlin, the French chemical society organized a first meeting on 25–26 April 1911 in Paris. At the meeting, attendees agreed upon the statutes for organizing the new association: each country would be represented by a society of pure chemistry or physical chemistry, and the number of delegates would be kept small. The goals, they decided, would be the unification of chemical nomenclature and the notations for chemical and physical constants. Following the official founding on 25 April, the attendees agreed to focus first on standardizing the nomenclature of inorganic chemistry, atomic weights (in collaboration with the International Committee of Atomic Weights), and symbols for physical constants. In addition, they discussed a system for gathering summaries of all chemistry papers, and ways to standardize publications to avoid the repetition of papers.

The next meeting of the International Association of Chemical Societies took place 13 April 1912 in Berlin under the presidency of Wilhelm Ostwald. Delegates from Russia, Italy, the Netherlands and the USA joined their peers from UK, France, and Germany agreed that the next course of action for the association would be the creation of international commissions that would study and decide upon matters of chemical nomenclature (organic and inorganic). It was also decided that the funding for this new international institution would be provided by the member societies.

Their was widespread agreement about the need for standardization, be it the size of publications, matters of notation, standard atomic weights, and chemical formulas, but when it came to making and enforcing these decisions, it was another matter. For example, delegates to the Berlin meeting agreed that the international format for journals should be 16 x 22,6 (cm x cm). But in November 1912, after much discussion, it was decided not to publish using this format, for reasons of cost.

Despite early optimism, delegates came to realize that the Promethean work (and its costs) of the new association could not be shouldered by the national societies alone. In early 1913, the lingering problem of funding seems to receive a solution. A conversation between Haller and the Belgium entrepreneur Ernest Solvay gave hope for the Future: the rich entrepreneur wanted to help fund the IACS, starting with 250 000 francs, to be followed by 55 000 francs every year for 29 years provided that the association held all its meetings in Brussels.

. . . delegates came to realize that the Promethean work (and its costs) of the new association could not be shouldered by the national societies alone.

Plans had already been made for the third congress to be held in London in September 1913, but Solvay was very clear that he wanted to host the IACS meeting and have it coincide with other anniversaries he intended to celebrate with splendor: 50 years since the founding of his company (Solvay et Cie) and a golden milestones in his own marriage. Haller was quite happy with Brussels, unlike Ostwald who would have preferred Berne or Geneva.

Group picture of the IACS meeting, 19–23 September 1913, also considered to be the first Conseil de Chimie Solvay. This is the first group picture of the IACS on record.

However, the prospect of such generous funding was impossible to turn down. Thus, early in 1913, plans were made for the next meeting to take place in Brussels in 1913 and for an International Institute of Chemistry to be established there.

In spite of these early hopes, the IACS was short lived. The 1914 meeting never took place because of the war. And science that had been celebrated as an international venture whose benefits could be evenly shared by all nations suddenly became a national or patriotic pursuit. And the use of chemical weapons demonstrated the disturbing behavior of some chemists, behavior which manifested how scientists could be as impure as their science. Pure chemistry wasn't that pure after all, since its achievements could lead one nation to victory and the other to submission.

And science that had been celebrated as an international venture whose benefits could be evenly shared by all nations suddenly became a national or patriotic pursuit.

What the first world war definitely demonstrated was the power of the German chemical industry, and how much national independence would not only rely on politics and economics but also on technology, of which chemistry was an essential part. For these reasons, the future the IACS was questioned as early as 1917.

Though IACS can be considered the forerunner of IUPAC, there are a few differences that should be stressed. The most striking is the fact that the International Association focused exclusively on PURE chemistry, whereas IUPAC, as its initials suggest, is also focused on applied chemistry. Clearly, IACS's aim was to organize and standardize chemistry so as to facilitate communication and the exchange of information and results. By encouraging networking at an international level, scientists, and especially chemists, were convinced they were serving the progress of science and humanity. But this noble aim wasn't exempt from competition or even rivalry.

The rhetoric of internationalism at the turn of the century should not be interpreted as a spirit of total cooperation. Instead, what occurred was "Olympic internationalism," as Paul Forman has labeled this behavior, in which nations attempt to promote international fraternization and national pride at the same time. Thus, it is no wonder that during periods of acute conflict, such as the First World War, national rivalries that had been

kept within the boundaries of gentlemanly competition, could turn into strong nationalism. This attitude, though not common, culminated in the *Aufruf an die Kulturwelt*, also known as the *Manifesto of the Ninety-Three*, because it was signed by 93 intellectuals and eminent scientists, including Fritz Haber, Adolf von Baeyer, Max Planck, Paul Erhlich, Wilhelm Röntgen, Hermann Emil Fischer, Wilhelm Ostwald, Walther Nernst, Richard Willstätter, Wilhelm Wien, and Felix Klein. In this short proclamation, they declared their total support of German military action at the beginning of World War I and denied any "war crimes" that were blamed on the German army such as the killing of civilians or needless destruction like the burning of the library at the University of Louvain.

Foreign intellectuals and scientists were outraged and this feeling persisted for many years after the war ended. At the same time, the Bureau of the IACS, after having conferred with its member societies decided that it would be impossible to resume fruitful collaboration with representatives of chemical societies of the allies and chemical societies of the central powers. IACS gave the money back to Solvay and disbanded the short-lived dream of international chemical collaboration and standardization. On 28 July 1919, a new international organization, the International Union of Pure and Applied Chemistry, was formed, which, in its statutes approved that day, excluded the former enemy countries, including Germany, which had been the leader in chemistry at that time. It wasn't clear how easily neutral countries would be accepted into this new confederation, but by 1925, politics had moved on, and following the Locarno treatises, scientific collaboration was able to resume. At last, the universal character that had been at the core of the IACS had returned.

Society	*Delegates*	*Number of members*
With voting rights		
American Chemical Society	H.R. Moody, W.A. Noyes, J.D. Pennock	6091
Chemical Society (London)	A.W. Crossley, P.F. Frankland, W. Ramsay	3202
Deutsche Chemische Gesellschaft	P. Jacobson, W. Ostwald, O.N. Witt	3356
Nederlandsche Chemische Vereenigung	E.J. Cohen, A.F. Holleman S. Hoogewerff	515
Kemisk Forening, Kjöbenhavn	E. Biilmann, N. Bjerrum, J. Petersen	155
Polyteknisk Forenings Kemikergruppe, Kristiana	A. Aubert, H. Goldschmidt, C.N. Riiber	125
Russian Chemical Society	N.S. Kurnakow, L.A. Tschugaeff, P.J. Walden	410
Schweizerische Chemische Gesellschaft	F. Fichter, P.A. Guye, A. Werner	367
Sociedad Española de Física y Química	J. Casares, E. Hauser, J.R. Mourelo	353
Società Chimica Italiana	A. Menozzi, A. Oglialoro, E. Paternò	654
Société Chimique de Belgique	L. Crismer, H. Van Laer, J. Wauters	510
Société Chimique de France	A. Béhal, A. Haller, M. Hanriot	1023
Tokyo Chemical Society	N. Nagai, J. Sakurai, T. Takamatsu	567
Verein Osterreicher Chemiker	G. Goldschmidt, L. Marchlewski, R. Wegschneider	1050
Without voting rights		
Deutsche Bunsengellschaft	F. Auerbach	777
Faraday Society	T.M. Lowry	202
Société de Chimie Physique	C. Marie	225

Membership and Delegates of the the affiliated societies to the IACS in 1913 (from R. Fennell, History of IUPAC, 1919-1987, p. 10)

Dr. Brigitte Van Tiggelen <vantiggelen@memosciences.be> is research associate at Université catholique de Louvain, Louvain-la-neuve, Belgium and leads Mémosciences, a non-profit organization devoted to the history of sciences. Dr. Danielle Fauque <danielle.fauque@u-psud.fr> is reasearch associate at Université de Paris-Sud 11 (Orsay, France) and chairs the Club d'histoire de la chimie, which is the historical division of the Société Chimique de France.

Notes, References, and Further Reading

- 2011 also marks the centenary of the first Solvay Conference in Physics, which gathered eminent scientists such as Albert Einstein, Henri Poincaré, Marie Curie, Pierre Langevin, Walther Nernst, Jean Perrin, Arnold Sommerfeld, Max Planck among other well-known names to discuss the new theories of radiation and quantas. This "Witches' Sabbath" as Einstein called it became a milestone in the history of modern physics as it raised awareness for the quantum physics.
- Danielle Fauque, *French Chemists and the International Reorganisation of Chemistry after World War I*, in *Ambix*, vol. 58-2 (July 2011), pp. 116–135.
- *Fondation de l'Association internationale des sociétés chimiques (AISC) à Paris*, www.societechimiquedefrance.fr/produit-du-jour/de-l-aisc-a-l-iupac.html
- Roger W. Fennell, *History of IUPAC 1919–1987*, Oxford: Blackwell Science, 1994.
- Geert J. Somsen, *A History of Universalism: Conceptions of the Internationality of Science, 1750–1950*, in *Minerva*, vol. 46 (2008), pp 361–379. www.springerlink.com/content/3r44072845r87p78/ (free access)
- Brigitte Van Tiggelen, *Les Premiers Conseil de chimie Solvay (1922-1928). Entre ingérence et collaboration, les nouvelles relations de la physique et de la chimie*, in Chimie Nouvelle, vol. 17 – n° 68 (December 1999), pp. 3015–3018.

A follow-up feature will appear in the next issue that will cover The Solvay Councils and the International Institute for Chemistry.

Reports from San Juan

A substantial amount of the General Assembly in San Juan was devoted to division and standing committee meetings, each of which spanned two days. Following are brief accounts of some of these meetings (part two will appear in the next issue). Prior to the GA, all divisions and standing committees provided a written report that is part of the Council Agenda book available online.

Chemistry and Industry

by Michael Droescher, committee chair

The highest priority for the Committee on Chemistry and Industry (COCI) in 2011 was the International Year of Chemistry. The World Chemical Leadership Meeting at the General Assembly in San Juan was a very successful example of COCI's involvement in IYC. In the plenary session and in the breakouts of the WCLM, the contribution of chemistry toward solving future challenges was well presented and discussed. From this iniative, IUPAC's contribution to the Rio+20 process is being developed. COCI also helped in the establishment of the Global Water Experiment, a key component of IYC.

In 2011, COCI introduced a new biannual science award, the IUPAC-ThalesNano Award for Flow Chemistry (see Nov-Dec 2011 *CI*, p. 30). The award was established in the context of COCI's goal of helping IUPAC increase the participation of scientists in industry. The prize, which includes USD 7500, is to be awarded to an internationally recognized scientist whose activities or published accounts have made an outstanding contribution in the field of flow chemistry in academia or industry. The prize is sponsored by the Hungarian ThalesNano Company, which has agreed to sponsor it for 5 times in the next 10 years.

In order to develop and maintain an active program to recruit, guide, and inform Company Associates, the industrial workshop series will be continued. After Germany in 2008, Japan in 2009, and Kuwait in 2010, the next workshop with Company Associates and trade associations is being planned for Toronto in June 2012 (see Where 2B & Y, p. 36). These workshops develop and deepen the liaisons with national and international associations that represent chemical industries, chemical societies, and international bodies involved in scientific and industrial development.

COCI is supporting projects that share best practices globally. Thus, COCI supports the development of a Life Cycle Assessment project in IUPAC and seeks partners across the IUPAC organization. COCI also contributes to activities from other IUPAC bodies, such as the CHEMRAWN conferences.

The traditional COCI family dinner, held in Old San Juan, included Young Observers, Safety Training Program fellows, members from other IUPAC divisions, and other friends.

A strong pillar of COCI activities is capacity building. Results from the long-established Safety Training Program were presented at the IUPAC Congress in San Juan.

In the context of public appreciation of chemistry, Responsible Care is an important building stone. COCI has published papers on its history and a major case study and supports educational workshops for postgraduate students. A second case study has been commissioned.

Physical and Biophysical Chemistry

by Jim McQuillan, division president

The division committee met over two days during the General Assembly at San Juan with its principal business being the review of existing divisional projects and consideration of potential new projects. The division has 21 current projects and participates in 7 projects with other divisions and committees. The meeting was attended by almost all of the titular

members along with Robert Hinde of the Commission on Physicochemical Symbols, Terminology, and Units, and Young Observers Maria Quintana from Peru and Anatoly Kolomeisky from USA.

A highlight for 2011 was the divisional activities for IYC, which included a Student Chemistry Cartoon Competition and Student Physical Chemistry Competition. The cartoon competition attracted 63 entries from high school, undergraduate, and postgraduate students in 8 countries. On 1 August, Jessica Hough of Valley Central High School, Montgomery, New York, USA, was awarded first prize in the Chemistry Cartoon Competition at a ceremony held in the Exhibition Hall of the IUPAC Congress in San Juan. Other winning entries in the contest were on display in the exhibit hall during the Congress. (See article in Nov-Dec 2011 *CI*, page 22.)

The winner of the video competition, Yordan Darachiev of Kotel, Bulgaria, was congratulated by "Skype meeting" during the committee meeting. These activities have stimulated the division to consider mounting an annual student physical chemistry cartoon competition to enhance its identity.

The Green Book and its revision is the foremost divisional activity and is primarily the task of the Commission on Physicochemical Symbols, Terminology, and Units under its chair Roberto Marquardt. A translation of the 3rd edition (2007) of the Green Book has now been published in Japanese, with French, Italian, and Portuguese versions due to appear in the coming years. An abridged student version of the Green Book is also well advanced.

The critically-evaluated gas kinetics database maintained at Cambridge, with input from a sustained series of divisional projects, plays a valuable role in climate-simulation schemes. The site receives up to 1000 visits a week, testimony to its significance. Michel Rossi has been a key link in IUPAC's contribution to this compilation of climate-related resources.

Adsorption of gases has been the subject of another sustained series of division I projects built on the most highly cited article from *Pure and Applied Chemistry* (*PAC* 1985, 57, 603). It is notable that Jean Rouquérol and Kenneth Sing have been members of four project task groups including one nearing completion.

It has been noted that the generation of new projects relies largely on the vestiges of the old IUPAC Commission structure and that maintaining links to these sectional groups is likely to be more productive than having expectations of the reformed IUPAC divisional structure.

In 2012, Kaoru Yamanouchi stepped in as the new division president, Roberto Marquardt became vice president, and Angela K. Wilson succeeded Marquardt as division secretary.

IUPAC Green Book Pull-Out

In July 2011, the Physical and Biophysical Chemistry Division published a four-page pull-out in *Chemistry International* based on *A Concise Summary of Quantities, Units, and Symbols in Physical Chemistry*. This version of the so-called Green Book was prepared by Jurgen Stohner and Martin Quack.

iupac.org/web/ins/110-2-81

Polymer

by Michael Hess, division secretary

The Polymer Division met in San Juan, Puerto Rico, on 29–30 July 2011. The meeting was conducted by Division President Christopher Ober (Cornell University, USA), whose term as president ended with the year 2011, and Michael Buback (University of Göttingen, Germany) who became president in 2012. Greg Russell (University of Christchurch, New Zealand) will be the next vice president. There were 43 participants from more than 20 countries, and several young scientists and observers.

The Polymer Division works to identify trends and challenges in polymer chemistry and related areas of materials science in order to provide an early spotlight on current developments and to respond to the question of what is needed from polymer science and education in the 21st century. Strategic conferences such as those supported by the polymer division can be a helpful tool.

The division is increasing its efforts to get young scientists and more members from industry involved in its work through the activities of the division subcommittees. In particular, the division will increase its efforts to magnify the impact of the IUPAC mission by fostering the visibility of its work to both the scientific community and the general public by selected use of modern information technologies. The proper

Former Division President Chris Ober, with the winner of the video contest, Yvonne Cho Shuen Lan.

use of IUPAC Terminology and Nomenclature in journals and textbooks remains another focus of the division (in cooperation with Division VIII). Projects are in progress that will provide fast-and-easy access and early support for authors and editors.

As part of its efforts to reach out to the public and the chemistry community, the division—particularly its Subcommittee on Polymer Education—has been involved in several projects related to IYC. A video and essay contest called "A World without Polymers?" was held this year and three essays and three videos from Asia, Africa, North America, and Europe were selected as winners. Yvonne Choo Shuen Lann from Malaysia attended the Congress in San Juan to accept her first-place prize. (See article in Nov-Dec 2011 *CI*, page 24.) Each winner will receive a copy of *Chemistry International* and the division's Purple Book, courtesy of the Royal Society of Chemistry.

The division also worked with the Committee on Chemical Research Funding to hold a funding call supported by seven countries in Europe and the Americas to provide roughly USD 7 million in research support over the next three years. Other activities include a web-based multilingual glossary of polymer terminology and the sponsorship of a series of polymer conferences throughout the world over the course of IYC 2011.

Polymer Conferences

At the IUPAC Congress in San Juan, the Polymer Division contributed two sessions: "Tailored Polymers by Precision Chain Polymerization," organized by M. Sawamoto (Japan) and G. Moad (Australia), and the "Polymer Chemistry Symposium–Young Polymer Chemists," organized by Chris Ober (USA), T. Emrick (USA), and D. Smith (USA).

The Polymer Division granted IUPAC sponsorship to 21 conferences held between 2010 and the end of October 2011 covering almost every aspect of polymer chemistry and resulting in about 1580 printed pages in *Macromolecular Symposia*.

Division Organization

At the present time the division is formed from six subcommittees:

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

As a result of the elections that were conducted during the last year there are a few changes in the division's membership. Dick Dijkstra (Germany), Roger Hiorns (France), Przemyslav Kubisa (Poland), Graeme Moad (Australia), Werner Mormann (Germany), and Dennis Smith (USA) were elected as titular members. Jiasong He (China), Igor Lacik (Slovakia), Mitsuo Sawamoto (Japan), Yusuf Yagci (Turkey), and Majda Zigon (Slovenia) were elected as associate members. Greg Russell (New Zealand) was elected as incoming division vice president and Michael Hess (Germany)

Attendees of the Polymer Division Meeting 2011, San Juan, Puerto Rico.

was re-elected as division secretary. National representatives for the biennium 2012–213 are Mubarak Ahmed Khan (Bangladesh), Nevenka Monolova (Bulgaria), Jiri Vohlidal (Czech Republic), Shlomo Margel (Israel), Mario Malinconio (Italy), Joon-Soep Kim (Republic of Korea), M. Ilyas Sarwar (Pakistan), Aziz M. Muzafarov (Russia), Gaspar Mhinzi (Tanzania), and Voravee P. Hoven (Thailand).

The next meeting of the division is scheduled for just before the IUPAC World Polymer Congress in June 2012 in Blacksburg, Virginia, USA.

ChemRAWN Chair Leiv Sydnes (center) talks with COCI Chair Michael Droescher (left) and René Deplanque, later elected Secretary General.

ChemRAWN—CHEMical Research Applied to World Needs

by Gary vanLoon, committee secretary

The ChemRAWN Committee met for two days at the IUPAC Congress in San Juan. Twelve members from five continents, along with a number of observers, including two Young Observers, took part in a lively meeting under the chairmanship of Leiv Sydnes. The committee welcomed a new titular member, Nadia Kandile from Egypt (term begins in 2012) and look forward to additional associate members and national representatives in the near future. Nominations for these national representatives have been solicited and the committee has received a good response from several of our member countries.

The most immediate activity of the committee is the ChemRAWN XIX Conference on Bioenergy and Biomaterials from Renewable Resources, held 27–29 September 2011 in Kuala Lumpur. Ting-Kueh Soon chaired this event, which included approximately 70 papers, mostly oral, on biorefining and biofuels with an emphasis on biodiesel. The conference focused on using biomass in ways that do not impinge on world food requirements or adversely affect the environment. As is always the case, a Future Actions Committee has been established to develop follow-up activities from the meeting.

Among the conference topics under consideration for the coming years, are the following:

- Herbal Medicines—Issues would include definitions, testing protocols, quality assurance, safety, role of standard pharmaceutical companies, intellectual property issues, relations between local suppliers and commercial companies, and export issues.
- Water—Interest in the subject of water in the Middle East arises out of earlier Malta meetings, but would also include a wider focus, especially on water treatment technologies.
- Green Catalysis—The theme would be to discuss technologies that can simultaneously improve both the economy and the environment of a country. This subject would be built on IUPAC concepts of what is meant by green chemistry and would take a life-cycle approach.
- Medical diagnostic technologies for resource-limited countries—This would be a sequel to a similar conference held in the USA about three years ago. The rationale was that such technologies could be highly beneficial in that they require minimal infrastructure and are low cost.
- Solid-waste management—The kinds of waste would include both municipal urban and industrial wastes and possibly also agricultural waste. Where appropriate, methods for transforming waste into value-added products would be examined.

Each of these potential meetings is chaired by a ChemRAWN member or supporter and in all cases, liaison possibilities with other IUPAC committees are being investigated. Final decisions regarding which meetings will proceed will be made at subsequent meetings of the committee.

Chemistry and Human Health

by Doug Templeton, division president

The Division of Chemistry and Human Health met during the General Assembly in Puerto Rico, with subsequent meetings of the Subcommittees of Medicinal Chemistry and Drug Development, Nomenclature for Properties and Units, and Toxicology and Risk Assessment over the next few days. The division and subcommittees have 25 current projects classified as terms and glossaries, databases, clinical chemistry, drug discovery, and toxicology. Projects have been completed recently in the areas of mechanisms of metal sensitization, glossaries for immunotoxicology and for biomolecular screening, traditional plants as functional foods, and stand-alone drugs. Recent books include *Analog Based Drug Discovery (Part II)*, *Concepts in Toxicology*, and *Practical Studies for Medicinal Chemistry*.

The Chemistry and Human Health Division hard at work in San Juan: John Duffus (left), chair of the Subcommittee on Toxicology and Risk Assessment, and Division President Doug Templeton.

The Subcommittee on Medicinal Chemistry announced the awarding of the 2010 IUPAC-Richter Prize to Professor Arun Ghosh of Purdue University for discovery of the darunavir for use against drug-resistant AIDS and development of new ß-secretase inhibitors for Alzheimer disease, using protein backbone-based structural design. As part of the IYC initiative, the subcommittee produced videos highlighting the importance of medicinal chemistry, including an informative lab tour and discussion with Ghosh held with high school students, and a historical look at drug discovery by Dr. Jan Heeres. The subcommittee hosted a Symposium on Discovery and Development of Drugs during the 43rd IUPAC Congress.

A significant initiative of the Subcommittee on Nomenclature for Properties and Units (NPU) is the harmonization of nomenclature in the clinical laboratory sciences. NPU is a joint task force of IUPAC and the International Federation of Clinical Chemistry and Laboratory Medicine. The NPU database includes about 20 000 entries (system, component, kind-of-property, result), and has been translated into 9 languages. The goal is that other databases LOINC (Logical Observation Identifiers Names and Codes) SNOMED-CT (Systemized Nomenclature of Medicine—Clinical Terminology; owned by IHTSDO) may be mapped to one another, and to NPU. SNOMED would then have access to both systems, which are often more detailed than SNOMED-CT. This would make it possible to bring together and unify data from different terminology sources, and aid in the globalization of transmissible patient medical records.

A major continuing task of the Subcommittee on Toxicology and Risk Assessment is the development of glossaries in toxicology. The *Glossary of Toxicology* has been adapted by the National Library as a module of the toxicology tutorial "ToxLearn," (http://toxlearn.nlm.nih.gov), a joint project of the U.S. Society of Toxicology and the U.S. National Library of Medicine. Part of the work is integrated as an annex in the *Encyclopedia of Toxicology*, and a Chinese translation is being considered. The *Glossary of Terms in Ecotoxicology* was published in 2009 and the *Glossary of Terms in Immunotoxicology* is now being finalized. In the future, the glossaries will be combined into a single online database, and may be expanded with further subspecialties. The Toxicology in the Classroom project ("Toxiclaro"), chaired by W. Temple, has received tremendous input from the partners in Malaysia. The online-learning program has been designed in a child-friendly way and is appropriate for use in school for children 10–12 years old. It is available on the internet and also as a CD.

We regret the passing of Emeritus Fellow F. William Sunderman Jr. and welcome new Emeritus Fellow Rita Cornelis.

Chemistry Education

by Morton Z. Hoffman, U.S. national representative on CCE

In addition to its voting members, more than 35 guests with wide interests in chemistry education, including Young Observers, participated in the Committee on Chemistry Education's meetings on 31 July and 1 August at the IUPAC General Assembly in San Juan. CCE reviewed its activities (International Year of Chemistry, chemistry education for development, Flying Chemist Program, Young Ambassadors of Chemistry Program), its relationship with other organizations (UNESCO, Federation of African Societies of Chemistry, Federation of Asian Chemical Societies, Chemical Heritage Foundation, International Council for Science, Network for Inter-Asian Chemistry Educators. European Association for Chemical and Molecular Sciences), and its completed, current, considered, and future projects.

The highlights and statistics of the 21st International Conference on Chemical Education (ICCE) in Taiwan in August 2010 as compiled by Mei-Hung Chiu were reviewed, and the details about the 22nd ICCE ("Stimulating Reflection and Catalyzing Change in Chemistry Education"), which will be held in Rome at Università "La Sapienza" on 15–20 July 2012, jointly with the 11th European Conference on Research in Chemical Education, were presented by Michele A. Floriano of the University of Palermo <www.iccecrice2012.org>. A bid to host the 23rd ICCE ("Developing Learning Communities in the Chemical Sciences") in Toronto on 13–18 July 2014, presented by Judith Poë from the University of Toronto, was accepted by CCE <icce2014.org>. A preliminary expression of interest was made by Ting-Kueh Soon, the National Representative of Malaysia, to host the 24th ICCE in that country in 2016. The hope was expressed that ICCE-2018 will be held in Latin America; alternatively, a site in Africa or Europe will be sought.

Peter Mahaffy, 2006–2011 chair of CCE, poses with Michael Wadleigh and his Oscar. Wadleigh, winner of the 1970 Academy Award for Best Documentary, presented "The Homo Sapiens Report: The Future of Humanity" to members of the Committee on Chemistry Education.

The committee recognized the contributions of Titular Members Ram Lamba (Puerto Rico), Lida Schoen (Netherlands), and Natalia Tarasova (Russia), whose lengths of service have ended, rendering them ineligible to serve again in that capacity. Their dedicated contributions were gratefully acknowledged. A Nominating Committee (Lida Schoen, Chair, Eva Åkesson, Choon Do, Morton Hoffman, and Richard Hartshorn) was appointed and proposed the following slate of candidates for the six open Titular Member positions: Jan Apotheker (Netherlands), Nina Aremo (Finland), Suzanne Boniface (New Zealand), Mei-Hung Chiu (Taiwan), Masahiro Kamata (Japan), Tina Overton (United Kingdom), Mustafa Sözbilir (Turkey), and Erica Steenberg (South Africa).

The next meeting of CCE will be in Rome on 15 and 18 July 2012 during the ICCE.

Attendees at the Committee on Chemistry Education meeting held at the 2011 IUPAC General Assembly in San Juan.

Sustainable Energy for All

Energy is central to nearly every major challenge, and opportunity, the world faces today. Be it jobs, security, climate change, food production, or increasing incomes, access to sustainable energy for all is essential for strengthening economies, protecting ecosystems, and achieving equity.

In fact, more than 1.4 billion people worldwide have no access to electricity, and 1 billion more only have intermittent access. Some 2.5 billion people—almost half of humanity—rely on traditional biomass for cooking and heating.

United Nations Secretary-General Ban Ki-Moon made sustainable energy one of the five priorities that will guide his second five-year term. Specifically, he will direct the UN to extend energy's reach in order to combat endemic poverty. Universal access to energy, improved efficiency, and enhanced deployment of renewable sources are ambitious goals, and the Secretary-General is leading a Sustainable Energy for All initiative to make them achievable.

This initiative will call for private-sector and national commitments and attract global attention to the importance of energy for development and poverty alleviation. The goal is to meet three objectives by 2030:

- ensuring universal access to modern energy services
- doubling the rate of improvement in energy efficiency
- doubling the share of renewable energy in the global energy mix

In recognition of the importance of energy access for sustainable economic development and supporting achievement of the Millennium Development Goals, the UN General Assembly has designated 2012 as the International Year of Sustainable Energy for All.

sustainableenergyforall.org

A family in Tarialan, Mongolia, uses a solar panel to generate power for their ger. (UN Photo)

The 2012 International Chemistry Olympiad (IChO) Comes to Washington, D.C.

The American Chemical Society will host the International Chemistry Olympiad (IChO) from 21–30 July 2012. IChO provides chemistry students the opportunity to compete at the highest levels and establish networks that go beyond cultures and borders. As part of its ongoing commitment to science, technology, engineering and math education, The Dow Chemical Company is investing $2.5 million to bring the IChO to the USA for the first time since 1992.

The International Chemistry Olympiad is an annual competition for the world's most talented chemistry students at the secondary school level. Nations around the world send a team of four students, who are tested on their chemistry knowledge and skills in a five-hour laboratory practical and five-hour written theoretical examination. Through a special donation, IUPAC offers support for the participation of countries with limited financial resources. The priorities for the use of this support are: bringing additional students if there are less than four in the team, bringing an additional mentor if there are less than two, or support to reduce the participation fee of a country.

www.icho2012.org

InChI 1.04

In September 2011, version 1.04 for Standard and Non-Standard InChI/InChIKey was released, which now supports the chemical elements up to 112, copernicium. The inchi-1 executable (both Windows and Linux versions) now allows the processing of multiple input files in a single run (common file name wildcards are recognized). In addition, version 1.04 also fixes a number of minor bugs.

The 2011 annual InChI meeting was held 28 August during the ACS National meeting in Denver. The proceedings were led by Jason Wilde (publishing director at Nature Publishing Group and chairman of the InChI Trust) and Alan McNaught (secretary, IUPAC Division VIII InChI Subcommittee, secretary, InChI Trust). Trust members attending included Accelrys, ACD/Labs, Elsevier, FIZ CHEMIE Berlin, RSC, Springer, and Wiley. After taking care of several administrative votes, the committee provided updates on the various InChI activities underway:

- **InChI (v 1.04)** is being released under more liberal licensing terms to alleviate concerns brought to the Trust by corporate participants.
- **Member and Supporter Logos** are now available for posting on member and supporter websites.
- **The InChI Validation program** has been launched allowing users to certify their implementation of InChI. The programs test the installation against a broad set of structures (which are provided with the suite). Once the programs are run and the results sent back to the Trust, an "InChI certified" logo is sent to the organization.
- **InChI Extensions:** Under the guidance of IUPAC, several sub-teams are now working on expanding InChI to new areas of chemical representation:
  - Reaction InChI (RInChI): the reaction working group has completed its recommendations, and work is ready to begin.
  - Polymers/Mixtures: The polymers/mixtures working group also has submitted its recommendations, and work to incorporate the new representations should begin once version 1.04 is released.
  - Markush: This project is the most complex undertaken to date. The initial recommendations have been submitted, but financing of the work still needs to be sorted out.
  - Upcoming reports: IUPAC has two more working groups underway, focusing on organometallics and electronic states, whose reports are due over the next year.

Update provided by Carmen Nitsche.
Reprinted in part from bulletin.acscinf.org/node/263.

www.inchi-trust.org/

InChI in San Diego

Plan to participate in the next INCHI Symposium to be held during the Spring 2012 ACS in San Diego, 25–29 March 2012. A whole day program, including a FLASH session, is being organized by Antony Williams and Alex Tropsha

Possible Changes to The International System of Units

At its 24th meeting, held 21 October 2011, the General Conference on Weights and Measures (CGPM) adopted Resolution 1: "On the possible future revision of the International System of Units, the SI." Resolution 1, available at www.bipm.org/utils/en/pdf/24_CGPM_Resolution_1.pdf, is succinct and written for specialists.

Final approval of the New SI with a date for its implementation will be made by the CGPM after its prerequisite conditions have been met; this will not be before 2014.

The SI is the system of measurement units used in most of the world. Its building blocks are seven "base" units: the second, the metre, the kilogram, the ampere, the kelvin, the mole, and the candela. The SI has the great advantage that these same units are used in all activities of society that involve measurement: daily life, precision engineering, advanced science, etc.

Sufficient progress has been made in National Metrology Institutes around the world to give serious consideration to updating the present definitions of the kilogram, the ampere, the Kelvin, and the mole. In particular, the kilogram has received much public attention because its definition dates from 1889 and it is the last base unit still defined in terms of a manufactured object, the international prototype of the kilogram, which is conserved and used at the International Bureau of Weights and Measures (BIPM) in Sèvres, France. It would be far better, particularly for the scientific community, if the base units were defined in terms of fundamental constants of nature because these constants are invariable over time. Such definitions have been achieved for the definitions of the second and the metre, both of which have been defined for many years through such constants.

Updating the definitions of the four units mentioned above will require care. In making the change, it is a prerequisite that for all the activities of daily life, a kilogram will still be a kilogram; water will still freeze at zero degrees Celsius, etc. That is to say, none of these proposed changes will be noticeable in everyday activities. However, the changes will have immediate impact in the excruciatingly accurate measurements carried out by highly specialized laboratories.

A redefinition of the kilogram first requires highly accurate measurements of a fundamental constant of nature in terms of the mass of the international prototype of the kilogram, currently exactly equal to 1

kilogram. The numerical value of the fundamental constant will then be fixed and the same experiment will later be used to measure the mass of objects including the international prototype. Several facilities throughout the world capable of carrying out such measurements will be needed after the redefinition in order to make practical use of the new kilogram definition.

The target uncertainty for the most accurate of such measurements is 20 microgram per kilogram, which is the same as 20 parts in one thousand million. It is remarkable that at least two experimental approaches are very close to achieving this goal. One approach uses a special electronic balance—a "watt balance"—in order to measure the kilogram in terms of the Planck constant, which is the fundamental constant of quantum mechanics. A second technique compares one kilogram to the mass of a single atom of the chemical element silicon. Physics tells us that the results of these two seemingly different approaches can be accurately compared with each other and, of course, they should agree. The present situation has been examined by the CODATA Task Group on Fundamental Constants based on work published through the end of 2010. They conclude that the present uncertainty of the Planck constant from all relevant experimental approaches is the equivalent of 44 microgram per kilogram.

The CGPM will not adopt the proposed new definitions until present difficulties are resolved. However, on 21 October 2011, the General Conference took a historic step towards the revision by adopting Resolution 1 and thereby outlining the proposed New SI as well as the steps required for the final completion of this project. The text of Resolution 1 is that of Draft Resolution A, which had been publicly available for some months on the BIPM "New SI" website, with only minor changes made during the conference. One of these asks the International Committee for Weights and Measures to continue its work to render the language of the New SI understandable, as far as possible, for users in general, while maintaining scientific rigor and clarity, and without altering the basic content and structure of the New SI as set forth in Resolution 1.

In all, 10 resolutions on a host of topics were adopted during the 24th meeting of the CGPM. In due course, these will all be publicly available on the BIPM website at <www.bipm.org/en/convention/cgpm/resolutions.html>, where previous resolutions of the CGPM can also be found. Since 1967, the CGPM has chosen to meet every four years. However, in a break with recent tradition, the 25th meeting of the CGPM will be held in approximately three years' time.

In addition to the text of Resolution 1 adopted at the 24th meeting of the CGPM, the BIPM website on the "New SI" includes answers to the following questions:

- Why change the SI?
- When might the proposed changes take place?
- Additional FAQs

For further information contact: webmaster@bipm.org

Michael Blackburn Awarded 2011 Arbuzovs Prize

Michael Blackburn was awarded the International Arbuzovs Prize at the Butlerov 150th Anniversary Congress in Kazan, sponsored by the Russian Academy of Science. Blackburn is an emeritus professor of chemical biology at the University of Sheffield and a visiting professor at Xiamen University, Fujian, China.

The International Arbuzovs Award was created in 1997 to commemorate the great achievements of Alexander Arbuzov (father) and Boris Arbuzov (son), who established a golden era for organic chemistry in Kazan. It is awarded every two years to an outstanding chemist who has made significant international contributions to phosphorus chemistry.

The presentation ceremony, which took place in the Concert Great Hall of Kazan University on 19 September 2011, was presided over by the Prime Minister of Tatarstan, Ildar Khalikov. Blackburn's Laureate Lecture was delivered at the close of the Butlerov Congress.

Blackburn graduated from Cambridge University, did his Ph.D. studies on Vitamin B_{12} in Nottingham, and returned to Cambridge as a Rockefeller Fellow and University Demonstrator in Organic Chemistry. Working with Lord Todd, he was initiated into phosphorus chemistry and the synthesis of nucleic acids just 50 years ago. Collaborations within the youthful Cambridge Laboratory for Molecular Biology led to his use of carrier-free ^{32}P-phosphate to establish the role of puromycin in ribosomal peptide synthesis, to the structure of thymine photodimer in bacteria, and to the mechanism of phosphate diester formation by the reagents then used for oligonucleotide synthesis. He became an active member of the international phosphorus community, beginning with the Georg Wittig Symposium in Heidelberg in 1964 and culminating in his organizational role in the 16th ICPC Meeting in Birmingham in 2004.

Prime Minister of Tatarstan, Ildar Khalikov (right), presents Michael Blackburn with the Arbuzovs Prize.

Juxtaposing protein crystallography and ^{19}F NMR spectroscopy to deliver accurate, and sometimes critical, analyses of these complexes, Blackburn has rationalized major features of enzymatic phosphoryl transfer in terms of the "anionic shield" of phosphate esters and "charge balance" as a hypothesis explaining how enzymes respond to it. These studies are now demonstrating the relative simplicity of enzyme catalysis of kinases, phosphatases, and mutases even though these processes include some of the most remarkable accelerations of any enzymatic reactions. In conclusion, these investigations lead to the conclusion that phosphorus is the unique element whose oxyacids are capable of fulfilling the multiple roles of phosphate esters in terrestrial life and fully justify Lord Todd's 1981 prediction that phosphorus (sic) will play the same roles in life wherever it is found in the universe.

Blackburn has been a member of the IUPAC Organic and Biomolecular Division on and off since 2000. He returns this year as a titular member.

Gold Book PDF

In October 2011, version 2.3 of the Gold Book was released, completing IUPAC project 2009-038-1-024. Entries with related content were merged in this version, which includes an updated FAQ and an experimental PDF rendering of the whole Gold Book in one file.

goldbook.iupac.org

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(Executive Committee members are denoted in **bold**).

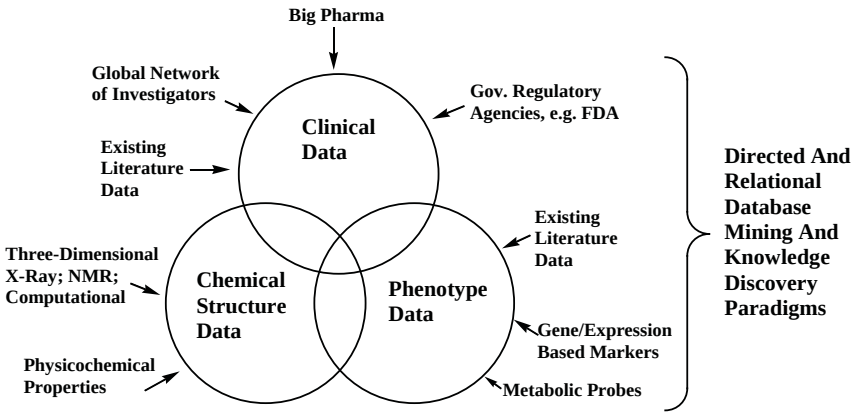
Human Drug Metabolism Database

This project will lay the foundation for establishing a relational database coupled with substructure searching capability pertaining to the metabolism of xenobiotics in humans. The database will eventually be made available on the internet via a nonprofit mechanism.

Accounting for all applicable clinical data in an unbiased manner with regard to study protocols, and across all human genotypes and assessed phenotypes, the database's critical mass will allow it to be utilized to develop more accurate and meaningful human structure-metabolism relationships (hSMR). Specific aspects of the overall hSMR, in turn, can then be applied in a proprietary fashion to assist in the selection and development of new drug candidates into and through clinical testing. Equally important at this juncture, the assembly of this type of database may be the only way to assess and potentially validate the actual utility of the numerous biochemical and in vitro methods that are proliferating in this field in order to predict the metabolic fate and metabolism-associated toxicity for a new xenobiotic upon its administration to humans.

For more information contact the task group chair Paul Erhardt <paul.erhardt@utoledo.edu>.

www.iupac.org/web/ins/2011-018-1-700



Informational fields in the proposed human drug metabolism database.

Strategic Planning for a New Network for Heterocyclic Chemistry

While most of the research in heterocyclic chemistry in the Mediterranean Sea region is of very high quality, a careful inspection shows that most of the research is concentrated in European countries. Current research in this area focuses on the synthesis, reactivity, and application of heterocyclic compounds of interest in the fields of medicinal chemistry, new materials, nanotechnologies, and biotechnologies. However, the needed networks among developed and underdeveloped countries are languishing due to a lack of funding. This project seeks to establish such a network in the Mediterranean.

The program is designed to create world-class research hubs in selected fields within the countries of the region. At the same time, the program would foster the next generation of leading researchers by establishing sustainable collaborative relations among research/education institutions in Spain, Portugal, France, Italy, Slovenia, Croatia, Albania, Greece, Bulgaria, Romania, Georgia, Russia, Cyprus, Turkey, Egypt, Giordan, Tunisia, Algeria, and Morocco. Under this program, core institutions would collaborate in cutting-edge fields of research and on research topics deemed to be of high international importance. The core institutions in the various countries would conduct exchanges based on a principle of equal partnership in the form of joint research, scientific meetings, and researchers. It is anticipated that the hubs formed by the core institutions will continue to carry out research activities after the funded project has ended. The scope of the project on heterocyclic chemistry includes, but is not limited to, the core areas of heterocyclic chemistry, organic synthesis methodology, and total synthesis of natural products.

For more information contact Task Group Chair Saverio Florio <florio@farmchim.uniba.it>.

www.iupac.org/web/ins/2011-006-2-300

The Port of Piraeus in Athens, Greece, the busiest cargo port and largest container port in the country. *Photo by N. Diakidis, Wikipedia.*

Management of Maritime Pollutants in European Ports

Ports are closed or semi-closed coastal systems with limited water circulation, poor flushing, and weak tidal exchange. Consequently, they are characterized as pollution hotspots or areas of stagnation with a variety of maritime pollutants, found in the air, water column, and sediments, and characterized by long residence times and high concentrations. The ubiquitous problem of TBT and its long-term legacy is a notable example. During the last decade, ports around the world have grown at an extremely high rate. Fortunately, many shipping and port managers are striving to develop suitable environmental management systems and environmental policies to minimize and prevent these effects.

This project is intended to provide performance and quality indicators based on physical and biogeochemical environmental parameters required to monitor and audit the effectiveness of environmental management systems and environmental policies applied in European ports. Parameters include the following:

1. Sediment parameters consisting of grain-size surficial sediments, redox potentials along the vertical profile and heavy metal content, including metals like, As, Cd, Cr, Cu, Fe, Hg, Pb and Zn. Higher hydrodynamics are associated with a greater presence of coarse silt and fine sand while lower flow competence is correlated to a larger clay and fine silt deposition. Redox potential is a result of sediment diagenesis, implying dissolved oxygen consumption in surface sediments and the use of other electron acceptor species in deeper sediments leading to decreasing redox values.
2. Water parameters comprising water circulation, dissolved oxygen, ammonia, cyanide, phenol, and metals like Cd, Cu, Fe, Pb and Zn. In general, the more intense water circulation corresponds to less anoxia, less reduced sediment conditions, coarser particle content, and lower organic matter amounts. Enrichment in finer particles and organic matter corresponds to favorable conditions for pollutant accumulation, leading to environmental degradation.
3. Biological parameters including occurrence of particular species, species richness and diversity as well as microbial biomarkers to identify certain genes that convey resistance to toxic metals (as for example the well characterized in the literature genes that convey arsenic resistance) or ability to degrade toxic organic compounds.

These indicators will be used to strengthen decisionmaking when developing, shaping, and evaluating national and local environmental management systems and environmental policies. In addition, the project will supply a list of guidelines as well as a protocol for effective maritime pollutants management. The outcome can be used by regulatory and management authorities.

For more information contact Task Group Chair Fani Sakellariadou <fsakelar@unipi.gr>.

www.iupac.org/web/ins/2010-028-3-600

Impact of Scientific Developments on the Chemical Weapons Convention

In early 2011, IUPAC was approached by the Organization for the Prohibition of Chemical Weapons (OPCW) and asked to prepare the basic scientific document required to carry out the third revision of the Chemical Weapons Convention (CWC), which is due to be finalized in April/May 2013. The Union agreed to take on this task, and a task group was quickly established with Leiv K. Sydnes from Norway as chair.

The work is now well under way in close cooperation with an International Advisory Board, which has members from several IUPAC divisions. A major part of the work is the planning and execution of a workshop on recent advances in chemistry and chemical technology of relevance to CWC and its implementation. At the workshop, which will take place in Spiez, Switzerland, at the end of February 2012, leading experts in relevant fields of the chemical sciences have been invited as lecturers. The material they present will be discussed in a CWC-context by invited scientists familiar with the convention. All the material and the conclusions that are drawn will constitute the platform for the written report that the task group is going to deliver to OPCW by mid year.

For more information contact Task Group Chair Leiv Sydnes <leiv.sydnes@kj.uib.no>.

www.iupac.org/web/ins/2011-036-1-020

Postgraduate Course in Polymer Science

For more than a decade, the IUPAC Polymer Divison has supported a program that enables young university graduates and Ph.D.s from countries with limited research facilities to acquire knowledge about recent advances in polymer science and the professional skills needed for promotion of polymer science in their home countries. The 16th and 17th runs of the course will be held in the academic years 2011–2012 and 2012–2013 at the Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic, in Prague. The courses are also sponsored by UNESCO with financial assistance from the Academy of Sciences of the Czech Republic. The institute, which has more than 100 scientists and more than 50 years of experience in postgraduate education, offers up-to-date facilities for postgraduate training in polymer science.

The number of participants in each of the 15 runs of the program usually has been between 5 and 13, depending on the funds available. The course lasts 10 months and comprises about 50 hours of lectures in modern polymer science, experimental work on research projects under the supervision of senior scientists of the institute, and participation in all educational activities within the institute. The results of the research are published in international technical journals and presented at meetings.

The UNESCO/IUPAC Course 2011–2012 began 1 October 2011. The deadline for applications for the coming year is 25 February 2012.

For more information, contact Task Group Chair Pavel Kratochvil <krat@imc.cas.cz>.

www.imc.cas.cz/unesco

Stamps International

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

Russia's Leonardo

Mikhail Vasil'evich Lomonosov (1711–1765), much like Leonardo da Vinci in Italy some 250 years earlier, was a man of many talents and is often regarded as a polymath (i.e., an individual with a restless curiosity, an unquenchable thirst for knowledge, and the rare ability to excel in a variety of subjects or fields). Although Lomonosov may not have a *Mona Lisa* in his curriculum vitae, he was a prolific writer, with major contributions to grammar, rhetoric, poetry, and history, and he is considered one of the key players in the development of the modern Russian language. His long list of accomplishments in multiple areas of scientific endeavor, including chemistry, physics, mathematics, mineralogy, geology, and astronomy, is also undeniable. For example, he established at the St. Petersburg Academy of Sciences the first chemistry laboratory in Russia (1748), which was one of the first in the world in which university students could carry out experiments by themselves. He opposed the theory of phlogiston prevalent at the time, regarded heat as a form of motion, and proposed pioneering ideas towards the establishment of the law of conservation of matter. He measured the solubilities of various salts at different temperatures, conducted experiments on atmospheric electricity, built a mosaic glass factory, and demonstrated the organic origin of coal, petroleum, and amber. He explained the formation of icebergs and predicted the existence of Antarctica, recorded for the first time the freezing point of mercury, and cataloged more than 3000 different minerals. It is therefore not surprising that Lomonosov's multifarious contributions to society have been widely recognized in his native Russia, including the official name of its largest university (Moscow State University).

The stamp illustrated in this note was issued in 1986 to celebrate the 275th anniversary of Lomonosov's birth and it features the best-known portrait of the renowned scientist. The same image has also been used in several other stamps from Russia as well as Cuba, Romania, and, more recently, Guinea, Togo, and Vietnam. Perhaps, Lomonosov is finally becoming better recognized outside Russia. So, we ought to remember that the International Year of Chemistry 2011 was also the tricentennial of his birth. Happy birthday Misha!

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

Provisional Recommendations are drafts of IUPAC recommendations on terminology, nomenclature, and symbols made widely available to allow interested parties to comment before the recommendations are finally revised and published in Pure and Applied Chemistry. *Full text is available online.*

Terminology and Nomenclature for Macromolecular Rotaxanes and Pseudorotaxanes

This document provides definitions of terms related to macromolecular rotaxanes and macromolecular pseudorotaxanes, and recommendations for naming these macromolecular assemblies. The nomenclature recommendations presented here have been developed by combining the nomenclature rules for the low-molecular-weight rotaxanes and the nomenclature rules for macromolecules (both established in published IUPAC Recommendations) in such a way that the developed nomenclature system provides unambiguous names for macromolecular rotaxanes (pseudorotaxanes) including differentiation among various isomers of these supramolecular assemblies. Application of the nomenclature recommendations is illustrated using examples covering a wide range of structure types of macromolecular rotaxanes and pseudorotaxanes. An alphabetical index of terms and a list of abbreviations and prefixes are included.

Comments by 31 March 2012

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http://media.iupac.org/reports/provisional/abstract11/vohlidal_310312.html

Name and Symbol of the Element with Atomic Number 114 and 116

A joint IUPAC/IUPAP Working Party (JWP) has confirmed the discovery of the elements with atomic numbers 114 and 116. In accord with IUPAC procedures, the discoverers proposed names as follows: flerovium and symbol, Fl, for the element with Z = 114 and livermorium with the symbol Lv for the element with Z = 116. The Inorganic Chemistry Division recommended these proposals for acceptance.

For element with atomic number 114, the proposal lies within tradition and honours the Flerov Laboratory of Nuclear Reactions where superheavy elements are synthesised. Georgiy N. Flerov (1913–1990) was a renowned physicist, author of the discovery of the spontaneous fission of uranium (1940, with Konstantin A. Petrzhak), pioneer in heavy-ion physics; and founder in the Joint Institute for Nuclear Research the Laboratory of Nuclear Reactions (1957).

For the element with atomic number 116, the proposed name livermorium is again in line with tradition and honours the Lawrence Livermore National Laboratory. A group of researchers of this Laboratory with the heavy element research group of the Flerov Laboratory of Nuclear Reactions took part in the work carried out in Dubna on the synthesis of superheavy elements including element 116.

Comments by 30 April 2012

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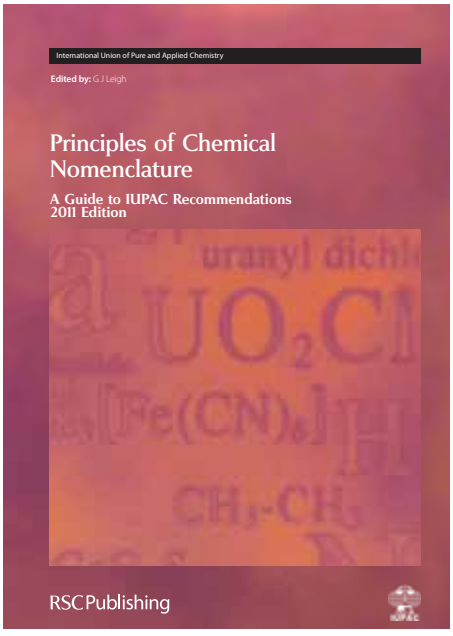
http://media.iupac.org/reports/provisional/abstract11/corish_300412.html

Principles of Chemical Nomenclature: A Guide to IUPAC Recommendations, 2011 Edition

Royal Society of Chemistry
Cambridge, UK, November 2011
ISBN 978-1-84973-007-5

reviewed by G.J. Leigh (editor)

This new edition of *Principles of Chemical Nomenclature* was published on 25 November 2011. Like the first edition of 1998, it is directed towards teachers and students of chemistry in schools and universities, but it should be equally useful to people such as government officials concerned with customs and taxation. Such people often need some acquaintance with chemical names, but generally have little knowledge of chemistry, and obviously would be inhibited from using a professional guide such as the IUPAC color books, Red, Blue, and Purple, initiated in January 2007.



This book has a coverage considerably greater than that of the 1998 edition. That book was written by three nomenclature experts, Henri Favre, the late Val Metanomski, and myself. I was the overall editor. It occupies about 130 pages. The new edition is twice as long, due to the wider coverage. Consequently, there are many more authors, 12 in all. Each of these authors is an expert in the selected field of nomenclature. The clash of opinions and the differing practices employed in the nomenclatures used by the different groups of chemists has caused the editor a great deal of work, and the occasional quarrel. However, the five-year struggle is now over,* and the editor and authors may rightly feel proud of their work.

The principal changes between the first and current editions are as follows. The definitions chapter is lengthened and improved; there is an expanded treatment of formulae and especially of stereoformulae; the chapter on the naming of substances has been expanded and replaced by several chapters dealing with various types of nomenclature, such as substitutive and coordination nomenclatures; and the chapters on organometallic compounds and polymers have been rewritten and greatly expanded, as has the chapter on biochemical nomenclature. In addition, there are now chapters detailing types of nomenclature other than that of IUPAC, the naming of boron hydrides, the IUPAC international chemical identifier (InChI), guidelines for drawing chemical structures, and, perhaps most useful of all for many readers, a guide to constructing and deconstructing IUPAC chemical names. This new volume has a full list of appropriate references appended to each chapter, and many attached tables which are of general application, such as one listing trivial and common names and their IUPAC equivalents, and another about 25-pages long giving the names of specified atoms and groups when they are considered to be uncharged, or negatively charged, or positively charged, or cited as ligands.

In attempting to impose a common style upon the writing of 12 authors, I have come to realize that within the IUPAC family of nomenclatures there are inconsistencies that probably would not have been found without an exercise such as the writing of this book, which attempts to cover all areas. For example, words such as "ending," "suffix" and "termination" might be taken by the lay reader to be synonyms. That is not necessarily true for nomenclaturists. The words "configuration" and "stereochemistry" are considered to be almost interchangeable by some, but certainly not by all nomenclaturists. The meaning of the words "ethylene" and "ethene" depends upon the person using the name and the context. Some would claim that they are synonyms, the first form to be discouraged, others that they represent different species. These and related matters will no doubt receive more attention from IUPAC in the future.

*The preparation of this edition was carried out under IUPAC project 2006-029-1-800.

www.rsc.org/shop/books/2011/9781849730075.asp

Halogen Bonding

by David L. Bryce

The **IUCr Satellite Workshop on "Categorizing Halogen Bonding and Other Noncovalent Interactions Involving Halogen Atoms"** was held 20–21 August 2011 in beautiful Sigüenza, Spain, at the Hospederia Porta Coeli (a facility of Alcalà University). The workshop was organized over two full days with nine oral scientific sessions and one poster session covering all of the research fields in which halogen bonding and other noncovalent interactions involving halogen atoms play a fundamental role.

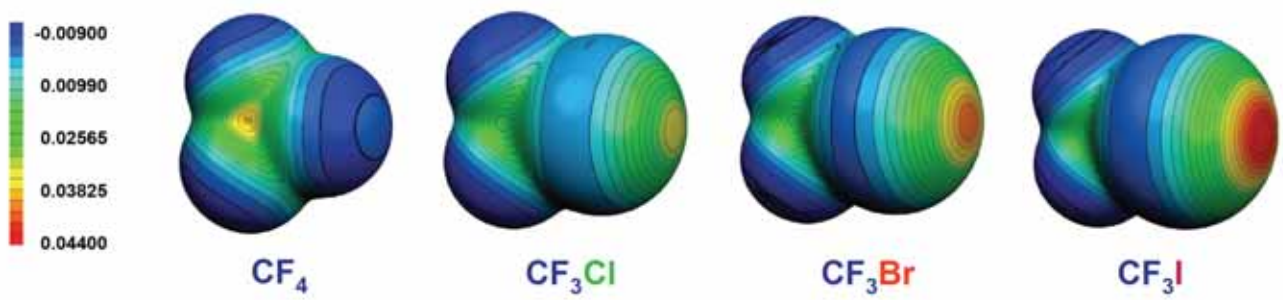
Project chairs Pierangelo Metrangolo and Giuseppe Resnati (Politecnico di Milano) warmly greeted many of the 60 participants on the evening of the 19th and a late supper was enjoyed. The 60 workshop participants represented over 20 countries from North America, Europe, as well as China, Japan, India, and South Africa. The workshop began with opening remarks by the project chairs, who reiterated the role of the workshop:

- to take a comprehensive look at intermolecular interactions involving halogens as electrophilic species and classify them
- to give a modern definition of halogen bonding (XB), which takes into account all current experimental and theoretical pieces of information on both gaseous and condensed halogen-bonded systems in chemical and biological environments

The scientific sessions consisted of three or four 25-minute presentations given by selected scientists working in the field of halogen bonding, followed by five minutes of questions and discussion. Each session was chaired by one of the scientists presenting at the workshop. The topics of the sessions were as follows:

- Theoretical Modelling, Experimental Techniques
- Crystal Engineering
- Donors & Acceptors
- Biomolecules
- Materials (two sessions)
- Supramolecules
- A Proposed Definition of Halogen Bonding

I found the meeting to be very interesting and stimulating, as it brought together a diverse group of scientists each with their own expertise and perspective on the topic of halogen bonding. For example, Anthony Legon (Bristol, UK) discussed the information available from rotational spectroscopy on halogen-bonded complexes in the gas phase, Marc Fourmigué (Rennes, France) presented results on halogen bonding in molecular conductors, and P. Shing Ho (Fort Collins, Colorado, USA) presented anisotropic models for biological halogen bonds with an emphasis on nucleic acids. My own presentation discussed our multinuclear solid-state magnetic resonance studies of haloanilinium halides as well as a series halogen-bonded thiocyanates and selenocyanates. Lee Brammer (Sheffield, UK) discussed the role of halogen bonds in inorganic chemistry, Pavel Hobza (Prague) provided a computational perspective on the role of halogen bonding in drug design, Gautam Desiraju (IIS Bangalore, India) provided novel examples



It is well-known that the electron density around the halogen nucleus is highly anisotropic, for this reason halogen atoms can be involved in a wide variety of intermolecular interactions (Figure reproduced from Clark, T.; Hennemann, M.; Murray, J. S.; Politzer, P. Halogen bonding: the σ-hole. J. Mol. Model.*, 2007, 13, 291)*

of the role of halogen bonding in crystal engineering, and Christer Aakeröy (Kansas State, USA) presented an elegant experimental study of the balance between halogen and hydrogen bonds. One of the slides from Aakeröy's presentation humorously reflected some of the previous presentations which suggested that, depending on one's perspective, the halogen bond could be seen as having much in common with the hydrogen bond or, conversely, as being substantially different from the hydrogen bond. There were several more excellent presentations, but the general topics mentioned above illustrate the breadth of approaches to studying halogen bonding, as well as the variety of fields of application. The oral presentations were punctuated with lively question-and-answer sessions. The poster session, held on a very hot Saturday night in the adjacent "Doncel's House," was equally lively.

The final session of the workshop was a round-table discussion among all attendees of the definition of halogen bonding. This was chaired by Roberto Marquardt, secretary of the IUPAC Physical and Biophysical Chemistry Division. He addressed the audience and gave an overview of the IUPAC project structure and, in specific, he introduced the halogen bonding project (IUPAC project 2009-032-1-100). Marquardt highlighted some important statements from various speakers which had emerged during previous sessions in the workshop. Several possible experimental and theoretical criteria for establishing the existance of a halogen bond were mentioned (e.g., "a halogen bond is a Lewis-acid-Lewis base attractive contact where a halogen atom is the interacting moiety in the Lewis acid"; "charge transfer might be strongly related to the existence of halogen bonds"; "the bond path and the bond critical point must be observed in the electron density between the halogen and the donor attached to it", "can halogen bonding be seen as a case of an unbalanced 3-centre/4-electron bond?"). My own work suggested that the magnetic shielding tensor is sensitive to the halogen bonding interaction. The session continued with a presentation by E. Arunan on the IUPAC definition of hydrogen bonding, showing several examples where hydrogen bonding has been studied using different experimental and computational techniques. Arunan introduced a comparison between the hydrogen bond and halogen bond, showing several similarities and differences.

Co-chairs Metrangolo and Resnati then gave a summary of past and future events and activities associated with the IUPAC halogen bonding project. They noted that a draft of a preliminary recommendation for the definition of the halogen bond is expected to be delivered shortly. Resnati then started the round-table discussion with a question concerning how detailed the definition for a halogen bond should be. After some discussion, the majority consensus seemed to be that a flexible, simple definition would be most suitable and useful, rather than a strict definition. P. Sing Ho pointed out that to be practical, the definition must be understandable to a wide audience of scientists. There was then some discussion of the relevance of various existing experimental and theoretical evidence in the formulation of a definition, and it was felt that a simple definition should not have to rely on particular pieces of evidence, given that there is large number of experimental observations concerning the halogen bond.

Various special and/or extreme cases pertaining to the halogen bond were then addressed, including the I_3^- anion, fluorine as a halogen bond donor, and halonium ions. There was good agreement in these three cases that they all qualify as falling under the definition of halogen bonding. There was some animated discussion concerning various different possible theoretical descriptions of the halogen bond (e.g., role of electrostatics, polarization, charge transfer, and dis-

The CNC-IUPAC Travel Awards

David Bryce's participation in this IUPAC workshop was an integral part of his CNC-IUPAC Travel Award. The Canadian National Committee/IUPAC travel awards were established in 1982 to enable young Canadian scientists to present their research at IUPAC-sponsored conferences outside continental North America. Applicants should be within 10 years of having obtained their Ph.D. The awards are sponsored jointly by the Canadian National Committee, IUPAC's company associates, and the Gendron Fund, which was established in memory of a noted Canadian chemist who organized a highly successful IUPAC congress in Vancouver, British Columbia in 1981. Although many IUPAC member countries have national committees that handle liaison with IUPAC, to the best of our knowledge, the Canadian National Committee is the only one that operates a travel awards program. See www.cnc-iupac.ca/awards_e.html for more details and future announcements.

persion), including the presentation of some new data by Kevin Riley (Prague) which intimated the important role of dispersion.

Finally, some more subtle points were also raised: e.g., the terminology of "halogen bonding" vs. "the halogen bond," and the proper representation of a halogen bond when drawing a molecular structure. Robin Rogers (Alabama, USA) closed the session with a presentation related to the journal *Crystal Growth and Design*, which will publish a special virtual issue featuring papers submitted by the speakers at this workshop (see http://pubs.acs.org/page/cgdefu/vi/index.html). At the conclusion of the meeting, members of the IUPAC working group started working on a draft of the definition of halogen bonding.

From my perspective, this interactive and productive meeting brought together a diverse group of scientists, each with their own point of view on halogen bonding. This diversity is essential to establishing a consensus that supports a practical and accurate IUPAC definition of the halogen bond.

www.halogenbonding.eu

David L. Bryce <dbryce@uottawa.ca> is an associate professor at the University of Ottawa (Canada). He obtained his B.Sc. (Honours) degree from Queen's University (1998). His Ph.D. thesis work (Dalhousie, 2002) was carried out in the group of Rod Wasylishen at Dalhousie University and the University of Alberta. This was followed by an NSERC postdoctoral fellowship with Ad Bax at the NIH (2003–2004). He currently serves as the chair of the Steering Committee for Canada's National Ultrahigh-Field NMR Facility for Solids. Research interests include solid-state NMR of quadrupolar and low-receptivity nuclides, quantum chemical calculations of NMR parameters, and biomolecular NMR. Recent activities include the development and application of solid-state NMR of the quadrupolar halogens, $^{35/37}$Cl, $^{79/81}$Br, and ^{127}I, which led to his current interest in halogen bonding and the potential for solid-state NMR to contribute to this area of research. Work with graduate student Cory Widdifield on ^{127}I and $^{185/187}$Re solid-state NMR spectroscopy recently led to the observation of "higher-order quadrupolar effects." This necessitated the development and implementation of new simulation software by student Fred Perras, which treats quadrupolar interactions exactly rather than via second-order perturbation theory. The Bryce group has also recently initiated a research program in double-rotation NMR. A successful ongoing collaboration with J. Boisbouvier (IBS, Grenoble) led to the direct observation of CH/π interactions in proteins in 2010.

http://mysite.science.uottawa.ca/dbryce

Conducting Polymers

by Majda Zigon

This **75th Prague Meeting on Macromolecules** (PMM) was held 10–14 July 2011 at the Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic (IMC) in Prague. It was devoted to conducting polymers, representing one of the most active and developing areas of polymer science. PMM conferences are well-known—the IMC has been organizing these international meetings every year since 1967.

The 75th PMM was organized by Jaroslav Stejskal and Miroslava Trchová under the auspices of the City of Prague, the vice-mayor Ivan Kabický, IUPAC, and the International Society of Electrochemistry. The conference has been approved as the official event of the International Year of Chemistry 2011. It attracted 124 participants from 37 countries and brought together both young and experienced researchers, as well as many students. At the opening ceremony, the attendees were welcomed by František Rypáček, director of the IMC, and Jaroslav Stejskal, co-organizer of the conference. The official IUPAC representative, Majda Žigon, from the National Institute of Chemistry in

Group photo of participants at the 75th Prague Meeting on Macromolecules.

Ljubljana, Slovenia, outlined the activities of IUPAC in general and its Polymer Division in particular, as well as activities related to the International Year of Chemistry.

The conference highlighted areas such as the synthesis of conducting polymers and the preparation of their composites, their structural characterization, physical and chemical properties, modelling, and applications. The scientific program consisted of 7 invited lectures, 45 short contributed lectures, and 79 poster presentations. The invited lectures were of excellent quality and covered all aspects of conducting polymers. The first invited lecture was given by Adam Pron, France ("Low and High-Molecular-Weight Semiconductors for Organic Electronics: Synthetic Strategies, Characterization and Application to Organic Transistors). Other invited lectures were as follows:

- Gordana N. Ćirić-Marjanović, Serbia ("Computational Insights into the Mechanism of the Oxidative Polymerization of Arylamines")
- Mikhail A. Vorotyntsev, France ("Electrochemistry of Porphine-Based Electroactive Polymers")
- Andrey N. Aleshin, Russia ("Conducting Polymers–Inorganic Nanoparticles Composites for Organic Optoelectronics")
- Miroslava Trchová, Czech Republic ("Polyaniline–Silver Composites")
- Jadranka Travas-Sejdić, New Zealand ("Two Applications of Scanning Ion Conductance Microscopy to Conducting Polymers: Electropolymerization and Ion Flux Measurement")
- Maria Omastová, Slovakia ("Polypyrrole, a Conducting Electroactive Polymer: From Past to Future").

The conference was held in a friendly and stimulating atmosphere. The participants followed the lectures with great interest, which was reflected in fruitful discussions, which extended throughout the day and culminated in afternoon poster presentations, accompanied by selected specialties of Czech cuisine and beer. The participants voted for the best poster presentations, which were awarded at the conference's closing ceremony. The winners were as follows:

- "Synthesis of Crystalline Polyaniline by Interfacial Polymerization" presented by Ahmed Mahmoud Youssef, Egypt
- "Controllable Optical, Electrical and Morphologic Properties of 3,4 ethylenedioxythiophen-based Electrocopolymerization Films" by Cheng Gu, China
- "Synthesis of Copolymers Used as Compatibilizers for Organic Solar Cells" by Sébastien-Jun Mougnier, France
- "Biocompatibility of Polyaniline" by Petr Humpolíček, Czech Republic.

Apart from the scientific work, the participants enjoyed a relaxed atmosphere in the evenings at the welcome reception, gala dinner, and during a visit to the Prague Old-Town Hall with the famous Astronomical Clock "Orloj," standing at the oldest and most important square of historical Prague.

The conference was a great success also thanks to the Organizing Committee, composed of Elena Konyushenko, Ivana Šeděnková, Patrycja Bober, Zuzana Rozlívková, and Milena Exnerová and the Conference Secretariat, represented by Daniela Illnerová and Marie Rodová. Special thanks go to the official sponsors named above, the conference associates, and to the industrial sponsors.

www.imc.cas.cz/sympo/75pmm/

Chemical Safety and Security

by Leiv K. Sydnes

As the International Year of Chemistry has unfolded, a steady flow of new organizations, societies, companies, and individuals have joined in and contributed to the celebration of the chemical sciences. This has increased the scope and perspective of the celebration, and over and over again we have seen how important chemistry is everywhere throughout the world. On 12–13 September 2011, the Organization for the Prohibition of Chemical Weapons, OPCW, became a celebrant as well, by organizing a **Conference on International Cooperation and Chemical Safety & Security** in The Hague, Netherlands.

The meeting was well attended, with some 350 participants on site and several hundred following the presentations through a webcast. The purpose of the conference was to promote the goals of the Chemical Weapons Convention (CWC) by highlighting the achievements of OPCW, but more importantly, by analyzing the challenges that lie ahead and discuss with important stakeholders how these challenges can be dealt with through coordinated actions and collaboration. All the most important players on the international scene were there, and those represent-

Stills from videos of the OPCW conference. From left: David Black, IUPAC secretary general; Berhanu Abegaz, executive director of the African Academy of Sciences; and Nancy Jackson, 2011 president of ACS.

ing IUPAC were pleased to experience the significant standing the Union has within OPCW and among the State Parties to CWC.

The opening of the conference and the program before lunch the first day was held in the conference section of the Peace Palace, a great venue in the middle of the city. In his opening address, the Director General of OPCW, Ambassador Ahmet Üzümcü from Turkey, emphasized the importance of working in partnership: "only by working together as multiple stakeholders [] can we accomplish the goals of the CWC, especially in relation to national implementation, assistance, and protection against chemical weapons and the achievement of universality." The same message was in essence presented by the Dutch Minister of Foreign Affairs from a political position and by Professor Paul J. Crutzen, recipient of the 1995 Nobel Prize in Chemistry, on the basis of an analysis of the global impact of chemicals in our times, the age of Anthropocene.

The rest of the conference was held at the OPCW headquarters. The sessions after lunch the first day were devoted to a series of plenary presentations about three topics: International Cooperation, Chemical Safety, and Chemical Security. IUPAC's involvement was mentioned with appreciation several times. The second day, the same themes were discussed in parallel sessions on the basis of more specialized presentations delivered by specialists from all parts of the world. There was ample time for discussion, and in at least two of the groups, the interventions were vivid and constructive. Rapporteurs took thorough notes, not only to be able to give a summary of the discussion in plenum at the end of the conference, but also to use the material as basis for further discussions within OPCW.

IUPAC's presence was quite visible. In the opening session, Secretary General David StC. Black gave a thorough presentation of IYC; he argued convincingly for why there should be an international year of chemistry, and told about how the year was celebrated. Later the same day, Professor Alastair Hay from Liverpool University, UK (an active member of several task groups on chemical weapons, code of conduct, and education within IUPAC) talked about "Ethics in Chemistry", which is an issue of significant interest to OPCW. His presentation was in part based on material developed in an IUPAC project a few years back, and he also brought the audience's attention to the report on a Code of Conduct that a task group led by Graham Pearson has published (see Nov-Dec 2011 *CI*).

The second day, the Union's next vice president, Mark Cesa, gave a thorough presentation of the IUPAC Safety Training Program, which he has been very much engaged in for many years. The presentation was very well received, and in the plenum session at the end of the conference, the Safety Training Program was specifically mentioned as the sort of activity that should be expanded and given priority in the future.

On top of all this, IUPAC was also given a booth at the exhibition during the whole conference. All the material exhibited was picked up by the participants, which is encouraging.

Look up "opcwonline" on YouTube to watch an Introduction to the OPCW Conference on International Cooperation and Chemical Safety and Security. The video includes various interviews with participants, including David Black; Berhanu Abegaz, executive director of the African Academy of Sciences; and Nancy Jackson, 2011 president of the American Chemical Society.

www.youtube.com/user/opcwonline
www.opcw.org/index.php?id=1138

Chemistry of Natural Products and Biodiversity

by Mary Garson

The **27th International Symposium on the Chemistry of Natural Products** (ISCNP27) was held jointly with the 7th International Conference on Biodiversity (7ICOB) at the Brisbane Convention and Exhibition Centre in Brisbane, Australia from 10–15 July 2011. The joint meeting was attended by 180 delegates, who between them represented over 20 different countries.

The very first IUPAC meeting ever on natural products was also held in Australia (interestingly, the venue moved between Sydney, Canberra, and Melbourne) in 1961. The introduction of that field of research to a generation of young chemists led to a rapid expansion of interest by Australian chemists in natural products research. Hopefully, this 2011 meeting will have a similarly positive outcome.

The conference co-chairs for the 2011 meeting were Mary Garson of The University of Queensland (UQ) and Ronald Quinn from Griffith University (GU), with the considerable assistance of Joanne Blanchfield (UQ), Tony Carroll (GU), and Naresh Kumar (University of New South Wales, Sydney) as hard-working members of the Organizing Committee. The meeting was sponsored by Griffith University, The University of Queensland, and the Royal Australian Chemical Institute.

With inputs from the International Advisory Board, a world-class scientific program was assembled, which included topics such as discovery of new metabolites, isolation and structure elucidation, neglected diseases, biosynthesis, chemical ecology, new methodology, and biodiversity. Plenary lectures were delivered by Russell Kerr (Canada), Erik Sorensen (USA), Daisuke Uemura (Japan), Deniz Tasdemir (UK), and Yang Ye (China). In addition, there were 27 invited talks and 20 contributed oral presentations, as well as a lively poster session with 76 posters on show. Eighteen of the poster presenters were selected to give a three-minute oral contribution on their posters. Nine postgraduate students received awards for their poster or three-minute presentation.

The size of the conference made it convenient for delegates to network effectively, and to share discoveries and results. For the postgraduate audience, it was also an ideal opportunity to hear top-flight researchers from the natural products community, and to plan postdoctoral careers in overseas laboratories. There also was a small trade display.

On 13 July, delegates took advantage of the lecture-free schedule to visit research facilities at the two host universities, and to attend an hour-long discussion forum on "The Future of Natural Products Research." A selection of plenary and invited talks will appear in *Pure and Applied Chemistry* (see www.iupac.org/publications/pac/conferences/Brisbane_2011-07-10b).

In addition to the scientific content, there was a welcome reception and a dinner held at a riverside restaurant. Some participants also attended an Australian Outback spectacular show at the Gold Coast. Each day, participants were able to enjoy the South Bank parklands and the Brisbane River on their way to the Convention Centre, and to take advantage of the mild winter temperatures that make eating out in the central Brisbane area a pleasant experience during July.

Combined symposia for these two series of meetings had previously taken place in Charlottetown (2008), Kyoto (2006), and Delhi (2004). Prior to that, ISCNP23 was held in Florence, Italy (2002), while ICOB meetings were held in Antalya, Turkey (2001), Belo Horizonte, Brazil (1999), and Bangkok, Thailand (1997). The next venue is still to be finalized, with China already submitting an expression of interest to host ISCNP28/ICOB8.

Nowadays, discovery chemists often chose to attend highly targeted meetings addressing marine, plant or microbial topics, or regionally-based meetings, and so miss out on the opportunity to meet natural product chemists working in cognate fields or from other regions of the globe. A key aim of the ISCNP/ICOB series of meetings should be to continue to bring researchers with these overlapping, but distinct, interests together to celebrate the "sum of the many scientific parts" that make up modern natural products and biodiscovery research.

Delegates at the 27th International Symposium on the Chemistry of Natural Products in the foyer of the Brisbane Convention and Exhibition Centre.

Trace Elements in Food

by Eva M. Krupp and Jörg Feldmann

The fourth **International Conference on Trace Elements in Food** (TEF-4) took place in the far north of Europe, more precisely in Aberdeen, Scotland from 19–22 June 2011. The conference, which covered a diversity of topics pertaining to the important role that trace elements play in our health and well-being, was held at King's College Conference Centre in Old Aberdeen, in the heart of Scotland's third oldest university, founded in 1495. During three days, 150 delegates from 39 countries came together to experience 13 invited lectures, 25 oral presentations, and 108 posters.

Joerg Feldmann opening the conference.

Trace elements in our diet are the main source of essential, as well as toxic, elements that wind up in our bodies. Malnutrition due to a lack of essential trace elements like zinc, selenium, iron, or iodine affects millions of people worldwide. While exposures to toxic elements like mercury or arsenic also affects millions of people's health worldwide.

The idea of TEF is to combine these different aspects of trace elements in diet, and to shed light on their biological action, whether beneficial or toxic, or, as in the case of selenium, their ambivalence. This goal was achieved by bringing together researchers from different disciplines and backgrounds in an interdisciplinary approach.

The scientific program of TEF-4 was subdivided into four larger themes, each theme represented by invited speakers and further oral presentations:

- Source and transfer of trace elements into food and feed
- Trace elements in nutrition and health
- Toxicology and risk assessment of trace elements in food
- Analytical advances in trace elements in food

The conference was opened by Joerg Feldmann, chair of Environmental Analytical Chemistry at the University of Aberdeen and symposium chair.

The first session on the "Source and Transfer of Trace Elements into Food and Feed" was chaired by Andrew Meharg (University of Aberdeen). The first invited speaker, David Salt (formerly of Purdue University, USA, and now at University of Aberdeen), opened the conference with a paper on the ionome of plants and its connection to the genome. He discussed how to unravel the relationship between the genes and their expression in terms of element distribution and concentration in plant cells. The session continued with papers on the uptake of toxic metals in rice, and finished with a second invited speaker, Fangje Zhao (Rothamsted Research Centre, UK), stressing the importance of arsenic and selenium speciation in soil for their uptake in crops.

The second conference theme, "Trace Elements in Nutrition and Human Health" (chaired by John Beattie and Heidi Goenaga-Infante of the UK), was opened by invited speaker Nancy Krebs (USA), reporting on her investigation of zinc and human health through the use of stable isotopes. Two more lectures on zinc followed that covererd biomarkers for zinc status determination and gastro-intestinal uptake. Gender-related differences in iron metabolism and essential elements in chocolate were the topics of two more oral presentations. The next invited speaker, Alan Sneddon (UK), reported on the importance of selenium to human health and its role as an

University of Aberdeen, King's College

antioxidant agent. Three further oral presentations dealt with selenium and selenium compounds in the diet, with another presentation on the iodine status of the Australian population. This theme was closed by invited speaker Philip White (UK), who stressed the possibility of biofortification of human nutrition with essential elements.

The third session on "Toxicology and Risk Assessment of Trace Elements in Food" (chaired by Francesco Cubadda, Italy; Eva Krupp, UK; and Marie Vahter, Spain) featured two invited speakers. Allan Smith (USA) connected arsenic metabolism and exposure with epidemiological risk assessments, while Marie Vahter stressed the importance of early life exposure and its life-long consequences. Two more oral presentations featured arsenic speciation in baby food and the gastro-intestinal tract. The second part of this session featured a variety of elements, starting off with invited speaker Xinbin Feng (China), who reported on methylmercury accumulation in rice grain in mercury-polluted areas of China. The role of manganese toxicity was evaluated by Tanja Schwerdtle (Denmark), which was followed by presentations on cerium, cadmium, and other toxic elements. The third part of this session dealt exclusively with arsenic, featuring invited speaker Beatriz de la Calle (EU) who reported on the importance of reference materials and standardized methods for arsenic determination in food. Four further presentations were given on the importance of arsenic and its determination in food, with a closing talk by Andrew Meharg (UK) on rice as an important source of arsenic.

The fourth theme, "Analytical Advances in Trace elements in Food" (chaired by Ryszard Lobinski, France, and Jens Sloth, DK) was opened by invited speakers Jens Sloth and Enzo Lombi (Australia). Sloth presented novel developments and discussed future needs in trace element analysis for food and feed. Lombi evaluated the usefulness of synchrotron techniques, which can determine element distribution in situ. Three additional oral presentations, featuring imaging, mercury speciation, and metallomics studies followed. Invited speaker Heidi Goenaga-Infante reported on the needs and challenges in the development of reference materials for selenium speciation in food and supplements. Georg Raber discussed pitfalls in arsenic speciation in food followed and the challenge of selenium speciation in a commercial standard. The last talk of the conference was given by invited speaker Ryszard Lobinski, who presented a detailed overview of highly advanced techniques in trace element determination in food stuffs.

IUPAC poster prizes were awarded as follows:

- "Micro-Scale Distribution of Cadmium, Zinc, and Manganese in Rice Node" presented by N. Yamaguchi and co-workers S. Ishikawa, T. Abe, K. Baba, T. Arao, and Y. Terada from the National Institute for Agro-Environmental Sciences and Synchrotron Radiation Research Institute in Japan
- "Hyphenation of RP-HPLC to HR-ICP-MS and Simultaneously to HR-ES-MS for Direct Identification and Quantification of Arsenolipids in Capelin Fishmeal" presented by K. Amayo and co-workers A. Petursdottir, H. Gunnlaugsdottir, C. Newcombe, A. Raab, E. Krupp, and J. Feldmann, University of Aberdeen, Scotland
- "Synthesis, Analysis and Cell Toxicological Characterization of Thio-DMA" presented by M. Bartel and co-workers L. Leffers, U. Karst, F. Ebert, and T. Schwerdtle from University of Muenster, Germany

The conference was complemented with a social program that included a tour of a Whisky Distillery, a visit to a Scottish Castle (Crathe's Castle) with its famous walled garden, and a trip to the fishing village of Stonehaven south of Aberdeen. An icebreaker party, held in the evening in the heart of the old King's College Campus, featured bagpipes, beer, and an optional whisky tasting. Monday night saw a Civic Reception in Cowdry Hall in the commercial center, sponsored by the Aberdeen City Council. On Tuesday night, Elphinstone Hall, often called the "Harry Potter Hall" was the venue for the conference dinner, which closed with a performance by one of the best Ceilidh bands of Scotland, Clachan Yell—everyone was encouraged to join the dance.

Exhibition, poster, and coffee/tea break in Elphinstone Hall.

www.abdn.ac.uk/tef-4/

www.ufscar.br/icgc4

4th International IUPAC Conference on GREEN CHEMISTRY

"Exchanging experiences towards a sustainable society taking care of natural resources in their socio-economic development"

25 – 29 august 2012
Foz do Iguaçu/PR, Brazil

CONFIRMED PLENARY SPEAKERS:

Paul Anastas *(EPA, USA)*
James Clark *(University of York, UK)*
Jairton Dupont *(University of Rio Grande do Sul, Brazil)*
Buxing Han *(Chinese Academy of Sciences, China)*
Adelio Machado *(Porto University, Portugal)*
Anita Marsaioli *(University of Campinas, Brazil)*
Robin Rogers (University of Alabama, USA)
Karl Barry Sharpless (Scripps Research Institute, USA)
Roger Sheldon (Delft University, the Netherlands)
Rajender Varma (EPA, USA)

ABSTRACT SUBMISSION CLOSES APRIL 30, 2012

IUPAC International Union of Pure and Applied Chemistry

Sociedade Brasileira de Química

CAPES CNPq FAPESP ufscar Universidad Nacional de La Plata UFPR

The Chemistry of Sustainable Supply Chains

1 June 2012, Toronto, Ontario, Canada

This workshop on the **Chemistry of Sustainable Supply Chains,** organized by the IUPAC Committee on Chemistry and Industry (COCI), will explore how chemistry-based industries are contributing to sustainable development in the various supply chains in the Great Lakes Region of North America. To be held 1 June 2012 in Toronto, Ontario, Canada, this workshop is the fourth in the COCI series previously held in Marl, Germany, Kawasaki, Japan, and Kuwait.

This workshop will focus on the Great Lakes region where many chemical companies and their customers and suppliers are situated. Its aim is to improve communication among chemical industries, chemical societies/IUPAC members or NAOs, and COCI. Although IUPAC occupies a unique and highly esteemed position at the center of the world of chemistry, better communication and understanding is needed. It is desirable for IUPAC to strengthen its relationship with chemical industries and absorb more suggestions from them for future activities.

COCI Corner

The format of the workshop will allow COCI to update key stakeholders on IUPAC activities, such as the safety training program, and to listen to their concerns and ideas, especially input regarding Rio+20. Finding desirable methods of interaction between industry and IUPAC will be an important outcome of the meeting.

This workshop is planned as part of IUPAC project 2011-053-1-022. Chemical companies, from small to medium enterprises to global players, are invited to take part and to support the workshop.

For more information or to suggest topics and speakers please contact Task Group Chair Bernard West <bernard.west@sympatico.ca>, COCI Chair Michael Droescher <m.droescher@t-online.de>, or COCI Member Carolyn Ribes <cribes@dow.com>.

www.iupac.org/web/ins/2011-053-1-022

Space Research

14–22 July 2012, Mysore, India

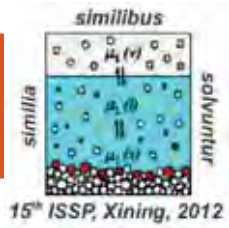
The **39th COSPAR Scientific Assembly** will take place 14–22 July 2012 at Narayana Murthy Centre of Excellence (Infosys Training Centre), Mysore, Karnataka, India. The assembly will offer 120 meetings covering the fields of COSPAR Scientific Commissions (SC) and panels. Following is a sampling:

- SC A: The Earth's Surface, Meteorology and Climate
- SC B: The Earth-Moon System, Planets, and Small Bodies of the Solar System
- SC C: The Upper Atmospheres of the Earth and Planets Including Reference Atmospheres
- SC D: Space Plasmas in the Solar System, Including Planetary Magnetospheres
- SC E: Research in Astrophysics from Space
- SC F: Life Sciences as Related to Space
- SC G: Materials Sciences in Space
- SC H: Fundamental Physics in Space
- Panel on Satellite Dynamics
- Panel on Scientific Ballooning
- Panel on Planetary Protection
- Panel on Capacity Building
- Panel on Education
- Panel on Exploration

Mysore Palace.

The abstract deadline is 10 February 2012. For more information contact the COSPAR Secretariat <cospar@cosparhq.cnes.fr>.

www.cospar2012india.org



Solubility and Equilibria

23–27 July 2012, Xining, China

The **15th International Symposium on Solubility Phenomena and Related Equilibrium Processes** (15th ISSP) will be held 23–27 July 2012 in Xining, China. This will be the latest in a successful series of biennial meetings that brings together scientists from diverse subject areas in which solubility and associated equilibria play important roles.

Traditionally the symposium deals with all aspects of solubility: in and between solids, liquids and gases, new experimental methods for the investigation of solubility phenomena, new analytical techniques, new experimental data, prediction of solubilities and phase equilibria by thermodynamic and molecular modelling, correlation with molecular structure, thermodynamic data bases, applications of solubility data and phase equilibria in industry, for the protection of the environment, and in geochemistry.

During the 15th ISSP, many presentations on solubility equilibria will be planned to honor Heinz Gamsjaeger on his 80th birthday in appreciation of his scientific contributions to solid-liquid equilibria research and his organizational activities in the IUPAC Solubility Data Project over many decades.

Solubility studies related to ionic liquids, solid solutions and salt lake brines will be among the main topics of this conference. By emphasizing the role of theoretical, thermodynamical and kinetic models in solubility determinations, and exploring the solution chemistry relevant to solubility phenomena, the meeting is expected to advance solubility research from onerous measurements to theoretical predictions.

The scientific program includes plenary and keynote lectures, oral presentations, a poster session, and a special workshop on "Solubility and Other Equilibria in Salt Brines." About 20 participants from developing countries will receive financial assistance to enable them to attend the symposium. As always, contributors from more than 30 countries are expected to attend the 15th ISSP. The symposium language will be English.

See Mark Your Calendar on page 37 for contact information.

http://issp2012.csp.escience.cn

Physical Organic Chemistry

9–13 September 2012, Durham, UK

The **21st IUPAC International Conference on Physical Organic Chemistry** (ICPOC21) will be held 9–13 September 2012 in Durham, a small city in north-east England whose castle and cathedral are designated World Heritage sites. The conference will consist of plenary, keynote, and contributed lectures, as well as poster sessions. Further information (including registration, location, travel, and how to apply for student bursaries) may be found on the conference website or by contacting RSC Events <events@rsc.org>.

The ICPOC meetings bring together a broad range of scientists from across the whole community who share a quantitative perspective on chemistry. Although traditionally considered as the study of mechanism, reactivity, structure, and equilibrium in organic systems, especially leading to the quantitative, molecular level understanding of their properties, physical organic chemistry now encompasses a wider range of contexts than ever before. This meeting will be structured around three themes, each covering several key topics:

- Physical underpinnings: dynamics in solution, scope and limitations of transition state theory, advances in reaction monitoring, new approaches to aromaticity.
- Mechanism and Catalysis: homogeneous—including organo- and organometallic; heterogeneous—including nanoparticles, mechanistic enzymology.
- Supramolecular and Systems Chemistry: noncovalent interactions, molecular self-assembly, gel-forming materials.

The Scientific Committee welcomes abstracts for contributed oral presentations and poster presentations. The deadline for oral presentations is 23 March 2012.

See Mark Your Calendar on page 40 for contact information.

www.rsc.org/ICPOC21

Chemistry: The Key for Our Future

2–6 July 2012, Mauritius

The **International Conference on Pure and Applied Chemistry** (ICPAC 2012) will be held 2–6 July 2012, in Mauritius. This second ICPAC conference, which follows a successful event in 2010, is being organized under the theme "Chemistry: The Key for Our Future."

The ICPAC 2012 conference program will feature a keynote lecture, a wide variety of plenary, invited, and contributed lectures, as well as poster sessions. Robert Huber, the 1988 Nobel Prize Winner in Chemistry, will deliver the keynote lecture. The island of Mauritius is famous for its sun, sea, and sand and multiculturalism.

For more information, please coontact Ponnadurai Ramasami <icpacmru@gmail.com>, chairman of the Organizing Committee.

www.uom.ac.mu/icpac/2012

Biotechnology for GreenWorld

16–21 September 2012, Daegu, Korea

The **15th International Biotechnology Symposium and Exhibition,** which is held every four years on a different continent, is recognized as the premier international conference in the rapidly growing field of biotechnology. The mission of the IBS is to promote R&D in all aspects of basic and applied biotechnology. The history of IBS dates back to 1960. For the first time, the IBS will be held in Korea, the fastest growing economy in the world.

Our society is facing unprecedented challenges including resources shortage, environmental deterioration, biodiversity loss, and economic and social imbalances. The overall theme of IBS 2012 is "Innovative Biotechnology for a Green World and beyond." Nine topic areas covering all aspects of biotechnology will be covered: 1) Pharmaceutical Biotechnology, 2) Medical Biotechnology, 3) Agricultural and Food Biotechnology, 4) Bioenergy & Biorefinery, 5) Environmental Biotechnology, 6) Applied Microbiology, 7) Process Biotechnology, 8) Biosensors and Nanobiotechnology, and 9) Biosafety, Bioeconomy, Bioploicy, Bioeducation, Bioethics.

See Mark Your Calendar on page 40 for contact information.

www.ibs2012.org

Mycotoxins and Phycotoxins

5–9 November 2012
Rotterdam, The Netherlands

The **7th Conference of The World Mycotoxin Forum® and the XIIIth IUPAC International Symposium on Mycotoxins and Phycotoxins** will be held jointly from 5–9 November 2012 in Rotterdam, The Netherlands. This unique combined event, WMF meets IUPAC, will build on the success of the previous conferences which were held separately all over the world.

The aim of WMF meets IUPAC is to increase awareness of human and animal health risks due to natural toxicant contamination in agricultural commodities and seafood, and of potential risk management options, technologies, and strategies for minimized contamination. The event will focus in particular on mycotoxins, phycotoxins, and plant toxins. It will provide a unique platform for the food and feed industry, regulatory authorities, and science:

- to exchange current information
- to promote the harmonization of food and feed safety regulations and control procedures
- to make recommendations for strategies enhancing the prevention and control of contamination
- to ensure the safety and wholesomeness of an adequate food and feed supply

WMF meets IUPAC will offer an excellent way to network and to share ideas, providing a reference source for anyone involved in these fields.

See Mark Your Calendar on page 40 for contact information.

www.WMFmeetsIUPAC.org

Mark Your Calendar

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

2012 (after 15 February)

15–18 February 2012 • The Role of Chemistry for Sustainable Agriculture • Pusa, Delhi, India
2nd International Conference on Agrochemicals Protecting Crops, Health and Natural Environment
Dr. Najam A. Shakil, Indian Agricultural Research Institute, Division of Agricultural Chemicals, New Delhi 110 012, India, Tel.: +91 981 819 6164, Fax: +91 11 2584 3272, E-mail: iamshakil@gmail.com

4–7 March 2012 • Heterocyclic Chemistry • Gainesville, Florida, USA
13th Florida Heterocyclic and Synthetic Conference
Prof. Alan R. Katritzky, University of Florida, Department of Chemistry, Gainesville, FL, 32611-7200, USA
Tel.: +1 352 392 0554, Fax: +1 352 392 9199, E-mail: katritzky@chem.fl.edu

26–30 March 2012 • Polymer Characterization • Dubrovnik, Croatia
20th International Conference on Polymer Characterization - World Forum on Advanced Materials
Dr Vera Kovacevic, University of Zagreb, Department of Chemical Engineering & Technology, Marulicev Trg., 19, HR-10000 Zagreb, Croatia, Tel.: +385 1 459 7188, Fax: +385 1 459 7260, E-mail: polychar20@fkit.hr

16–21 April 2012 • Chemical Sciences • Corfu, Greece
12th Eurasia Conference on Chemical Sciences
Prof Nick Hadjiliadis, University of Ioannina, Dept. of Chemistry, GR-45110 Ioannina, Greece
Tel.: +30 2 651 008 420, Fax: +30 2 651 008 786, E-mail: nhadjis@uoi.gr

20–25 May 2012 • Heteroatom Chemistry • Kyoto, Japan
10th International Conference on Heteroatom Chemistry
Prof. Norohiro Tokitoh, Kyoto University, Institute of Chemical Research, Gokasho, Uji, Kyoto 611-0011, Japan
Tel.: +81 774 38 3200, Fax: +81 774 38 3209, E-mail: tokitoh@boc.kuicr.kyoto-u.ac.jp

24–29 June 2012 • Macromolecules • Blacksburg, Virginia, USA
44th International Symposium on Macromolecules—IUPAC World Polymer Congress
Prof Timothy E. Long, Virginia Polytechnic University, Chemistry Dpt, VA 24061, USA
Tel.: +1 540 231 2480, Fax: +1 540 231 8517, E-mail: telong@vtu.edu

1–6 July 2012 • Organic Synthesis • Melbourne, Australia
19th International Conference on Organic Synthesis
Prof Mark Rizzacasa, University of Melbourne, School of Chemistry, The Bio21 Institute, Melbourne, Victoria 3010, Australia, Tel.: +61 3 3844 2397, Fax: +61 3 3947 8396, E-mail: masr@unimelb.edu.au

1–5 July 2012 • Macromolecules • Prague, Czech Republic
76th Prague Meeting on Macromolecules: Polymers in Medicine
Dr. Tomáš Etrych, Academy of Sciences of the Czech Republic, Institute of Macromolecular Chemistry, Heyrovsky Square, 2, CZ-162 06 Prague 6, Tel.: +420 296 809 224, Fax: +420 296 809 410, E-mail: etrych@imc.cas.cz

8–11 July 2012 • African Network of Analytical Chemists • Maputo, Mozambique
African Network of Analytical Chemists Analytical Chemistry Conference
Prof. Carvalho Madivate, University of Eduardo Mondlane, Department of Chemistry, Campus Universitario, Maputo 257, Mozambique, Tel.: +258 21 430 239, Fax: +258 21 304 405, E-mail: cmadivate@yahoo.com

15–20 July 2012 • Photochemistry • Coimbra, Portugal
XXIVth IUPAC Symposium on Photochemistry
Prof Hugh D. Burrows, University of Coimbra, Dept. of Chemistry, P-3004 535 Coimbra, Portugal
Tel.: +351 239 854 482, Fax: +351 239 827 703, E-mail: burrows@ci.uc.pt

15–20 July 2012 • Change in Chemistry Education • Rome, Italy
22nd International Conference on Chemical Education (ICCE) and 11th European Conference on Research In Chemical Education—Stimulating Reflection and Catalysing Change in Chemistry Education
Prof. Luigi Campanella, Conference Chair; Agency YES Meet, organizing secretariat
Tel: + 39 081 8770604, Fax: + 39 081 8770258, E-mail: info@iccecrice2012.org

22–27 July 2012 • Solubility Phenomenon • Xining, China
15th International Symposium on Solubility Phenomena and Related Equilibrium Processes
Prof. Dewen Zeng, Qinghai Institute of Salt Lakes, Xining Road, # 18, Xining 810008, China
Tel.: +86 13 618 496 806, Fax: +86 971 630 6002, E-mail: dewen_zeng@hotmail.com

Mark Your Calendar

22–27 July 2012 • Carbohydrate • Madrid, Spain
XVIth International Carbohydrate Symposium
Prof. Jesús Jiménez-Barbero, Centro de Investigaciones Biológicas, Consejo Superior de Investigaciones Ciencias, Ramiro de Maeztu 9, E-28040 Madrid, Spain
Tel.: +34 91 837 3112, Fax: +34 91 536 0432, E-mail: jjbarbero@cib.csic.es

5–10 August 2012 • Chemical Thermodynamics • Búzios, Brazil
22nd International Conference on Chemical Thermodynamics and 67th Calorimetry Conference
Prof. Watson Loh, Universidade de Estadual de Campinas, Instituto de Química, Caixa Postal 6154, Campinas, São Paulo 13083-970, Brazil, Tel.: +55 193 521 3001, Fax: +55 193 521 3023, E-mail: wloh@iqm.unicamp.br

25–29 August 2012 • Biomolecular Chemistry • Beijing, China
9th International Conference on Biomolecular Chemistry
Prof. Liangren Zhang, School of Pharmaceutical Sciences, Peking University Health Science Center, 38 Xueyuan Road, Beijing 100083, China, Tel.: +86 10 82 802 491, Fax: +86 10 82 802 638, E-mail: liangren@bjmu.edu.cn

25–29 August 2012 • Green Chemistry • Foz do Iguacu, Brazil
4th International IUPAC Conference on Green Chemistry
Prof. Vania Gomes Zuin, Federal University of Sao Carlos, Department of Chemistry, Rodovia Washington Luis, Sao Carlos, 1365-905, Brazil, Tel.: +55 163 361 8096, Fax: +55 163 361 8350, E-mail: vaniaz@ufscar.br

9–13 September 2012 • Coordination Chemistry • Valencia, Spain
40th International Conference on Coordination Chemistry
Prof. Eugenio Coronado, University of Valencia, Institute of Molecular Sciences, C/ Catedrático José Beltrán 2 E-46980 Paterna, Valencia, Tel.: +34 963 544 4415, Fax: +34 963 543 273, E-mail: eugenio.coronado@uv.es

9–13 September 2012 • Physical Organic Chemistry • Durham, United Kingdom
21st International Conference on Physical Organic Chemistry
Professor Ian H. Williams, Department of Chemistry, University of Bath, Claverton Down, Bath BA2 7AY, United Kingdom, Tel.: + 44 1225 386 625, Fax: + 44 1225 386 231, E-mail: i.h.williams@bath.ac.uk

11–14 September 2012 • Polymer-Solvent Complexes • Kiev, Ukraine
9th International Conference on Polymer-Solvent Complexes and Intercalates
Professor L. Bulavin, Kiev National Taras Shevchenko University, Department of Physics, Volodymyrska, 60, UA-01610 Kiev, Ukraine, Tel.: +380 044 526 45 37, Fax: +380 044 526 44 77, E-mail: bulavin221@gmail.com

15–20 September 2012 • Pesticide and Environmental Safety • Beijing, China
4th International Symposium on Pesticide and Environmental Safety & 8th International Workshop on Crop Protection Chemistry and Regulatory Harmonization
Prof. Zhang Jing, China Agricultural University, Centre for Chemicals Applications Technology, Yuanmingyuan West Road, Beijing 100193, China, Tel.: +86 10 6273 1456, Fax: +86 10 6273 3688, E-mail: zj810515@163.com

15–20 September 2012 • Catalysis in Organic Synthesis • Moscow, Russia
International Conference on Catalysis in Organic Synthesis
Prof. Mikhail P. Egorov, Russian Academy of Sciences, Zelinsky Institute of Organic Chemistry, 47 Leninsky Prospekt, B-334, RF-119991 Moscow, Russia, Tel.: +7 095 135 5309, Fax: +7 095 135 5328, E-mail: mpe@ioc.ac.ru

16–21 September 2012 • Biotechnology • Daegu, Korea
15th International Biotechnology Symposium and Exhibition
IBS 2012 Secretariat, 6F, Sunghwa B/D, 1356-51 Manchon, 1-Dong, Suseong-Gu, Daegu 706-803, Korea
Tel.: +82 53 742 5557, Fax: +82 53 742 9007, E-mail: info@ibs2012.org

14–19 October 2012 • Novel Materials • Xian, China
8th International Conference on Novel Materials and their Synthesis
Prof. Yuping Wu, Fudan University, Department of Chemistry, New Energy & Materials Laboratory, Shanghai, 200433, China, Tel.: +86 21 55 664 223, Fax: +86 21 55 664 223, E-mail: wuyp@fudan.edu.cn

5–9 November 2012 • Mycotoxin • Rotterdam, Netherlands
7th World Mycotoxin Forum and XIIIth International IUPAC Symposium on Mycotoxins & Phycotoxins
Ms. Helena B. Bastiaanse (Program Coordinator), Bastiaanse Communication, P.O. Box 179, NL-3720 AD Bilthoven, Netherlands, Tel.: +31 302 294 247, Fax: +31 302 252 910, E-mail: helena@bastiaanse-communication.com

ICCE ECRICE

22nd International Conference on Chemistry Education
11th European Conference on Research In Chemical Education

Website

http://www.iccecrice2012.org/

Topics

Communicating Chemistry
Didactics of Third Level Chemistry
ICT and Multimedia in Teaching Chemistry
Didactics of Second Level Chemistry
Laboratory Work in Teaching Chemistry

Venue

The congress ICCE-ECRICE 2012 will be held at the University of Rome "La Sapienza", the largest and one of the oldest European university being founded in 1303.
In Italian, *"sapienza"* means *"wisdom"* or *"knowledge"*.

Organisers

IUPAC International Union of Pure and Applied Chemistry
European Association for Chemical and Molecular Sciences
coordinated by its DIDACTICS DIVISION Società Chimica Italiana
SAPIENZA Università di Roma
Dipartimento di Chimica

For the first time, the two major conferences on Chemical Education will join under the same roof, that of Rome, the eternal City: we are really proud for this and we will do our best to ensure full success of the event and a wonderful Italian trip of all the conveners.
We hope that the Rome Conference will be remembered in the future for its contribution to the growth of the quality in Chemical Education. We are working hard to assemble a high-level scientific program as well as setting up working, living and leisure conditions suitable to make ICCECRICE 2012 a memorable event.

I am sure that you will like to be part of it!
See you in Rome!

Organizing Secretariat

e-mail: info@iccecrice2012.org
Tel +39 081 8770604 - Fax +39 081 8770258

IUPAC

ADVANCING THE WORLDWIDE ROLE OF CHEMISTRY FOR THE BENEFIT OF MANKIND

MISSION

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

NATIONAL ADHERING ORGANIZATIONS

Australian Academy of Science *(Australia)*
Österreichische Akademie der Wissenschaften *(Austria)*
Bangladesh Chemical Society *(Bangladesh)*
The Royal Academies for the Sciences and Arts of Belgium *(Belgium)*
Brazilian Chemical Society *(Brazil)*
Bulgarian Academy of Sciences *(Bulgaria)*
National Research Council of Canada *(Canada)*
Sociedad Chilena de Química *(Chile)*
Chinese Chemical Society *(China)*
Chemical Society located in Taipei *(China)*
Croatian Chemical Society *(Croatia)*
Sociedad Cubana de Química *(Cuba)*
Pancyprian Union of Chemists *(Cyprus)*
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)*
Royal Irish Academy *(Ireland)*
Israel Academy of Sciences and Humanities *(Israel)*
Consiglio Nazionale delle Ricerche *(Italy)*
Caribbean Academy of Sciences—Jamaica Chapter *(Jamaica)*
Science Council of Japan *(Japan)*
Jordanian Chemical Society *(Jordan)*
Korean Chemical Society *(Korea)*
Kuwait Chemical Society *(Kuwait)*
Fonds National de la Recherche *(Luxembourg)*
Institut Kimia Malaysia *(Malaysia)*
Koninklijke Nederlandse Chemische Vereniging *(Netherlands)*
Royal Society of New Zealand *(New Zealand)*
Chemical Society of Nigeria *(Nigeria)*
Norsk Kjemisk Selskap *(Norway)*
Chemical Society of Pakistan *(Pakistan)*
Polska Akademia Nauk *(Poland)*
Sociedade Portuguesa de Química *(Portugal)*
Colegio de Químicos de Puerto Rico *(Puerto Rico)*
Russian Academy of Sciences *(Russia)*
Serbian Chemical Society *(Serbia)*
Slovak Chemical Society *(Slovakia)*
Slovenian Chemical Society *(Slovenia)*
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Swiss Chemical Society *(Switzerland)*
Tanzania Chemical Society *(Tanzania)*
Chemical Society of Thailand *(Thailand)*
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Royal Society of Chemistry *(United Kingdom)*
National Academy of Sciences *(USA)*
Programa de Desarrollo de Ciencias Básicas *(Uruguay)*

INTERNATIONAL UNION OF
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