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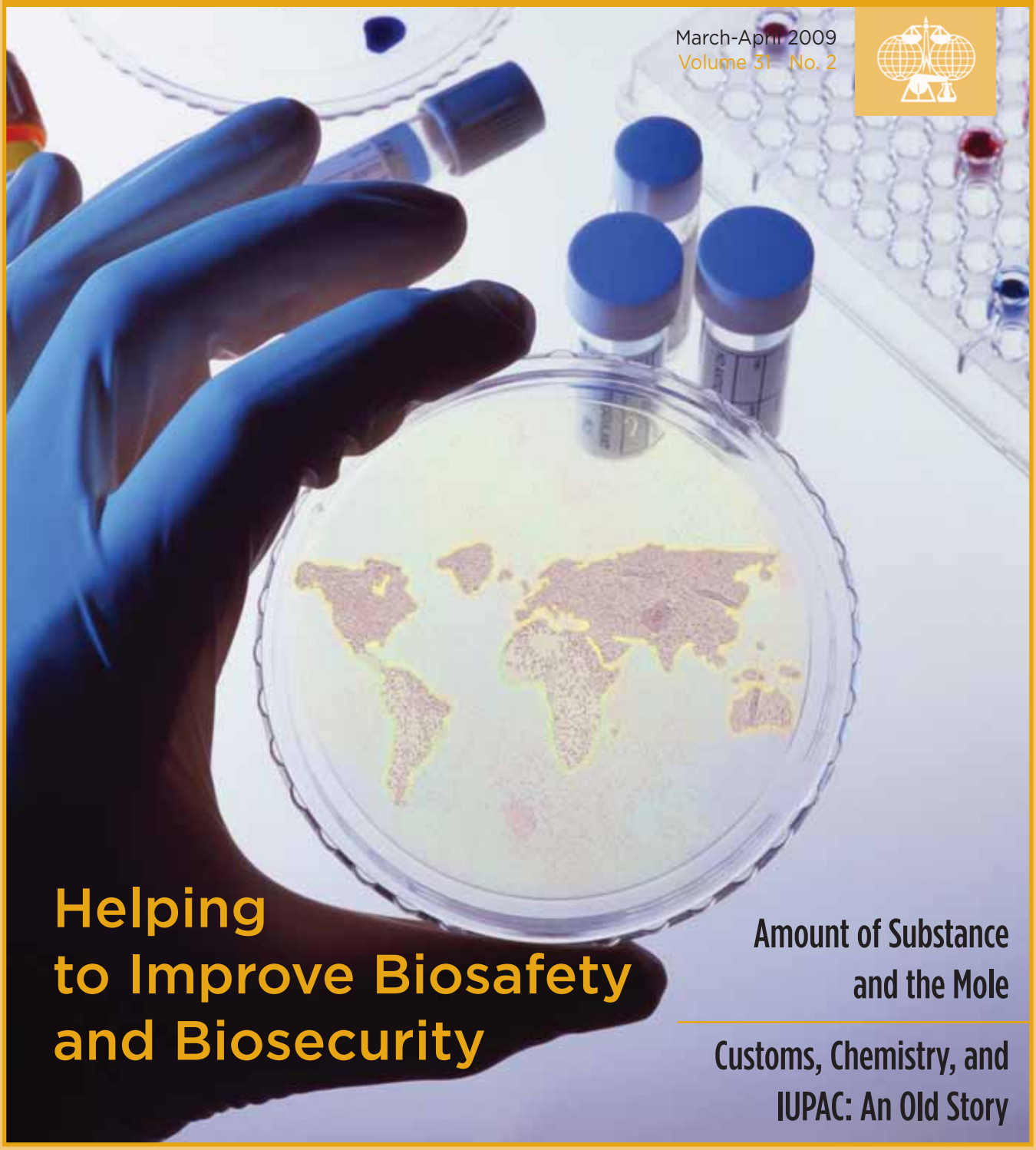

Helping to Improve Biosafety and Biosecurity

Amount of Substance and the Mole

Customs, Chemistry, and IUPAC: An Old Story

CHEMISTRY International

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

www.iupac.org/publications/ci

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From the Editor

In less than 6 months, we will meet for the biennial IUPAC Congress and General Assembly (GA) in Glasgow, UK. IUPAC members engaged in divisions and committees will, as usual, juggle a busy schedule of meetings, but also hopefully find the time to participate in the Congress organized by the Royal Society of Chemistry.

In recent years, IUPAC Congresses have been flagged with major themes. This year's theme is "Chemistry Solutions." Two years ago, in Torino, Italy, the theme was "Chemistry Protecting Health, Natural Environment, and Cultural Heritage." In 2005, in Beijing, China, it was "Innovation in Chemistry." In 2003, in Ottawa, Canada, it was "Chemistry at the Interfaces," and in 2001, in Brisbane, Australia, it was "Frontiers in Chemistry."

Interestingly, these themes reflect how chemistry is changing, how the chemistry community sees itself, and how chemists necessarily adapt to the world around them. While academic research focuses on pinning down a problem, it is a contemporary necessity to design "solutions." Today, many recognize that chemists help to make a better world by providing solutions to pressing problems involving health, water, energy, and the environment. As the organizers of the Glasgow event advertise (p. 2), "the aim of the 42nd IUPAC Congress is to reflect the breadth of the chemical sciences, highlighting the impact of our science and exciting innovations with an overall focus on 'Chemistry Solutions.'"

During the GA, it is hoped that the more compact schedule offered this year will also catalyze "solutions." How the Union and its numerous committees will approach and plan for the celebration of the 2011 International Year of Chemistry will surely be a topic of discussion among many, if not all, groups. "The IYC2011 will give a global boost to chemical science in which our life and our future are grounded," says Jung-Il Jin, IUPAC president. It will also provide an opportunity for chemists to portray themselves as "solution providers."

In this issue of *CI*, a range of articles shows how IUPAC is key to many aspects of our science—from the pure to the applied. On the "pure" end, Mills and Milton give us an update on the mole and clarify some of the basic concepts. On the "applied" front, Schepers reviews how complex and "nightmarish" the naming of chemicals can be for customs officials, and outlines some possible solutions. Another "applied" contribution involves biosafety and security. Articles in the Project Place section (p. 20) demonstrate even more "solutions" or plans for solutions.

See you and your solutions in Glasgow!

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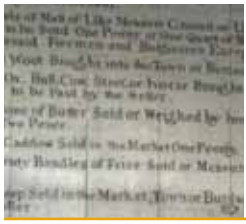
Contents

CHEMISTRY International March-April 2009 Volume 31 No. 2



Stamps International 12

Chemistry Solutions

by Paul O'Brien and John Evans

From 2–7 August 2009, scientists from across the globe will come together at Glasgow's iconic Scottish Exhibition and Conference Centre (SECC) for the IUPAC Congress, one of the world's most prestigious international chemistry conferences. Four years ago, the Royal Society of Chemistry (RSC) was successful in its bid to host IUPAC's biennial congress, and with just over six months to go, many activities have been planned, and the opportunities to get involved are abundant.

Paul O'Brien

John Evans

Our program will feature 50 symposia that will demonstrate the impact of the chemical sciences, highlight exciting innovations, and emphasize the ongoing importance of "chemistry solutions."

We are delighted to have a number of world-class plenary speakers confirmed, including Sir Fraser Stoddart, Sir Harry Kroto, Richard Zare, and Louise Johnson (DBE). One of Britain's leading biophysicists, Dame Louise is the David Philips Professor of Molecular Biophysics in Oxford University's Biochemistry Department.

In addition, we have received many submissions for oral presentations, and the conference website has been updated with the full program so you can best plan your time at the congress. With 15 parallel sessions taking place each day, plus end-of-day satellite meetings still being added, delegates will have a wide range of topics and talks to choose from.

The 2009 IUPAC Congress will also include a lively social program. Included in the registration fee is the welcome reception on 2 August at the Glasgow Science Centre, Scotland's leading science attraction, just across the River Clyde from the SECC. After sessions Monday through Thursday, we will welcome everyone back to the exhibition hall for poster and networking receptions, also included in your registration. And Thursday will feature the conference banquet, to be held at Glasgow's magnificent Kelvingrove Art Gallery and Museum.

Read on for details of the poster and registration deadlines, and discounts and exhibition options. And, don't forget to book your place by 5 June to take advantage of our IUPAC affiliate early-bird discount.

We look forward to welcoming you to one of Europe's most exciting cities for a world-class conference and exhibition. See you in Glasgow!

Paul O'Brien, a professor at the University of Manchester, is chairman of the 42nd IUPAC Congress. John Evans, a professor at the University of Southampton, is scientific chairman of the congress.

General Information:

Registration: Register online and learn about accommodations, social events, and partner activities. The deadline for early bird registration is 5 June 2009; the deadline for standard registration is 3 July 2009. Plus, don't forget that IUPAC affiliates are eligible for a discounted member rate. If you register before the early bird deadline of 5 June, you'll receive an even bigger savings—more than 25 percent off the full standard registration fee.

Abstracts: A major exhibition and poster display will be the focal point of the congress. Full details on how to submit your poster abstract are available online. The deadline for submissions is 5 June.

Sponsorships: Some exhibition and sponsorship opportunities still remain, so contact RSC today to discuss advertising your organization's activities to an international audience. The exhibition already features a range of companies from makers of analytical instruments to pharmaceuticals.

www.iupac2009.org

Scottish Exhibition and Conference Centre, Glasgow, Scotland, site of the 42nd IUPAC Congress, 2–7 August 2009.

Amount of Substance and the Mole

by Ian Mills and Martin Milton

The International System of Units, the SI, is built upon seven base quantities and seven base units, as summarized in the table below. Although most of these are familiar to all scientists, the quantity "amount of substance" and its unit "mole" are less familiar and are mainly used by chemists.[1] In the chemistry community, the unit "mole" is familiar, but the name of the corresponding quantity "amount of substance" is not so familiar, and the concept is still a source of difficulty for many students. This article reviews and clarifies these two concepts[2] and discusses the definition of the unit "mole" and its possible revision.

Martin Milton (left) and Ian Mills

Base quantity	symbol	Base unit	symbol
length	*l*	metre	m
mass	*m*	kilogram	kg
time, time interval	*t*	second	s
electric current	*I*, *i*	ampere	A
thermodynamic temperature	*T*	kelvin	K
amount of substance	*n*	mole	mol
luminous intensity	I_v	candela	cd

Amount of Substance

Amount of substance, symbol *n*, is a **quantity** that measures the size of an ensemble of entities. It appears in thermodynamic relations, such as the ideal gas law, and in stoichiometric relations between reacting molecules, as in the Law of Multiple Proportions. Familiar equations involving *n* are thus

$$pV = nRT \qquad (1)$$

for an ideal gas, and the equation

$$c = n/V \qquad (2)$$

for the amount-of-substance concentration (usually called simply the concentration, the molar concentration, or the amount concentration) of a solution. Here, *V* is the volume of a solution containing the amount of solute *n*. Another important relation is that between amount of substance *n* and mass *m* for a pure sample

$$n = m/M \qquad (3)$$

where *M* is the mass per amount of substance, usually called the "molar mass." Similarly, amount concentration *c* (SI unit mol/dm^3) may be related to mass concentration ρ (SI unit g/dm^3) by the equation

$$c = \rho/M \qquad (4)$$

An important application of the quantity *n* in chemistry is to the way in which molecules react in a titration (or more generally in any chemical reaction); molecules (or ions or entities) of X always react with molecules (or ions or entities) of Y in a simple ratio, such as 1:1, or 1:2, or 2:1, and so forth. This is the most fundamental concept of chemical reactions. Thus, the ratio of volumes of solutions of X and Y that react together in a titration are given by

$$\left(\frac{V_X}{V_Y}\right) = \left(\frac{n_X / c_X}{n_Y / c_Y}\right) = \left(\frac{n_X / n_Y}{c_X / c_Y}\right) \qquad (5)$$

where the quantity (n_X/n_Y) is a simple rational fraction. Hence, the concentration of an unknown solution may be determined from the concentration of a standard solution by measuring the volumes in a titration. This is the law of multiple proportions.

It is difficult to give formal definitions for quantities, particularly base quantities, such as length, mass, time, temperature, and amount of substance. The most useful definitions of quantities are in terms of the equations that relate them to other quantities, and, in this way, derived quantities are defined in terms of base quantities. But defining the base quantities is more difficult. The best formal definition of "amount of substance" is as follows:

> Amount of substance is a quantity proportional to the number of entities *N* in a sample. The proportionality constant is the same for all substances and is the reciprocal of the Avogadro constant N_A.

> The entities may be atoms, molecules, ions, electrons, other particles, or specified groups of such particles.

The quantity amount of substance, *n*, is thus an alternative to using the quantity number of entities, *N*. They are related by the equation

$$n = N/N_A \qquad (6)$$

where N_A is the Avogadro constant, a fundamental constant whose value is related to the unit of amount of substance *n*. Because the number of entities *N* is a dimensionless number, the dimension of N_A is the reciprocal of the dimension of *n* and is thus (amount of substance)$^{-1}$.

One might reasonably ask why we need the quantity amount of substance *n* at all. Why not simply use number of entities *N* in its place? There are three reasons for preferring the use of *n* rather than *N*:

1. First, equations, such as Equation 3, can be used to determine molar mass *M*, or amounts in terms of moles, without knowing the value of the Avogadro constant. The atomic weights of atoms in the periodic table were known long before the value of the Avogadro constant was known with similar accuracy. Even today, the value of the Avogadro constant is known only to about a part in 10^7, whereas many atomic weights are known to about a part in 10^9 or better.

2. A second reason is practical: The number of entities is generally of the order 10^{23}, whereas *n* is generally a number of order 1 when expressed in moles. Thus, for example, in a chemistry laboratory, the concentration of solutions is typically quoted in moles per litre, with numbers in the general order of magnitude 1. It would be inconvenient to quote concentrations in molecules per litre, with numbers of the order 10^{23}. Thus we find bottles labeled "0.1 M NaOH," where M is read as "molar" and is an accepted shorthand for the unit mol/L = mol/dm^3. The quantity amount of substance may be seen as a device used to handle the same quantitative information with much smaller numbers.

3. A third motivation for introducing the quantity amount of substance with the mole as a base unit is that it extends the power of dimensional analysis in chemistry, and to equations involving chemical quantities. This follows from the fact that *n* is a base quantity with its own dimension, whereas *N* is dimensionless.

The Mole

The mole, with symbol mol, is the SI **unit** for the quantity amount of substance. It is currently defined as follows:[3]

> The mole is that amount of substance that contains the same number of elementary entities as there are atoms in 12 g of carbon 12. When the mole is used, the entities must be specified and may be atoms, molecules, ions, electrons, other particles, or specified groups of such particles.

It follows that the numerical value of the Avogadro constant, denoted $\{N_A\}$, expressed in the unit mol^{-1}, is simply the number of atoms in 12 g of carbon 12, so that the value of the Avogadro constant is directly related to the definition of the mole. The present best estimate of the Avogadro constant is[4]

$$N_A = 6.022\ 141\ 79\ (30) \times 10^{23}\ \text{mol}^{-1} \quad [u_r = 5 \times 10^{-8}] \qquad (7)$$

where the number in square brackets is the relative standard uncertainty.

The effect of this definition is that the molar mass of carbon 12, $M(^{12}C)$, is exactly 12 g/mol, and the molar mass of any atom or molecule X is determined from its atomic or molecular weight by simply multiplying by the unit g/mol, without the need to know the value of the Avogadro constant. This is summarized in the relations

$$M(^{12}C) = A_r(^{12}C)\ \text{g/mol} = 12\ \text{g/mol} \qquad (8)$$

$$M(X) = A_r(X)\ \text{g/mol} \qquad (9)$$

Here, $A_r(X)$ is the recommended symbol for the molecular weight of the entity X. The atomic or molecular weight of an entity is actually the relative atomic or molecular mass, relative to the value for the carbon 12 atom taken as exactly 12. The names "atomic weight" and "molecular weight" are universally used and have been officially sanctioned by IUPAC, although they are actually dimensionless quantities and are not either masses or weights.

The Names "Mole" and "Amount Of Substance"

The name "mole" has been—and still is—the cause of some confusion. Its origin has been discussed in several publications.[5] The terms "*Kilogrammemolekuel*" and "*g-Molekel*" were used by German scientists in the 1880s and 1890s. The term "gramme-molecule" was first used in English in 1893 in an article in the *Encyclopedia Britannica*. As the term implies, one gram molecular weight of a substance X is that amount in a mass equal to the molecular weight expressed in grams.

These terms proved too awkward for everyday use, and the shortening of the term "*g-Molekel*" to "*Mol*" was first recorded in 1898 by Nernst.[6] The term "mole" appears in English for the first time in the translation of Ostwald's *Principles of Inorganic Chemistry*, published in 1902, in which Ostwald associated the term with a standard number of molecules. Thus, one gram molecule of X became one mole of X.

The development of mass spectrometry and the discovery of isotopes in the early twentieth century led to the transition of atomic weights from a basis of either 16 for the naturally occurring mix of oxygen isotopes (used in chemistry) or 16 for the ^{16}O isotope (used in physics), and eventually to the use of 12 for ^{12}C, adopted in 1961 and described as the "unified atomic mass scale." During this period, it was recognized that the quantity for which the mole was a unit itself deserved recognition as a quantity, and it was given the name "amount of substance." The International Committee for Weights and Measures (Comité International des Poids et Mesures, CIPM), with the support of IUPAC, the International Union of Pure and Applied Physics (IUPAP), and the International Organization for Standardization (ISO), adopted "amount of substance" as a base quantity and "mole" as a base unit in 1971.[7]

It must be admitted that the name "amount of substance" is not well chosen; the word "amount" has a common dictionary meaning, and the additional words "of substance" seem inadequate to imply chemists' more special meaning for this name. It was the original intention that the words "of substance" should be replaced by the specification of the entity whenever possible, so that one would say (for example) "amount of benzene, C_6H_6" or "amount of hydrogen ions, H^+." Note the importance of specifying the molecular formula of the entity. For example, "amount of sulphur" might refer to an entity S, or S_2, or S_8 without further specification of the molecular formula. Yet in practice, many people say "amount of substance of benzene," or even "amount of substance of substance benzene," which is long winded and seems like a tautology in addition to being ambiguous.

Other names have been suggested for the quantity *n*. A possible name might be "chemical amount," because this quantity has to do with chemistry. The name "chemical amount" for *n* would then naturally extend to the name "chemical concentration" for *c* (compare with the name "mass concentration" for *C*), and when there is no confusion, the adjective "chemical" might be dropped—leading to the names that are usually used today in such phrases as "an amount of three moles," or "a concentration of 0.1 mol/dm^3." The name "enplethy" has also been suggested for amount of substance; see the discussion on page 4 of the new edition of the IUPAC *Green Book*.[8]

Another name for *n*, which is the name that most chemists use, is simply "number of moles." However, this name is problematic because it confuses the name of the quantity with the name of the unit. For this reason, we would not regard "number of kilograms" as an acceptable synonym for "mass" nor "number of kelvins" as an acceptable synonym for "temperature." A clear understanding requires that we always distinguish between quantities and units. Thus, mass is a quantity, for which kilogram (or gram, or milligram) is a unit; similarly, we wish to say that amount of substance is a quantity, for which mole (or millimole, or micromole) is a unit.

Setting aside the difficulties with the name "amount of substance," it is important to realize that in the system of quantities and units that is now universally adopted in chemistry, amount of substance *n* is regarded as a base quantity with its own dimension, whereas—in contrast—number of entities *N* is regarded as a dimensionless quantity.

A Possible New Definition for the Mole

The current definition of the seven base units of the SI is given in the *SI Brochure*.[3] However, proposals are under discussion to adopt new definitions for four of the base units. This follows from our desire to define each of the base units in relation to one of the fundamental constants of physics, or the properties of a simple atom, because we believe these to be the most stable and reliable constants of nature available. Specifically, new definitions are being considered for

the kilogram, ampere, kelvin, and mole. This is the subject known as quantum metrology, and the proposals are discussed in detail elsewhere.[9] However, the proposed new definition of the mole is particularly relevant to this discussion, and the suggestion is that it should simply specify the number of entities in a mole. This new definition might then read as follows:

> The mole is that amount of substance of a system that contains exactly 6.022 141 79 x 10^{23} specified elementary entities, which may be atoms, molecules, ions, electrons, other particles, or specified groups of such particles.

The effect of this new definition would be to fix the value of the Avogadro constant to be 6.022 141 79 x 10^{23} mol^{-1} exactly. The number would be chosen to be the best estimate of the numerical value of the Avogadro constant at the time the new definition is adopted, thus ensuring continuity in the value of the mole.

This new definition would be conceptually simpler than the current definition, which is chosen to fix the molar mass of carbon 12 rather than the number of entities in a mole. Also, the new definition would no longer be dependent on the kilogram, so that uncertainties in realizing the definition of the kilogram would no longer be transmitted to the mole, as they are at present.

The Molar Mass Constant M_u

Many of the relations between the quantities discussed here can be simplified by introducing the molar mass constant M_u, defined as one twelfth of the molar mass of the carbon 12 atom. This is the natural analog on the macroscopic scale of the unified atomic mass constant m_u on the atomic scale, defined as one-twelfth of the mass of a carbon 12 atom. The quantity m_u is often used as a unit of atomic mass, denoted either u (for "unified") or Da (for "dalton," a name for this unit that is widely used in the biosciences for expressing the mass of biomolecules with many thousands of atoms). Thus, we have

$$M_u = M(^{12}C) / 12 \qquad (10)$$

and

$$m_u = m(^{12}C) / 12 = 1\ u = 1\ Da \qquad (11)$$

The molar mass $M(X)$ of any entity X is then given in terms of the molecular weight $A_r(X)$ by the equation

$$M(X) = A_r(X)\, M_u \qquad (12)$$

just as the atomic mass of the entity X is given by

$$m(X) = A_r(X)\, m_u \qquad (13)$$

In the current SI, M_u = 1 g/mol exactly, and the Avogadro constant is an experimentally determined quantity (the number of atoms in 12 g of carbon 12), whose value is currently known with a relative standard uncertainty of about 5 x 10^{-8} (CODATA 2006). With the new definition proposed above, M_u will initially have the same value of 1 g/mol, but it will be an experimentally determined quantity with an uncertainty, and its value may change slightly from 1 g/mol as a result of future adjustments in the values of other constants. However, the relative change of M_u from the value 1 g/mol is unlikely ever to be greater than a few parts in 10^9, and this is so much smaller than the uncertainty with which chemical measurements are likely to be made that for all practical purposes, chemists may still treat M_u as being equal to 1 g/mol.

The relation between the Avogadro constant and the Planck constant presented by Mohr and Taylor,[4] which follows from the theoretical expression for the Rydberg constant R_∞, remains true under both the current and new definition of the mole:

$$\left(\frac{M(^{12}C)}{12}\right) = M_u = \left(\frac{2R_\infty N_A h}{\alpha^2 c A_r(e)}\right) \qquad (14)$$

In this equation, α is the fine structure constant, c is the speed of light in a vacuum, h is the Planck constant, and $A_r(e)$ is the relative mass of the electron on the unified atomic mass scale.

The molar mass constant M_u has not been much used in the established literature. It can, of course, always be replaced by the expression $M(^{12}C)/12$, which is how it is defined. We believe that this constant could be used to greater advantage than it is at present—in teaching chemistry, for example, to simplify the expression for calculating the molar mass of atoms and molecules.

Summary and Acknowledgements

It is something of a paradox that such concepts as the quantity "amount of substance" and its unit "mole," so widely used by practical chemists, are also the subjects of widespread misunderstanding. The proposed

new definition for the mole would simplify the link between the mole and the Avogadro constant, which has its own long and rich history.

This short article owes much to a paper drafted by B.N. Taylor for the benefit of the Consultative Committee for Units meeting held in June 2007. We are also grateful to Fabienne Meyers for a number of suggestions that improved this manuscript.

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Customs, Chemistry, and IUPAC: An Old Story

by Hervé Schepers

For many people, mention of a customs authority or agency brings to mind those annoying officials at the border who inspect your luggage and confiscate your travel souvenirs. Obviously, this is only a partial view of what customs does. Customs is responsible for collecting and safeguarding customs duties and for controlling the flow of goods, including animals, personal effects, and hazardous items, in and out of a country. Depending on local legislation and regulations, the import or export of some goods may be restricted or forbidden, and the customs agency enforces these rules.

Customs authorities have existed in some form since the earliest civilizations. Archaeologists and historians have discovered many artifacts and documents related to ancient customs operations, including numerous, sometimes very detailed, catalogs of goods subject to tariffs. In the past, tariffs formed a much larger part of government revenue than they do today. Modern customs authorities are more involved in the protection of the economy, health, environment, and security. In particular, customs authorities are responsible for controlling the flow of illegal drugs, chemical weapons, ozone-depleting substances, and many other dangerous chemicals. Customs can be seen as an interface with the rest of the world: Everything coming in or going out passes through customs offices.

A 1788 sign describing customs, tolls, and duties of the Corporation of Kinsale, a town in County Cork, Ireland.

Customs authorities and chemistry have been linked for hundreds if not thousands of years. In all likelihood, officials in antiquity controlled the quality of wine or olive oil. In Europe, modern customs chemistry labs trace their origins back at least 150 years ago. The Austrian Customs laboratory was founded in 1848. Jacobus H. van't Hoff, winner of the Nobel Prize in Chemistry in 1901, led the Dutch Customs laboratory. Today, European Customs includes an impressive network of 81 well-equipped and mostly accredited laboratories.

Customs and IUPAC are deeply linked in three ways: legislation, translation, and identification.

Legislation

The European Commission's Taxation and Customs Union produces legislation and procedures for customs, including the calculation of customs duties. An essential part of its function is the publication of a "customs nomenclature" or Combined Nomenclature (CN)[1] for customs, which lists all traded goods. This nomenclature is based on the Harmonized Commodity Description and Coding System of the World Customs Organization and serves as a basis for other regulations, such as autonomous suspension of customs duties and the pharmaceutical–General Agreement on Tariffs and Trade agreement. The CN code is one of the most important elements in the customs declaration and in customs control.

One extract of the Combined Nomenclature

CN code	Description	Conventional rate of duty (%)
2933 99 20	Indole, 3-methylindole (skatole), 6-allyl-6,7-dihydro-5*H*-dibenz[c,e]azepine (azapetine), phenindamine (INN) and their salts; imipramine hydrochloride (INNM)	5,5

Because customs operations require a precise and clear international language for chemicals, the European Customs Union and the World Customs Organization decided long ago to use the IUPAC nomenclatures in their Combined Nomenclature and, subsequently, in all legislation. Especially in the customs field, precision is important, because customs duties, preferential duties, and prohibitions are often applied according to a specific name. When the name in the legislation and the name on the customs declaration or on the invoice do

not correspond, it can have important consequences for businesses in terms of money or time.

For customs officials, different names mean different products; they cannot be blamed, they are not chemists. For example, o-cresol, ortho-cresol, and 1,2-cresol might be considered three different products, or "acetic acid, ethyl ester" as a group of two products.

But, IUPAC names are not a perfect solution either. Creating a good name is not necessarily easy, even for a chemist with the "recommended," "accepted," or "discarded" options to choose among. And customs officials do not like names like methyl (1R,4Z,8S,13E)-13-[2-[[2-[[[p-(3-carbamoylpropoxy)-α-methylbenzylidene]hydrazino]carbonyl]-1,1-dimethylethyl]dithio]ethylidene]-8-[[4,6-dideoxy-4-[[[2,6-dideoxy-4-S-[4-[(6-deoxy-3-O-methyl-α-L-mannopyranosyl)oxy]-3-iodo-5,6-dimethooxy-o-toluoy]-4-thio-β-D-ribo-hexopyranosyl]oxy]amino]-2-O-[2,4-dideoxy-4-(N-ethylacetamido)-3-O-methyl-α-L-threo-pentopyranosyl]-b-D-glucopyranosyl]oxy]-1-hydroxy-11-oxobicyclo[7.3.1]trideca--4,9-diene-2,6-diyne-10-carbamate (ozogamicin (INN)).

Translation

If the creation of a chemical name is difficult, the translation can be a real nightmare. To start, all European Union legislation must be translated into 22 languages (the customs tariff is not yet translated into Irish). Regularly, new member states join the EU, adding new languages to the translation list.

Clearly, customs is a legal domain in which the difference of one letter or number is important. The translation of chemical names into 22 languages involves numerous modifications to concatenation, inversion, letters, word endings, alphabetical order of substituents, and first capital letters. The sources for mistakes are numerous.

An example of a simple chemical name in all the current EU languages follows:

BG	Калциев хлорид
CS	Chlorid vápenatý
DA	Calciumchlorid
DE	Calciumchlorid
EL	Χλωριούχο ασβεστίου
EN	Calcium chloride
ES	Cloruro de calcio
ET	Kaltsiumkloriid
FI	Kalsiumkloridi
FR	Chlorure de calcium
HU	Kalcium-klorid
IT	Cloruro di calcio
LT	Kalcio chloridas
LV	Kalcija hlorīds
MT	Klorur tal-kalċju
NL	Calciumchloride
PL	Chlorek wapnia
PT	Cloreto de cálcio
RO	Clorură de calciu
SK	Chlorid vápenatý
SL	Kalcijev klorid
SV	Kalciumklorid

DA	2-(2,4-dichlorphenoxy)ethylbenzoat
DE	2-(2,4-Dichlorphenoxy)ethylbenzoat
EL	βενζοϊκό 2-(2,4-διχλωροφαινοξυ)αιθυλο
EN	2-(2,4-dichlorophenoxy)ethyl benzoate
ES	benzoato de 2-(2,4-diclorofenoxi)etilo
FI	2-(2,4-dikloorifenoksi)etyylibentsoaatti
FR	benzoate de 2-(2,4-dichlorophénoxy)éthyle
IT	benzoato di 2-(2,4-diclorofenossi)etile
NL	2-(2,4-dichloorfenoxy)ethylbenzoaat
PT	benzoato de 2-(2,4-diclorofenoxi)etilo
SV	2-(2,4-diklorofenoxi)etylbensoat

Example of the modifications needed in the translation of a chemical name into some of the European languages.

The Customs Union typically uses specialized translators, normally chemists, for this work, but they may not be specialized in organic chemistry, certainly the biggest and the most difficult part of the IUPAC nomenclatures. Moreover, the time pressure involved increases the difficulty of the work. Even for a trained translator, an "o-cresol" can easily be mistyped "p-cresol." But for a customs official, this is clearly another product.

The opposite situation can also occur because of a too-clever translator. He/she may be an organic chemist who understands clearly what he/she is translating. However, problems can arise if this translator recognizes a mistake in the customs regulations and writes down the correct name. This issue is compounded if his/her 21 colleagues follow the original text.

The very clever translator:

EN Malonylurea (barbituric acid) and its salts

LT Barbitūro rūgštis (2,4,6(1H, 3H, 5H)-pirimidintrionas) ir jos druskos

instead of Malonilkarbamidas (barbitūro rūgštis) ir jos druskos

Identification

The amount of trade passing through European borders is enormous, yet everything has to be declared and often controlled. About 200 million customs declarations are made per year in the EU. Chemicals and pharmaceuticals represent an important part of this trade. Needless to say, businesses don't like to waste time with burdensome controls, so customs officials face increasing pressure to do their jobs quickly. The decision time for customs officials can be as small as a few seconds or a few minutes. Moreover, the description of a chemical is often not an IUPAC name or not necessarily a good IUPAC name, and it may be in German or Danish or possibly in another alphabet, such as Greek or Bulgarian. Customs officials are helped by risk analysis data, but, faced with such a large number of synonyms and languages, they might accidentally release for free circulation or export a dangerous chemical.

Some of the 80 or more names of DDT (ISO):

Clofenotane (INN)
1,1'-(2,2,2-Trichloroethylidene)bis[4-chorobenzene]
2,2,2-Trichloroethylidenebis(p-chorobenzene)
1,1,1-Trichloro-2,2-bis(p-chlorophenyl)ethane
1,1,1-Trichloro-di-(4-chlorophenyl)ethane
α,α-Bis(p-chlorophenyl)-β, β,β-trichlorethane
Dichlorodiphenyltrichloroethane
Chlorophenothane
Dicophane
Pentachlorin, pp'-DDT, para,para'-DDT
Zeidane, pp'-zeidane
Agritan, Gesapon, Gesarex, Gerasol, Guesapon, Neocid

The European Customs Inventory of Chemical Substances

To remedy these problems and facilitate customs operations and world trade, the European Commission's Taxation and Customs Union launched the European Customs Inventory of Chemical Substances (ECICS)[2] in the early 1970s. The ECICS is an inventory of chemicals that includes their customs classification and their IUPAC names whenever possible.

The database currently contains 30 000 traded or controlled chemicals, in particular INN pharmaceuticals, ISO pesticides, drugs and precursors, chemical weapons and precursors, and chemicals harmful to the ozone layer, human health, and the environment. The goals of the database are twofold: to provide the correct customs classification, in order to find easily the correct rate of duty; and to identify dangerous chemicals, even if they are hidden behind another name or another language. It is interesting to note that ECICS is used worldwide: the first six digits of the customs classification are common to the whole world, and the database is freely accessible on the Internet.

Given the difficulty of translating chemical names, especially with an increasing number of languages, EU customs officials created an "automatic" translator of IUPAC names into all EU languages. The current translation module, built in the 1980s, has been useful over the years, but utilizes old technology, is quite manual, and only works in 11 languages.

New Developments

New translation software named ECICS-2 is in development, which will include more products, more synonyms, more data, and more features. For example, it creates links between customs and transport (United Nations Dangerous Good numbers), health, and environment. It also includes the very interesting InChI and InChI Key identifiers.[3]

Two projects involve the IUPAC nomenclatures: the complete revision of ECICS names according to the latest nomenclatures, and construction of a new translation module, based on the latest nomenclatures and including all EU languages. The chemical software company ACD UK Ltd. is assisting with these projects. The database will include all nomenclatures: organic, natural products, biochemicals, inorganic, and polymers.

Of special interest to the IUPAC community is whether ECICS will list on its website all examples listed in the nomenclatures and indicate whether they are "recommended," "accepted," or "obsolete" names. In this framework, the "preferred IUPAC names" (PIN)

used in organic and inorganic chemistry would be especially helpful. Use of these PINs would make the work of customs officials easier, because *regular* IUPAC names can be difficult, especially for nonchemists. Likewise, work performed for this new translation module could help in the translation of the "IUPAC color books."

Another project will be to update the Harmonized Commodity Description and Coding System Explanatory Notes with up-to-date IUPAC names and improved chemical structures based upon the new recommendations on graphical representation standards for chemical structure diagrams. Even if this project is performed under the authority of the World Customs Organization, the European Customs will strongly support the update.

As this summary of customs laboratories shows, IUPAC nomenclature reaches more broadly than many might expect.

References

1. Commission Regulation (EC) No 1031/2008 of 19 September 2008 amending Annex I to Council Regulation (EEC) No 2658/87 on the tariff and statistical nomenclature and on the Common Customs Tariff, http://eur-lex.europa.eu/JOHtml.do?uri=OJ:L:2008:291:SOM:EN:HTML
2. http://ec.europa.eu/taxation_customs/common/databases/ecics/index_en.htm
3. The IUPAC International Chemical Identifier, <www.iupac.org/inchi>

Hervé Schepers <herve.schepers@ec.europa.eu> European Commission, DG Taxation and Customs Union.

Stamps International

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

What's in a Chemical Name?

The Geneva Conference of 1892, attended by 34 prominent chemists from nine European countries, marked the first international effort to address the dire need for a systematic way of naming organic compounds, the number and complexity of which were rapidly increasing at the time. A set of principles was developed to render the naming of such compounds less capricious, including the use of prefixes derived from the Greek numbers to indicate the length of carbon chains and the application of unique suffixes to denote the presence of specific functional groups. The effort to standardize organic, inorganic, and biochemical nomenclature continued in subsequent years and, although it almost came to a standstill during World War I, eventually contributed to the establishment of the International Union of Pure and Applied Chemistry (IUPAC) in 1919.

The stamp from Switzerland illustrated in this note was issued on 24 March 1992 to commemorate the 100th anniversary of the Geneva Conference. It features a structural diagram of 2,2-difluorobutane and a colorful space-filling model of the same molecule. Although several hydrofluorocarbons (HFCs) have been investigated in recent years as safer surrogates to ozone-depleting chlorofluorocarbons (CFCs) and have found applications as refrigerants, foaming agents, and propellants, this particular fluorinated hydrocarbon is not among them. Hence, the stamp designer's choice, based on a compound that was certainly not known back in 1892, is a mystery that perhaps only the masterminds at Swiss Post may decipher someday.

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

Helping Improve Biosafety and Biosecurity

IUPAC's Contribution to the Biological and Toxin Weapons Convention

by Graham S. Pearson

For many years, IUPAC had been working with the Organisation for the Prohibition of Chemical Weapons (OPCW) to consider advances in science and technology relevant to the Chemical Weapons Convention (CWC). In 2008, IUPAC participated for the first time in a Meeting of Experts of the Biological and Toxin Weapons Convention, bringing relevant knowledge, experience, and resources while sharing a common interest in ensuring that the life sciences are used in a safe and secure manner, and solely for the benefit of humankind.

The Biological and Toxin Weapons Convention was opened for signature in 1972 and entered into force in 1975. Each State Party to the Convention *undertakes never in any circumstances to develop, produce, stockpile, or otherwise acquire or retain:*

(1) microbial or other biological agents, or toxins, whatever their origin or method of production, of types and in quantities that have no justification for prophylactic, protective, or other peaceful purposes

(2) weapons, equipment, or means of delivery designed to use such agents or toxins for hostile purposes or in armed conflict

Today, it has 162 States Parties, and an additional 13 States have signed but have yet to ratify the Convention. The Convention holds review conferences at five-year intervals to evaluate its operations. At the Review Conference in 2006, the States Parties agreed to hold an annual one-week meeting of States Parties, which would be prepared for by a one-week Meeting of Experts, to "discuss, and promote common understanding and effective action on" topics under consideration. In 2008, both meetings took place in Geneva, Switzerland, with the Meeting of Experts held 18–22 August and the Meeting of States Parties held 1–5 December. The two topics to consider were:

(i) national, regional, and international measures to improve biosafety and biosecurity, including laboratory safety and security of pathogens and toxins

(ii) oversight, education, awareness raising, and adoption and/or development of codes of conduct with the aim to prevent misuse in the context of advances in bioscience and biotechnology research with the potential of use for purposes prohibited by the Convention

The purpose of these annual meetings is primarily to exchange information. Participants in the Meeting of Experts provide information that is collected by the secretariat, on behalf of the chair, and compiled in an Annex to the Report of the Meeting. The Annex consists of a list of considerations, lessons, perspectives, recommendations, conclusions, and proposals drawn from the presentations, statements, working papers, and interventions on the topics under discussion at the meeting. The chair uses this material to develop substantive statements on which consensus can be found at the December meeting.

It has become the practice at some of the Meetings of Experts for the chair to invite appropriate experts as guests. They participate alongside experts who may be part of States Parties delegations or who may represent international organizations, such as the World Health Organization, Food and Agriculture Organization, and the World Organization for Animal Health. Given the topics being considered this year, the chair, Ambassador Georgi Avramchev of the Republic of Macedonia, invited a considerable number of experts from such organizations as the American Biosafety Association, Asia-Pacific Biosafety Association, European Biosafety Association (EBSA), InterAcademy Panel on International Issues, International Biosafety Working Group, International Union of Biochemistry and Molecular Biology (IUBMB), National Academy of Sciences (USA), and IUPAC.

IUPAC's participation in the Meeting of Experts is analogous to work it performed with OPCW. Cooperation with OPCW began prior to the First Review Conference in 2003 and continued prior to the Second Review Conference in 2008. In addition, IUPAC jointly organized a workshop with OPCW in Oxford in July 2005 to address "Education, Outreach, and Codes of Conduct to Further the Norms and Obligations of the Chemical Weapons Convention" (see IUPAC project 2004-048-1-020 or Technical Report published as *Pure and Applied Chemistry* 78(11), 2169-2192, 2006). The summary findings and observations from that workshop included recommendations on Chemistry Education and Outreach:

Steps need to be taken in chemistry education both at secondary and postsecondary levels to enhance the awareness of both the benefits that science and technology using chemicals can bring and of the potential for misuse in regard to illicit drugs, chemical and biological weapons, chemicals subject to the prior informed consent convention (PIC chemicals), persistent organic pollutants (POPs), etc.

In regard to codes of conduct, the workshop made the following recommendation:

Codes of conduct are needed for all those engaged in science and technology using chemicals to protect public health and the environment and to ensure that activities in science and technology using chemicals are, and are perceived to be, in compliance with international treaties, national laws, and regulations, such as those relating to illicit drugs, chemical and biological weapons, banned and severely restricted chemicals, PIC chemicals, POPs, etc.

IUPAC's Contribution

The August 2008 Meeting of Experts focused on biosafety and biosecurity and oversight, education, awareness raising, and codes of conduct. The two IUPAC representatives were Alastair W.M. Hay, project chair, Educational Material for Raising CWC Awareness and the Multiple Uses of Chemicals (IUPAC project 2005-029-1-050); and Graham S. Pearson, project chair, Codes of Conduct (project 2007-022-2-020).

Hay provided a poster entitled "Multiple Uses of Chemicals and Chemical Weapons: The Role of Science Education in Raising Ethical Awareness." He also presented the IUPAC statement, which is available at <www.iupac.org/web/ins/2007-022-2-020>. In addition, he made a presentation on the IUPAC project on Educational Material for Raising CWC Awareness.

Four particular points made in the IUPAC statement were captured in the Annex to the Report:

Codes of conduct should be to ensure that activities in the life sciences cause no harm and thus form part of a comprehensive integrated approach to ensuring compliance with international treaties, national laws, and regulations, such as those relating to life sciences, illicit drugs, chemical and biological weapons, banned and severely restricted chemicals, etc.	Statement 21/08/2008
Codes of conduct should emphasize the importance that activities are both in compliance and perceived to be in compliance with the Convention and national implementing legislation.	Statement 21/08/2008
Codes of conduct should emphasize that those engaged in the life sciences will not knowingly engage in activities prohibited by the Convention or national legislation.	Statement 21/08/2008
Education projects for the life sciences should remind those engaged in the life sciences of the choices they face, that the life sciences can have multiple effects, and that decisions about how they are used, including not to be used as biological weapons, are the responsibility of each individual engaged in the life sciences.	Statement 21/08/2008

On several occasions during the week, Pearson was able to ask questions of clarification. One of these interventions (on 22 August 2008), which related to a presentation by the InterAcademy Panel, was captured in the Annex to the Report:

There are three parallel activities which have closely similar goals yet are facing the same problems of lack of awareness and lack of education in essentially the same target audience: (i)

Opening session of the Meeting of States Parties on 1 December 2008

> *biosafety and biosecurity and risk management to meet the obligations and goals of the BTWC; (ii) WHO's biosafety and biosecurity programme and risk assessment; and (iii) UNEP Convention on Biological Diversity Cartagena Protocol on Biosafety programme of capacity building/risk assessment of GMOs. There would be significant benefits in all three activities working together on awareness raising and education. Although there are some differences, consideration should be given to a harmonized effort amongst these three activities to address awareness and education.*

This intervention recognized the benefits of trying to coordinate the three parallel initiatives involving biosafety awareness. It is a point that applies to the ongoing IUPAC project on codes of conduct where the target is the community engaged in chemistry.

Education and Codes of Conduct

The IUPAC participation was useful because it educated States Parties about what IUPAC had done and is doing that is relevant to the ongoing efforts of the Convention. It was also useful for the IUPAC delegates themselves, who gained information on developments in codes of conduct, notably those of the UNESCO Division of Ethics of Science and Technology, and were able to meet with three members of the Task Force from the USA, Australia, and the UK. There were useful side discussions with the president of the International Union of Biochemistry and Molecular Biology (IUBMB) and with the representative of the UNESCO Division of Ethics of Science and Technology. IUPAC's participation was noted in press releases issued by the UN Secretariat in Geneva before and after the Meeting of Experts.

The chair of the Convention included the following language regarding education and awareness raising in the substantive statements that were considered at the December 2008 Meeting of States Parties:

> *Recognizing the importance of ensuring that those working in the biological sciences are aware of their obligations under the Convention and relevant national legislation and guidelines; have a clear understanding of the content, purpose, and foreseeable social, environmental, health, and security consequences of their activities; and take a more active role in addressing the threats posed by biological weapons, States Parties should develop, implement, and support education and awareness-raising programs that:*
>
> > *(i) involve, and are developed in collaboration with, all relevant stakeholders from both public and private institutions and associations, as well as managers and administrators of universities, research institutions and commercial companies, and individual scientists*
> >
> > *(ii) explain the risks associated with the malign use of the biological sciences and biotechnology and the moral and ethical obligations incumbent on those using the biological sciences*

In regard to codes of conduct, the language proposed included:

> *12. Recognizing that codes of conduct can complement national legislative and regulatory frameworks and help guide scientific research so that it is not misused for prohibited purposes, States Parties should develop strategies to encourage stakeholders—including researchers and other professionals in the life sciences; editors and publishers of life science publications and websites; and organizations, institutions, government agencies, and private companies that conduct, license, fund, facilitate, inspect, or evaluate life sciences research or education, or that are involved in the stockpile or transport of dual-use biological agents or toxins—to develop, adopt and promulgate codes of conduct that:*
>
> > *(i) cover ethical and moral obligations throughout the scientific life cycle, including during the proposal, funding, execution, and dissemination stages*
> >
> > *(ii) refer to the Convention and relevant international and national legislation and regulations*

At the December 2008 meeting, the States Parties agreed upon the following language:

26. States Parties recognized the importance of ensuring that those working in the biological sciences are aware of their obligations under the Convention and relevant national legislation and guidelines; have a clear understanding of the content, purpose, and foreseeable social, environmental, health, and security consequences of their activities; and are encouraged to take an active role in addressing the threats posed by the potential misuse of biological agents and toxins as weapons, including for bioterrorism. States Parties noted that formal requirements for seminars, modules, or courses, including possible mandatory components, in relevant scientific and engineering training programs and continuing professional education could assist in raising awareness and in implementing the Convention.

27. States Parties agreed on the value of education and awareness programs:

(i) explaining the risks associated with the potential misuse of the biological sciences and biotechnology
(ii) covering the moral and ethical obligations incumbent on those using the biological sciences
(iii) providing guidance on the types of activities that could be contrary to the aims of the Convention and relevant national laws and regulations and international law
(iv) being supported by accessible teaching materials, train-the-trainer programs, seminars, workshops, publications, and audio-visual materials
(v) addressing leading scientists and those with responsibility for oversight of research or for evaluation of projects or publications at a senior level, as well as future generations of scientists, with the aim of building a culture of responsibility
(vi) being integrated into existing efforts at the international, regional and national levels

In regard to codes of conduct, the following language was agreed upon:

28. Having considered codes of conduct, States Parties agreed that such codes can complement national legislative, regulatory, and oversight frameworks and help guide science so that it is not misused for prohibited purposes. States Parties recognized the need to further develop strategies to encourage national stakeholders to voluntarily develop, adopt, and promulgate codes of conduct in line with the common understandings reached by the 2005 Meeting of States Parties and taking into account discussions at the 2008 Meeting of Experts.

Next Steps

The onus is always on the delegations of States Parties to take action on education, raising awareness, and codes of conduct. From past experience, it may be unduly optimistic to expect that what was so evident at the August 2008 Meeting of Experts—namely, that the life sciences community needs to be aware of the potential dangers to peace and security from biological agents and toxins—will indeed be acted upon. It will be left to international organizations, such as IUPAC and IUBMB, to act on appropriate opportunities in their interactions with global initiatives, such as the Strategic Approach to International Chemicals Management (see Nov-Dec 2008 *CI*, pp. 16–17), to draw upon international developments in regard to the Chemical Weapons Convention and the Biological and Toxin Weapons Convention, and to make the member states of these treaties aware of what IUPAC can contribute.

The UN Palais des Nations in Geneva where the BTWC meetings were held in August and December 2008.

More detailed reports on the Meeting of Experts and on the Meeting of States Parties have been published in the *CBW Conventions Bulletin* and are available at <www.sussex.ac.uk/Units/spru/hsp/pdf-bulletin.html>.

Graham Pearson <Graham_Pearson@Compuserve.com> is a visiting professor in international security in the Department of Peace Studies in the University of Bradford, UK, where he has been engaged for over 10 years in promoting the strengthening of the international treaties totally prohibiting chemical and biological weapons. He is chair of the IUPAC project 2007-022-2-020 on recommendations for a code of conduct for chemists.

UN Declares 2011 as International Year of Chemistry

On 30 December 2008, the 63rd General Assembly of the United Nations adopted a resolution proclaiming 2011 as the International Year of Chemistry, placing UNESCO and IUPAC at the helm of the event.

Ethiopia submitted the UN resolution calling for the year, which will celebrate the achievements of chemistry and its contributions to the well-being of humanity. The year will also draw attention to the UN Decade of Education for Sustainable Development, 2005–2014. National and international activities carried out during 2011 will emphasize the importance of chemistry in sustaining natural resources.

Chemistry is fundamental to our understanding of the world and the cosmos. Moreover, molecular transformations are central to the production of food, medicines, fuel, and countless manufactured and extracted products. Throughout the year, the world will celebrate the art and science of chemistry and its essential contributions to knowledge, to environmental protection, and to economic development.

"The International Year of Chemistry will give a global boost to chemical science in which our life and our future are grounded. We hope to increase the public appreciation and understanding of chemistry, increase young people's interest in science, and generate enthusiasm for the creative future of chemistry," declared IUPAC President Jung-Il Jin.

"I welcome the opportunity to celebrate chemistry, one of the fundamental sciences," said UNESCO Director-General Koïchiro Matsuura. "Raising public awareness about chemistry is all the more important in view of the challenges of sustainable development. It is certain that chemistry will play a major role in developing alternative energy sources and in feeding the world's growing population," he added.

The year 2011, the 100th anniversary of the awarding of the Nobel Prize in chemistry to Maria Sklodowska Curie, will also provide an opportunity to celebrate the contribution of women to science. In addition, the year marks the 100th anniversary of the founding of the International Association of Chemical Societies (IACS), which was succeeded by IUPAC a few years later. IACS and IUPAC were established to address the needs for international scientific communication and cooperation among chemists by standardizing nomenclature and terminology.

In 2007, the IUPAC Council unanimously endorsed the plan to obtain the proclamation of 2011 as the International Year of Chemistry. Less than a year later, UNESCO's Executive Board recommended the adoption of such a resolution and agreed to support all efforts leading the UN General Assembly to declare 2011 the International Year of Chemistry.

www.chemistry2011.org

The IYC 2011 Management Committee welcomes your comments. Send your ideas and suggestions to <info@iyc2011.org>.

UNESCO—United Nations Educational, Scientific, and Cultural Organization

UNESCO, founded in November 1945 as a specialized agency of the UN, contributes to the building of peace, the alleviation of poverty, to sustainable development, and intercultural dialogue through education, science, culture, and communication. In fulfilling its mission, UNESCO functions as a laboratory of ideas and a standard setter to forge universal agreements on emerging ethical issues. The organization also serves as a clearinghouse for the dissemination and sharing of information and knowledge, while helping member states build their human and institutional capacities in diverse fields. Through these activities, UNESCO promotes international cooperation among its 193 member states and 6 associate members. Its programs in natural science focus on mobilizing science knowledge, and policy for sustainable development in the areas of basic sciences, science education, ecological and earth sciences, water sciences, and climate change.

IUPAC Executive Director Search

The International Union of Pure and Applied Chemistry (IUPAC) is seeking to appoint a new executive director to replace Dr. John W. Jost, who will retire towards the end of 2010. The executive director reports to the president through the secretary general (and for financial matters through the treasurer). The executive director is responsible for the administration of the business of the Union, including management of the Union's Secretariat, its publications, finance, interaction with National Adhering Organizations that comprise the Union, organization of biennial General Assemblies and Congresses, and the provision of support for the officers and governing bodies of the Union. The IUPAC Secretariat has a current staff of five and is located in Research Triangle Park, North Carolina, USA. Extensive travel outside the United States is required.

The executive director must have the following:

- a substantial background in chemistry (doctoral degree preferred)
- ability to organize, manage, recruit, and interact effectively with workers in a small office environment
- proficiency in information technology
- ability to formulate and execute the IUPAC budget (currently ~USD 1.5 million p.a.)
- ability to communicate effectively and diplomatically with a large number of scientific leaders throughout the world

A detailed job description is available on request. Salary is commensurate with experience. Only applicants with permanent residence status in the USA can be considered. The desired appointment date is early in 2010 to allow for a period of overlap with Dr. Jost.

Interested applicants are asked to send their applications, including CVs and the names and contact details of three referees, by e-mail to the Secretary General at <secretariat@iupac.org>, by 31 May 2009.

Val Metanomski Remembered*

Longtime IUPAC member Val Metanomski died on 11 December 2008. He was an expert in the development and application of polymer nomenclature, and was one of the authors of the IUPAC *Purple Book*, the *Compendium of Polymer Terminology and Nomenclature*.

Val's long and sterling service to IUPAC, which included serving on the Commission on Macromolecular Nomenclature and Subcommittee on Polymer Terminology and chemical nomenclature in general (ICTNS), spanned more than 30 years. He made a memorable effort in bringing together and editing the first edition of the *Purple Book* and his thoroughness and dedication kept the work on the second edition alive at a critical time, particularly in the 1990s.

IUPAC colleagues remember Val as an extremely trustworthy and dependable colleague who approached his work with academic rigor, perspicacity, maturity, and humor. He will be sorely missed, both as a colleague and a friend.

Val Metanomski during the IUPAC General Assembly held in Berlin, Germany, in August 1999. (photo by Koichi Hatada)

Val Metanomski was a senior scientific information specialist with the Chemical Abstract Service (CAS), an organization he served for 44 years. He was responsible for generating and editing Chemical Abstract Index names for polymers selected by other specialists from the primary literature (journal articles and patents) for inclusion in the CAS database (Registry File, CA File, etc.). On a typical day, Val examined several queues of chemical structures, sorted and accessible by the CAS registry numbers, at various stages in the naming process. Chemical substances (compounds) are selected for indexing by document analysts who read full original journal papers, conference proceedings, and patents. Compounds that renew, or have new information reported about them, are selected for inclusion in the databases.

*Most of the biographical material for this article was extracted from *Nontraditional Careers for Chemists—New Formulas in Chemistry*, by Lisa M. Balbes, Oxford University Press 2007, ISBN-13 9780195183665, reproduced by permission of Oxford University Press, Inc.

Once a compound was selected, Val's job was to generate the CA index name, according to the CAS nomenclature rules. The entire process, from selecting a compound to releasing the verified name, can take a month. Val explained, "Polymer–macromolecular-nomenclature is quite challenging, and rules have to be continually updated as new types of polymers are synthesized. Polymers are actually given two types of names, source-based names expressed in terms of monomers–starting materials, and structure-based names expressed in terms of structural–constitutional-repeating units, if known."

Val's career choice was unconventional. After serving in the army during World War II, Val found that available grants were given only to those pursuing careers in practical sciences; so, Val chose chemistry for his undergraduate major. Val become interested in chemical literature, information retrieval, and related problems as early as the fourth year of his undergraduate studies in England. Having received a BS in chemical engineering, Val moved to Canada and worked for a water-treatment company. After six years in industry, Val decided to go back to school and continue toward a Ph.D. in the same field.

Upon receiving his doctorate in 1964, Val applied for a job with CAS in Columbus, Ohio, where he worked for the rest of his career. During that time, his career path paralleled that of the organization, which went from the printed-product environment to the modern online and Internet environment, and he adapted to and embraced the changes as they came along.

As time went on, he became involved with a variety of projects aimed at converting the traditional manual operations into highly automated processes. For example, Val assisted editors in developing vocabulary-control systems for both abstracts and index entries. Ensuring that a consistent vocabulary was used throughout all publications simplified the automation and electronic processing of documents. Val also was responsible for managing an editorial planning and development department. He took an active part in the transition from the printed-product environment to the modern online and Internet environment of chemical information.

Val's advice to those interested in a career in chemical information was that "knowledge of the tools available for chemical-information retrieval, and knowledge of chemistry to assign potential-value ratings to the information retrieved" are crucial.

For careers in "chemical information," or "cheminformatics," Val recommended first getting a basic degree in chemistry (attending a three-year college program leading to a B.Sc. would be fine), then a master's degree at an information-science or librarianship school.

On 20 May 2008, Val was presented with the 2008 Columbus Section of the American Chemical Society award in recognition of achievements extending over a lifetime of service to chemical information. At the award banquet held in his honor, Val talked of his personal "Road Less Traveled" and in his closing observation, he answered the question, Is there anything from the old days that was better than today?

"Perhaps it was also serendipity, many years ago," said Jeffrey Wilson from CAS, "when a job opening at CAS caught the attention of a chemist at a crossroad in his career. We can all be glad that opportunity was not lost."

"Nowadays," said Val, "when searchers, sitting at their own terminals connected to a plethora of databases with the ability to use clever front-end software, pose a well-defined question, they get instantly highly relevant answers, and nothing more. In the old days, browsing through the printed issues of abstracts or through tables of contents of primary journals allowed you to see, through a corner of your eye, something else on the same page, something of some obvious interest or even related to your topic. That was serendipity at its best. This capability has been lost altogether."

"Perhaps it was also serendipity, many years ago," said Jeffrey Wilson from CAS, "when a job opening at CAS caught the attention of a chemist at a crossroad in his career. We can all be glad that opportunity was not lost."

Val's wife of 44 years, Helena, died soon after him on January 17, 2009. He is survived by a daughter, Marianne and two grandchildren.

In Memoriam

IUPAC was saddened to learn of the following deaths (reported since 1 March 2007) of Union colleagues. We shall remember them with respect and gratitude for their service to IUPAC.

Prof. Ronald D. **Brown** (Australia)—Member, Commission on Molecular Structure and Spectroscopy, 1981–1983; IUPAC Representative on Committee on Space Research (COSPAR), 1994–2008. (Died 4 November 2008)

Prof. Giovanna **Costa** (Italy)—National Representative, Macromolecular (Polymer) Division, 2002–2005; Member, Subcommittee on Developing Polymer Materials, 2006–2007; Member, Subcommittee on Polymer Education, 2006–2007. (Died in December 2007)

Prof. H.B.F. "Hal" **Dixon** (United Kingdom)—Member, IUBMB-IUPAC Joint Commission on Biochemical Nomenclature, 1998–1999; Commission Chair, IUBMB-IUPAC Joint Commission on Biochemical Nomenclature, 2001–2002; Titular Member, Interdivisional Committee on Nomenclature and Symbols (IDCNS), 1998–2001); Task Group Chair, Nomenclature of phosphorus-containing compounds of biochemical importance; Task Group Member, Recommendations for nomenclature and databases for biochemical thermodynamics; Revision of "Principles of Chemical Nomenclature." (Died 30 July 2008)

Prof. Ernest L. **Eliel** (United States)—Former President, American Chemical Society; Task Group Member, Frontiers of chemical sciences: research and education in Middle Eastern countries. (Died 18 September 2008)

Prof. Robert I. **Haines** (Canada)—Member, Commission on Solid Solubilities, 2000–2001. (Died in September 2007)

Prof. Dana E. **Knox** (United States)—Member, Subcommittee on Solubility and Equilibrium Data, 2002–2007; Chair, Subcommittee on Solubility and Equilibrium Data, 2008; Associate Member, Analytical Chemistry Division, 2008. (Died 24 September 2008)

Dr. W. Val **Metanomski** (United States)—Chair, Interdivisional Committee on Nomenclature and Symbols (ICDNS), 1996–2001; Titular Member, Interdivisional Committee on Terminology, Nomenclature and Symbols (ICTNS), 2002–2005; Titular Member, Editorial Advisory Board, 1998–2001; Associate Member, Commission on Macromolecular Nomenclature, 1988–1991; Titular Member, Commission on Macromolecular Nomenclature, 1992–1999; Member, Division VIII Advisory Subcommittee, 2002–2008; Member, Subcommittee on Polymer Terminology, 2002–2008; Task Group Member, Terminology and Structure-Based Nomenclature of Dendritic and Hyperbranched Polymers; Glossary of Polymer Chemical and Topological Class Names; Nomenclature for Macromolecular Rotaxanes (revised title); Nomenclature of Regular Single-Strand Organic Polymers (revised edition); Nomenclature for Rotaxane Polymers; Terminology and nomenclature of macromolecules with cyclic structures; Nomenclature of rotaxanes and pseudorotaxanes; Revision of "Principles of Chemical Nomenclature." (Died 12 December 2008)

Prof. Alan **Sargesson** (Australia)—Associate Member and Titular Member, Commission on Nomenclature of Inorganic Chemistry (1985–1997) and Chair (1996–97); Associate Member, Inorganic Chemistry Division (1996–1997). (Died 29 December 2008)

Prof. Irene **Schnoell-Bitai** (Austria)—Member, Subcommittee on Modeling of Polymerization Kinetics and Processes, 2004–2008. (Died 4 December 2008)

Prof. Kazuo T. **Suzuki** (Japan)—Associate Member, Commission on Toxicology, 1998–2001. (Died 24 July 2008)

Dr. Harry J. **Svec** (United States)—Associate Member, Commission on Isotopic Abundance and Atomic Weights, 1967–1971. (Died 28 November 2006)

Dr. Aaldert H. **Wapstra** (Netherlands)—Titular Member and Associate Member, Commission on Isotopic Abundance and Atomic Weights, 1963–1979. (Died 2 December 2006)

The Project Place

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

Guide for Authors of Papers and Reports in Polymer Science and Technology

Polymer chemistry is advancing rapidly as major improvements in polymer synthesis make an impact. Some of the most far-reaching advances have come from "living" free radical polymerization and from the introduction of dendrimers. This means many polymers can now be prepared with high precision for specific applications. Clearly, these advances necessitate a method for describing the polymers precisely. Thus, nomenclature needs to develop in parallel with synthetic advances. IUPAC task groups have been actively pursuing this goal. This project aims to revise and to bring up to date the IUPAC Recommendations on Macromolecular Nomenclature, which are the first resource for authors of papers and reports in polymer science and technology.

For more information and comments, contact Task Group Chair Philip Hodge <philip.hodge@man.ac.uk>.

www.iupac.org/web/ins/2008-020-1-400

Update of Glossary of Terms Used in Medicinal Chemistry

It has been 10 years since the first *Glossary of Terms Used in Medicinal Chemistry* was published. During this period, a remarkable change in medicinal chemistry practice has occurred, largely in response to the genomic revolution, including the introduction of combinatorial chemistry, robotic techniques, and parallel synthesis. It has brought with it an accompanying vocabulary of new terminology. There is a particular need to address the terminology associated with chemogenomics, chemoinformatics, newer strategies for hit and lead discovery, and those parameters that deal specifically with chemical diversity and drug-likeness. A substantial list of new entries has already been compiled, and many more terms will arise as the project progresses.

The web version of the existing glossary has clearly demonstrated the interest and value of such a tool. Between 1999 and 2007, the total usage, based on the log of IP addresses, was over 200 000. Usage continually increased during this time period, such that 25 countries now exceed 500 uses. The USA, UK, Canada, and Germany head the list (see table). With such interest, there is an urgent need to ensure the currency of the glossary so that IUPAC does not lag behind in terminology.

Country	Usage 1999–2007*
USA	73 700
UK	8 769
Canada	3 626
Germany	3 583
Australia	3 275
Japan	2 641
Italy	2 571
France	1 809
India	1 462
Brazil	1 367
Russia	1 295

*Dr. Gerry P. Moss, Queen Mary, University of London, is gratefully acknowledged for providing these data.

The update process is now well underway, with a targeted completion date within two years.

For more information and comments, contact the Task Group Chair Derek Buckle <DRB.Associates@dsl.pipex.com>.

www.iupac.org/web/ins/2008-010-1-700

Analogue-based Drug Discovery II

Analogue-based drug discovery has a very important role in drug research. The first project under the same title afforded a book published by Wiley-VCH in 2006. It was well received (e.g., see M. Cowart, *J. Med. Chem.* 2006, **49**, 4799), and all the copies were sold within 18 months.

This positive feedback of the medicinal chemistry community encouraged the editors to continue this work with new topics. The second volume, to be published in early 2010, will contain the following chapters:

I. General Aspects

1. Optimizing Therapy by Analogues (J. Fischer, C.R. Ganellin, E.M. Alapi)
2. Analogues and Standalone Drugs (J. Fischer, C.R. Ganellin, A. Ganesan, J. Proudfoot)
3. Lead and Drug Optimization (J. Fischer, C.R. Ganellin, and J. Proudfoot)
4. Molecular Modeling in ABDD (G. Ferenczy)
5. The Impact of Natural Products upon Modern Drug Discovery (A. Ganesan)
6. Monoterpenoid Indole Alkaloids (A. Nemes)
7. Paclitaxel Analogue (P. Erhardt and M. El-Dakdouki)
8. Issues for Patenting of Analogues (S. Smith)

II. Analogue Classes

1. Beta2 Agonists (G. Gaviraghi)
2. M3 Muscarinic Antagonists (M. Grauert, P. Casarosa, M.P. Pieper)
3. SSRIs (D. Rotella and W.E. Childers)
4. Progestogens (Z. Tuba , S. Maho, J. Csorgei, and C. Molnar)
5. DPP-IV Inhibitors (J.U. Peters, P. Mattei)
6. PDE5 Inhibitors (H. Haning, E. Bischoff)
7. Serotonin and Norepinephrine Reuptake Inhibitors (M. Abou-Gharbia and W. Childers)
8. Anthracyclines (F.A. Arcamone)
9. Rifampicin analogues (E. Selva and G. Lancini)

III. Case Studies

1. Eplerenone (J. Kalvoda and M. De Gasparo)
2. Lapatinib (K. Lackey)
3. Dasatinib (J. Das and J.C. Barrish)
4. Conazoles (J. Heeres, P. Lewi, L. Meerpoel)
5. Clevudine (C.K. Chu)
6. Rasagiline (M. Youdim)
7. Liraglutide (L.B. Knudsen)
8. Tipranavir (S. Thaisrivongs, J. Strohbach, S. Turner)
9. Rilpivirine (J. Guillemont and J. Heeres)

The second volume will discuss a broad spectrum of discoveries of anticancer, antifungal, antiviral, cardiovascular, CNS, diuretic, hormonal, respiratory, and diabetes type 2 drugs. The majority of the authors, who come from 10 different countries, were also involved as inventors. This IUPAC project started in May 2008. According to the planned contents, 42 authors will participate.

For further information and comments, contact János Fischer <j.fischer@richter.hu> or C. Robin Ganellin <c.r.ganellin@ucl.ac.uk>.

www.iupac.org/web/ins/2008-013-1-700

Frontiers of Chemical Sciences: Research and Education in the Middle East

Building on the tremendous success of the first, second, and third Malta conferences (see projects 2002-061-1-020, 2004-030-1-020, and 2006-035-1-020, respectively), the Executive Committee has recently approved a project to be known as Malta IV. The objectives are as follows:

- to use science as a bridge to peace in the Middle East by bringing together top scientists from 14 Middle East countries (Bahrain, Egypt, Israel, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, the Palestinian Authority, Qatar, Saudi Arabia, Turkey, the United Arab Emirates) for a five-day conference
- to give scientists the unique opportunity to develop cross-border collaborations to solve regional problems involving the environment, water, and energy, and to design a unified chemical education curriculum
- to attempt, via this conference and workshops, to generate trust among scientific communities—despite the hostility that some of the governments have toward each other—on ways that chemistry can address the problems of the region

The chemical sciences occupy a central position in the world economy, offering the possibility to cultivate mutual understanding through joint research projects and economic development. A general desire to improve the quality of life and political stability in the Middle East is being fulfilled by identifying unique opportunities for network creation and collaboration among chemical scientists to solve chemical, environmental, and educational problems.

The American Chemical Society, the German Chemical Society, the Royal Society of Chemistry, UNESCO, and IUPAC will cosponsor this fourth conference. It will include 70 around representatives, primarily from 14 Middle Eastern nations as well as from Canada, France, Germany, Norway, Switzerland, Taiwan, UK, and USA.

During the five-day conference, six Nobel Laureates will deliver plenary lectures and act as catalysts in the following workshops: Environment; Air and Water Quality; Science Education and Green Chemistry; Alternative Energy Sources; Medicinal and Natural Products; and Nanotechnology and Material Science.

A principal goal of this conference will be to continue to capture the attention of national governments

by inviting the best qualified chemical scientists from those countries to discuss how chemistry can address the problems of the region and contribute to the stability and prosperity of the Middle East.

For more information, contact Zafra Lerman <zafral@aol.com>.

www.iupac.org/web/ins/2008-044-1-020

Investigating Out-of-Specification Test Results of Chemical Composition Based on Metrological Concepts

By the current good manufacturing practice in pharmaceutical industry, out-of-specification (OOS) test results are results that fall outside the specifications or established acceptance criteria. Identifying OOS test results is described in FDA Guidance for Industry "Investigating OOS Test Results for Pharmaceutical Production" (2006). By analogy, measurement/test results obtained in other industries and such fields as environmental analysis, which do not comply with regulatory or specification limits, can be named also as OOS test results. When the compliance assessment is made on the basis of a measurement result accompanied by information on the uncertainty associated with the result, the rules developed in the EURACHEM/CITAC Guide "Use of Uncertainty Information in Compliance Assessment" (2007) are applicable.

After identification of the OOS test result it is important to determine its root causes: to ensure that another OOS test result is not possible or even inevitable. The FDA Guidance mentioned above formulates general rules for investigation an OOS test result, including production review, additional laboratory testing, reporting testing results, and determining the cause. Thus, it establishes an organizational approach to the full-scale investigation and decisions which can be accepted at the different stages of this investigation.

Another approach, outlined in the this new IUPAC project, is based on metrological concepts and includes assessment of the measurement process used for the test, from sampling to chemical analysis of a test portion. The project results will be formulated as a guide. In particular, the following should be addressed in a future development of the guide:

- assessment of validation data of the measurement process, including sampling, sample preparation, and chemical analysis
- use of the validation data for evaluation of the measurement uncertainty components
- assessment of traceability chains important for measurement parameters and environmental conditions influencing the test results

The project will be carried out in collaboration with the Cooperation on International Traceability in Analytical Chemistry. The planned IUPAC/CITAC guide will be helpful for full-scale investigations of OOS test results in pharmaceutical industry (in addition to the FDA Guidance) and in other fields of testing.

For more information and comments, contact the Task Group Chair Ilya Kuselman <ilya.kuselman@moital.gov.il>.

www.iupac.org/web/ins/2008-030-1-500

Young Ambassadors for Chemistry in Taipei, Taiwan, and Mauritius

by Lida Schoen, Mei-Hung Chiu, Erica Steenberg

The Young Ambassadors for Chemistry (YAC) project is a partnership of IUPAC's Committee on Chemistry Education (CCE) and Science Across the World (SAW), designed to facilitate the flow of ideas between chemistry and society using young people as mediators.

After five years of holding successful programs around the world—in Argentina, Bulgaria, Egypt, Jordan, Korea, Lithuania, Russia, South Africa, Taiwan—CCE submitted a new project proposal titled Research-Based Evaluation of the Young Ambassadors for Chemistry Project. This project was designed to

Students in Taipei produce a 30-second TV commercial.

evaluate the success of YAC and determine how to secure its sustainability and future sponsors.

The project targeted three countries: Taiwan, because of the earlier, successful events held there; Mauritius, because it was hosting ICCE 20 in August 2008; and Kenya, because it was hosting the post–ICCE 20 satellite conference. At this time, a program could not be started in Kenya. Thus, this report discusses the YAC events held in Taiwan and Mauritius and reports on the findings from questionnaires given to participating teachers, students, and members of the public. When possible, findings from a YAC event held in South Africa are included for comparison.

An article that appeared in the second largest newspaper in Taiwan: "High School Students Producing Hair Gel at Taipei's Main Train Station."

YAC in Taipei, Taiwan

This YAC course took place in the National Taiwan Normal University in December 2007. The event was held at Taipei's main train station, with 34 high school students and 120 members of the public participating.

Media Coverage

A goal of the YAC program is widespread media coverage; thus, it was a pleasure to see the event reported in Taiwan's second-biggest newspaper.

Evaluation

As part of the evaluation, three sets of questionnaires were developed for teachers, students, and the public. Some questions were first used in South Africa and modified for Taiwan.

1. Teachers: Taiwan Compared with South Africa

The teachers' questionnaire explored such issues as the teachers' use of chemicals, their attitudes toward science and chemistry, their teaching of chemistry, and their reflections on the YAC workshop. The teachers indicated that they enjoyed the YAC workshop and would like to participate in follow-up activities. They proposed using the Science Across the World topic "Chemistry in Our Lives" in their teaching, and were interested in using the Internet to communicate with teachers and students in other countries, although they expressed some concern about their ability to communicate in English.

Comparing these results with those from South Africa suggests that teaching approaches in Taiwan are more sophisticated. Teachers in Taiwan will use information and communications technologies to improve public understanding of chemistry, whereas South African teachers regard workshops and training programs as more valuable. The poor accessibility of ICT facilities in South Africa may be the reason.

Most teachers in South Africa were willing to organize a YAC event in their district but were concerned about the difficulty of obtaining chemicals and containers not easily available in rural areas.

Teachers were also asked to rank five images of chemistry from best to worst. In both nations, an image of a male and female chemist working on an experiment was ranked first; an image of an explosion, last.

2. Public: Taiwan Compared with South Africa

In Taiwan, as in South Africa, student "reporters" asked citizens their opinions about various topics related to chemistry. In Taiwan, 76% of those interviewed considered chemistry to have a positive impact on their daily lives and supported YAC activities as a part of school science learning.

In South Africa, 95% of those interviewed said that science has something to do with their everyday lives, although 87% stated that "chemicals are dangerous." TV programs and activities by students are thought to be most valuable in increasing the knowledge of the South African public about chemistry.

YAC in Mauritius

YAC Mauritius took place just before ICCE 20, and the event focused on students creating a new line of Mauritian cosmetics. Thirty students were asked to participate in the YAC event . . . but 70 came! The space in Trianon Park, adjacent to a major shopping area, was cramped, but roving reporters did a

Teachers in Mauritius perform a TV commercial as practice for teaching their students.

great job interviewing the public and guiding them to where their classmates were working hard on their new cosmetic products. A disc jockey was on hand, as well as a TV crew, allowing the students to create their own TV commercials for their cosmetics.

A roving reporter interviewing a member of the public.

In response to the teachers' enthusiasm, SAW personnel promised to stay in contact and help support future initiatives. In addition, Dean Prof. Wah, Prof. Gupta-Bhowon, and Prof. Jhaumeer-Laulloo of the University of Mauritius invited the group to use the university's facilities for future meetings.

Media Coverage

A local educational TV station recorded the preparations for the YAC event (i.e., training of teachers and students) and the event itself. The result was a 45-minute broadcast featuring the event and a DVD including coverage of the event and interviews with the event's organizers and two of the participating teachers.

Evaluation

1. Teachers: Mauritius Compared with Taiwan and South Africa

In Mauritius and South Africa, teachers regard newspapers and television as being valuable resources for knowledge about chemistry. In Taiwan, in contrast, activities by students were rated as being twice as valuable as information obtained from newspapers or television. The fact that university courses were regarded as valuable resources in all three countries is perhaps a consequence of the YAC workshops being hosted by universities.

Students in Mauritius act out their TV commercials.

In addition, 95% of the teachers in Mauritius and 100% of the teachers in Taiwan were interested in participating in similar YAC activities in the future and using them in their science teaching. During informal conversations in these countries, school headmasters also showed an interest in organizing YAC events in their communities.

In South Africa, 86% of teachers indicated that they would be willing to organize YAC activities in the future, but, as mentioned, were concerned about the availability of supplies in rural areas.

2. Students: Mauritius Compared with Taiwan

In Mauritius, 90% of the students liked the practical activities but were not sure whether they were qualified to act as "ambassadors for chemistry." In contrast, 70% of the Taiwanese students indicated their willingness to be young ambassadors for chemistry.

3. Public: Mauritius Compared with Taiwan

Figure 1 shows that public impressions of chemistry were positive in both Taiwan and Mauritius. (In addition, in the teacher questionnaire, relatively low percentages of teachers expressed negative impressions of chemistry.) These results suggests that a considerable effort may have been made by chemists, educational systems, or the media to raise the public image of chemistry.

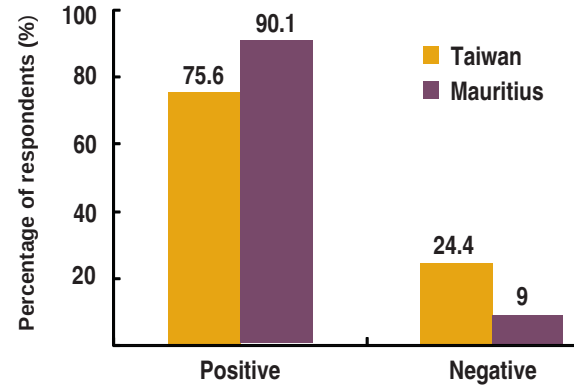

Figure 1. Positive impressions of chemistry in Taiwan and Mauritius

In addition, the public thinks that YAC's public events will benefit students' learning in science, as shown in figure 2 on page 25.

4. External Evaluators in Mauritius

Three external evaluators observed the three days of YAC activities and evaluated the teachers' course, the students' involvement, and the public setting and public engagement.

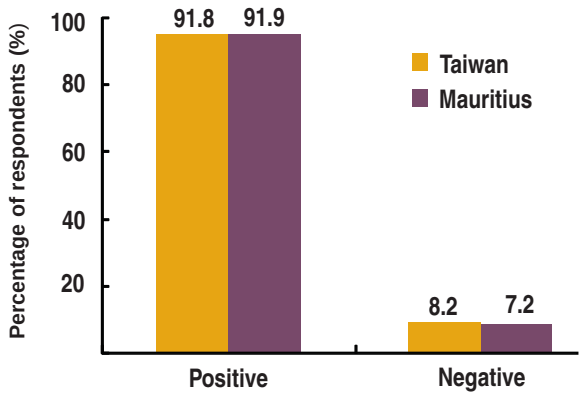

Figure 2. Public support for YAC's events

The reviewers agreed that the YAC instructors provided innovative resources for chemistry teachers. They also felt that the YAC program encouraged teachers to not only learn the chemistry activities but also to follow up by using Internet resources to teach chemistry. Finally, the reviewers reported that members of the public were quite involved in the chemistry display in Trianon Park and were very cooperative in the interviews conducted by the students.

Conclusions

Six conclusions can be made regarding YAC projects.

- Teachers highly value the YAC courses and events and are interested in learning more about the role of chemistry in their lives.
- Students feel that YAC activities help them understand the connection between chemistry and their daily lives. Interestingly, a relatively high percentage of the students have positive perceptions of chemistry, consistent with the public's positive impressions of chemistry in Mauritius, Taiwan, and South Africa.
- The public considers a YAC event an appealing, novel approach to helping students understand chemistry. This finding supports the idea that more YAC workshops and events are needed to promote public understanding of chemistry.
- Teachers and students can serve as ambassadors to help the public better understand chemistry.
- Teachers might need to be explicitly guided on how to help their students be young ambassadors for chemistry during future courses.
- Finally, the evaluation process provided detailed information about the success of the program and what can be done better in the future to help teachers, students, and the public understand the relevance and importance of chemistry in their lives.

For more information, contact Lida Schoen <amschoen@xs4all.nl>.

www.iupac.org/web/ins/2007-005-2-050

Provisional Recommendations

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

www.iupac.org/reports/provisional

Convention on the Use of Units for Time in Earth and Planetary Sciences

The units of time (both absolute time and duration) most practical to use in Earth and Planetary Sciences are multiples of the year, or annus (a). Its proposed definition in terms of the fundamental SI unit for time, the second (s), for the epoch 2000.0 is 1 a = 3.1556925445 = 10^7 s. Adoption of this definition, and abandonment of the use of distinct units for time differences, will bring the Earth and Planetary Sciences into compliance with the SI standard regarding units of time.

Comments by 30 June 2009

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Bookworm

Functional Food and Health

edited by Takayuki Shibamoto, Kazuki Kanazawa, Fereidoon Shahidi, and Chi-Tang Ho
ACS Symposium series 993, 2008 ACS (ISBN-13: 9780841269828)

reviewed by Antonio Monge

This book is a product of presentations made at the first symposium on Functional Foods, held 10–14 September 2006 at the American Chemical Society's national meeting in San Francisco, California, USA. The book establishes a relationship between functional food and health, viewing it as an important opportunity for good health and nutrition for the populations of the 21st century.

The chapters dedicated to bioavailability, metabolism, and toxicity provide important information regarding the usefulness of functional foods. Throughout the book, different authors present the science behind the beneficial effects that these products are reputed to have. This is an important, but not always easy, issue to resolve.

The book provides examples that relate results observed in traditional medicine with those obtained from validated scientific experimentation. These types of studies are especially important in today's society, in which demand is strong for clinical studies that evaluate the true effectiveness of functional foods.

The Hungarian adaption of **Nomenclature of Inorganic Chemistry** *(IUPAC Recommendations 2005), produced by Akadémiai Kiadó, is now available.*

Photo by Wilfredo Rodríguez.

Early findings show that juice from the Noni fruit may be helpful for treating high-blood pressure, according to the authors.

The book offers case studies of a good number of functional foods and the beneficial effects that they have on health. Such is the case, for example, of *Morinda citrifolia L.* (Noni) and its effects on high blood pressure (chapter 39). With regard to the different parts of the noni tree, traditional medicine has reported very effective uses, from anti-inflammation to cancer and from treatment of diabetes to high blood pressure. These uses do not always have a scientific base that would permit establishing a relationship between the plant and its effects. In this chapter, the authors discuss the effects of the Polonesian noni fruit juice for treating high blood pressure, demonstrating its initial usefulness. Such findings as this suggest the importance of carrying out clinical trials to determine the safety and effectiveness of functional foods.

The book is easy to read and provides up-to-date information for those interested in functional foods and for those who work with medicinal agents. Functional foods can provide us with interesting approaches in the discovery of new medicinal agents.

It is hoped that in successive works, the authors will deal with other important issues involving functional foods, including economics, their importance to developing countries, and the ethics of harvesting.

www.oup.com

Antonio Monge <cifa@unav.es> is a professor at the University of Navarra in Pamplona, Spain. His expertise and interest in the subject of functional foods was recently reported in a recent feature titled "Functional Foods: Reflections on an Expanding Market," Sep-Oct 2008 *CI*, pp. 9-13.

Biodiversity and Chemistry of Natural Products

by Russell Kerr

The IUPAC-sponsored conference on **Biodiversity and Chemistry of Natural Products**, held 13–18 July 2008 in Charlottetown, Prince Edward Island, Canada, was an amalgamation of the International Conference on Biodiversity and the International Symposium on the Chemistry of Natural Products. At the opening ceremony, the Right Honorable Robert Ghiz, the premier of the Province of Prince Edward Island, formally welcomed the 200 conference participants and spoke about the tremendous growth in natural products planned for PEI over the next five years.

Twenty outstanding scientists from academia, government, and industry gave plenary and invited talks; another 38 short talks were presented by an equally diverse group. Speakers represented 20 countries; poster presenters represented 28. Symposia topics included isolation and structure elucidation, biosynthesis, spectroscopy, synthesis, engineered biosynthesis, natural products as anticancer leads, new methods in natural products chemical ecology, metabolomics, and genomics. One highlight was the Royal Society of Chemistry's "Natural Product Reports" lecture award by Jason Micklefield (University of Manchester) on the biosynthetic engineering of nonribosomal lipopeptides.

A banquet on the beach.

In addition to a stimulating scientific program, social events were very popular. For the opening reception, participants were led from the conference hotel to an informal dinner by re-enactors dressed in clothing of the mid-1800s, who spoke about the history of Canada, noting that Charlottetown was the country's "birthplace."

The meeting concluded with acknowledgements to the generous conference sponsors and presentations to the student poster award winners, Sutaporn Bunyajetpong (University of Prince Edward Island) and Arthur Lelono (Ehime University). Mary Garson presented an overview of the next meeting in this series, to be held in Brisbane, Australia.

Russell Kerr <rkerr@upei.ca> is research chair in Marine Natural Products at the University of Prince Edward Island, Charlottetown, PEI, Canada.

Vanadium

by João Costa Pessoa

The **6th International Vanadium Symposium** (V6 Symposium) was held 17–19 July 2008 at the Calouste Gulbenkian Foundation, Lisbon, Portugal. The IUPAC-sponsored conference was supported by the Portuguese Chemical Society and organized by the Centro Química Estrutural, Instituto Superior Técnico in Lisbon. João Costa Pessoa was conference chairman, and Hitoshi Michibata (Hiroshima University, Japan) and Kan Kanamori (University of Toyama, Japan) were co-chairmen. Tamás Kiss (University of Szeged, Hungary) represented IUPAC at the meeting.

Interest in vanadium science can be traced back to 1986, when the very first vanadium meeting was held within the Federation of American Societies for Experimental Biology Meeting. The main purpose of this sixth meeting was to facilitate discussions about all aspects of vanadium science, including such topics such as chemistry, biological chemistry, therapeutic applications, and new materials and technology of vanadium compounds.

More than 100 participants from 26 countries took part in the conference. Most well-known experts in the field and many young researchers were present. No plenary lectures were planned; instead, many oral communications (56) were included to encourage as much participation as possible, to establish an informal atmosphere, and to stimulate interaction among attendees.

The 2008 Vanadis Award was given to Toshikazu Hirao, of the Graduate School of Engineering, Osaka University, Japan. The Vanadis Award is given to a researcher for her or his contributions to vanadium science, especially for having displayed innovative research that has a documented impact on the direction of the field.

In early 2009, special issues containing contributions from this meeting will be published in the *Journal of Inorganic Biochemistry* and in *Pure and Applied Chemistry*.

João Costa Pessoa <joao.pessoa@mail.ist.utl.pt> is a professor at the Instituto Superior Técnico, Lisbon, Portugal.

www.vanadiumsix.com

Geared and armed, Div. VIII vice president Richard Hartshorn gets ready for the task ahead.

Chemical Nomenclature and Structure Representation

by Karl-Heinz Hellwich

After its last meetings in Beijing (Aug 2005), Prague (Sept 2006), and Turin (Aug 2007), the IUPAC Chemical Nomenclature and Structure Representation (Division VIII) Committee took place 31 July–1 August 2008 in the medieval town of Büdingen, Germany, about 45 km northeast of Frankfurt. In addition, several working groups met 27–31 July. The groups were composed of 24 scientists from Belgium, Canada, the Czech Republic, Denmark, Germany, Hungary, the Netherlands, New Zealand, Portugal, Russia, South Africa, UK, and the USA. Particular thanks go to Evonik Industries, which sponsored the meetings.

A major topic of discussion was the distribution and use of IUPAC recommendations that are aimed at the advancement of communication among chemists world wide as well as between chemists and other scientists. Therefore, one of the most important projects is the interdisciplinary book *Principles of Chemical Nomenclature*, which is aimed at beginning chemists. The working party defined a unified concept for the presentation of the various nomenclature systems for compounds from all areas of chemistry. Completion of the manuscripts for all chapters was planned by the end of 2008, with the editorial work to be done in 2009.

Karl-Heinz Hellwich in the historic "laboratory" at Ronneburg.

Another important project is the revised and extended edition of the *Nomenclature of Organic Chemistry* (the IUPAC *Blue Book*). The new feature of this project is the selection of Preferred IUPAC Names (PINs). In this context, the nomenclature will become more systematic. The goal of this is to ensure that the nomenclature system will not only remain consistent but at the same time will include few exceptions. In order to provide an unambiguous and unique name, discussions must be highly detailed. An outlook on the more systematic approach for organic chemistry can be found when studying the most recent edition of the *Nomenclature of Inorganic Chemistry* (the IUPAC *Red Book*), published at the end of 2005.

While the development of PINs for organic-chemical compounds is nearing completion, the development of PINs for inorganic compounds, and polymers, are in the early stages. The working party on inorganic PINs discussed in detail different approaches to the choice of central atoms and to the treatment of delocalized ligand systems. They also discussed at length the possibilities for designating the attachment positions of ligands. It became evident that a strict additive approach to naming ligands may create names that are very difficult to decipher. In a joint meeting, the working parties on organic PINs and inorganic PINs discussed a redefinition of the boundry of responsibility between them.

A small working group discussed symmetry properties of rotaxane components and the possible description of the resulting stereoisomers. The results of all these meetings were reported to and further discussed by the Division Committee. Some projects on polymer nomenclature were also discussed briefly.

Because computer codes are of growing importance for the description of chemical substances (e.g., the InChI), the division established an InChI subcommittee. Stephen Heller was appointed to chair this subcommittee.

The group had several excursions into the historic center and the surroundings of Büdingen during breaks from the meetings. Most of the participants were fascinated by the millions-of-years-old filigree structures of the desert roses (baryte formations) exhibited in the Jerusalem Gate, Büdingen's historic town gate. At the Glauberg, an excavation site and a reconstruction of a Celtic calendar building from the 5th century B.C. were visited. Thanks to a donation by the Springer-Verlag, it was also possible to visit the renaissance castle of Ronneburg. The guided tour was accompanied by people in historic dresses giving an impression of life in the Middle Ages and the renaissance. Participants could even test the comfort of wearing historic dresses! During the subsequent dinner, a bard contributed to the atmosphere with his minnesongs.

In summary, it was a successful and fruitful meeting that, thanks to the excursions, as one of the participants expressed in his thanks to the organizer, seemed "more like a holiday."

Karl-Heinz Hellwich <hellwich.iupac@web.de> is a titular member on Division VIII. He is from Offenbach, Germany.

www.iupac.org/web/ins/800

Vacuum Microbalance and Thermoanalytical Techniques

21–24 July 2009, Kazimierz Dolny, Poland

The **32nd International Conference on Vacuum Microbalance and Thermoanalytical Techniques (IVMTTC32)** will cover all aspects of mass and force determination, in particular under vacuum or controlled atmosphere. The meeting, to take place 21–24 July 2009 in Kazimierz Dolny, Poland, includes theoretical and experimental work such as thermogravimetry, calorimetry, sorptometry and measurement of chemisorption, physisorption, surface reactions, magnetic properties, and surface tension. Reports on progress in instrumentation should deal with microbalance and related techniques including supplementary equipment and corresponding coupling techniques.

The scientific program will include plenary lectures (30 minutes) and contributed lectures (20 minutes) as well as poster presentations that deal with the following:

- history and advances in microweighing
- new techniques to measure mass and weight in vacuum and controlled environments
- gravimetric measuement of highly porous materials; adsorbents, catalysts, polymers, advanced nanomaterials, nanotechnology
- adsorption rates and equilibria
- industrial applications of microbalance and microforce sensors including oscillators and load cells
- the coupling techniques: to TGA, DSC, TMA, DTA, DTG, MS, IR
- vacuum apparatus, microelectronics and related equipment

An exhibition of balances, thermoanalytical apparatus, and complementary techniques will take place during this conference.

The Maria Curie-Skłodowska University (UMCS), founded in 1944, is a public higher education institution with an enrollment of 34 000 students, including 800 doctoral students. UMCS is the largest university in eastern Poland. The town of Kazimierz lies on the right bank of the river Vistula on its way to the Baltic. rich history, picturesque medieval houses, wonderful architecture, and kind climate, Kazimierz is known not only in Poland but also abroad as a sought after tourist location.

The chairpersons of the conference are Piotr Staszczuk, Anna Deryło-Marczewska, and Dariusz Sternik of the Department of Physicochemistry of Solid Surfaces at MCSU.

See Mark Your Calendar on page 31 for contact information.

Space Research

18–25 July 2010, Bremen, Germany

The **38th Scientific Assembly of the Committee on Space Research** (COSPAR) and Associated Events, "COSPAR 2010," will be held in Bremen, Germany, a city with an old Hanseatic tradition and an innovative character.

Bremen, which has evolved into a major center of German and European aerospace activities, will offer COSPAR 2010 participants the opportunity to share the latest research results in an environment strongly devoted to space. Moreover, participants will be able to discover and network with Germany and Bremen's space community through technical visits and an exhibition.

Hans J. Rath is chairman of the Local Organizing Committee and Tilman Spohn, of the Institute of Planetary Research, German Aerospace Center, is scientific program chair.

The meeting will offer approximately 90 meetings covering the fields of COSPAR Scientific Commissions and Panels. Following is a sample of the meeting offerings:

- The Earth's Surface, Meteorology, and Climate
- Space Plasmas in the Solar System, Including Planetary Magnetospheres
- Research in Astrophysics from Space
- Materials Sciences in Space
- Scientific Ballooning
- Potentially Environmentally Detrimental Activities in Space
- Radiation Belt Environment Modelling
- Planetary Protection

Selected papers will be published in *Advances in Space Research*, a fully refereed journal with no deadlines that is open to all submissions in relevant fields.

www.cospar2010.org

Mediators of Science: Women Translators

28 July–2 August 2009, Budapest, Hungary

As the field of women's studies blossoms, the contribution of women to scientific development is becoming better known. However, studies mainly focus on original contributions and solitary figures, whereas knowledge also progresses through translation, comments, and popularization. Women translated original scientific contributions, including textbooks, essays, treatises, papers published in journal, and popular science books. Aphra Behn translated Fontenelle's famous *Entretiens sur la Pluralité des Mondes* in 1686; Emilie du Chatelet made a famous translation of Newton's *Principia Mathematica* in 1749; and Mary Somerville provided a lucid exposition in English of Laplace's well-known *Mécanique Céleste*, in 1831. Less well known but crucial to the development of science during the eighteenth century are Marie-Geneviève-Charlotte d'Arconville, Claudine Picardet, and Marie-Anne Pierrette Paulze Lavoisier. Many other women translators are to be found and deserve further investigation.

This symposium will address the many issues involving these women translators of science during a time span that overlaps the early modern period. It will take place at the 23rd International Congress on the History of Science and Technology, 28 July–2 August 2009, Budapest, Hungary.

Among the many issues the symposium will address are the following: Who were these women? Did they choose anonymity or did they prefer to sign their work? Why did they devote themselves to translation? Which audience was targeted? How was their work received and used by the (almost exclusively) male scientific community? Was there a specific role for women in cross-cultural exchange? Since women were also active translators in other topics (theater, history, poetry, philosophy, and novels), how specific or extraordinary was the choice of a scientific topic?

Often translations are introduced by a preface and supplemented with notes. How deep did their translation reshape the original text? To what extent is the new version not an original work in itself? Was it a means through which women could find a way to make their voice heard in the masculine République des lettres?

For more information, please contact the symposium organizers: Brigitte Van Tiggelen <vantiggelen@memosciences.be> and Patrice Bret <patrice.bret@dga.defense.gouv.fr>.

www.conferences.hu/ichs09

Heterocyclic Chemistry

2–7 August 2009, St. John's, Newfoundland and Labrador, Canada

The **22nd International Congress on Heterocyclic Chemistry (ICHC-22)** will be held 2–7 August 2009 at the Delta Hotel and Convention Centre, St. John's, Newfoundland and Labrador, Canada. The themes for this congress include the following:

- New Methods in Heterocyclic Chemistry
- Biologically Active Heterocycles (Pharmaceuticals/Agrochemicals)
- Heterocyclic Natural Products and their Analogues
- Applications of Heterocycles in Organic Synthesis
- Heterocycles in Materials Science

The congress will feature plenary and invited lectures by globally prominent chemists, as well as contributed podium and poster presentations. In addition, a special symposium entitled "Focus on Heterocycles in Organic Synthesis Today and Tomorrow" is planned as a tribute to Victor Snieckus for his research accomplishments and long-time contributions to the International Society of Heterocyclic Chemistry.

For more information contact Mohsen Daneshtalab, chairman of ICHC-22.

See Mark Your Calendar on page 32 for contact information.

www.ichc2009.ca

Mark Your Calendar

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

2009 (later than 1 April)

IUPAC poster prizes to be awarded

1–3 April 2009 • Trace Elements in Food • Rome, Italy
3rd International Symposium on Trace Elements in Food (TEF-3)
Dr. Francesco Cubadda, National Centre for Food Quality and Risk Assessment, Istituto Superiore di Sanità, Viale Regina Elena 299, I-00161 Rome, Italy
Tel.: +39 06 4990 3643, Fax: +39 06 4990 2540, E-mail: francesco.cubadda@iss.it

16–17 April 2009 • Clinical Laboratory Diagnostics • Barcelona, Spain
5th European Symposium on Clinical Laboratory and Diagnostic Industry: Standardization and Tumor Markers
Dr. Xavier Filella, Hospital Clínic, Department of Biochemistry & Molecular Genetics, C/ Villarroel 170, E-08036 Barcelona, Spain, Tel.: +34 93 227 54 00 x 3141, Fax: +34 93 337 93 76, E-mail: xfilella@clinic.ub.es

20–24 April 2009 • Advanced Materials • Rouen, France
POLYCHAR-17: World Forum on Advanced Materials
Allisson Saiter, University of Rouen, Laboratory L'E.C.A.P., Avenue de l'Université, B.P. 12, F-76801 St-Etienne du Rouvray Cedex, France, Tel.: +33(0)2 32 95 50 86, Fax: +33(0)2 32 95 50 82, E-mail: allison.saiter@univ-rouen.fr

21–24 June 2009 • Vacuum Microbalance and Thermoanalytical Techniques • Kazimierz Dolny, Poland
32nd International Conference on Vacuum Microbalance and Thermoanalytical Techniques (IVMTTC 32)
Prof. Piotr Staszczuk, Maria Curie-Sklodowska University, Chemistry Faculty, Dept. of Physicochemistry of Solid Surfaces, M. Curie-Sklodowska Sq. 3, PL-20 031 Lublin, Poland
Tel.: +42 81 5375 646, Fax: +42 81 5333 348, E-mail: piotrs@hektor.umcs.lublin.pl

29 June–3 July 2009 • Chemical Thermodynamics • Moscow, Russia
XVII International Conference on Chemical Thermodynamics in Russia (RCCT 2009)
Prof. J.D. Tretjakov, Moscow State University, Department of Inorganic Chemistry, Leninskiy Gory, GSP-2, RF-119991 Moscow, Russia, Tel.: +7 8 495 939 2074, Fax: +7 8 495 939 0998, E-mail: rcct2009@kstu.ru

30 June–4 July 2009 • Heteroatom Chemistry • Oviedo, Spain
9th International Conference on Heteroatom Chemistry (ICHAC-9)
Dr. Enrique Aguilar, Universidad de Oviedo, Departamento de Química Orgánica e Inorgánica, C/Julián Clavería, E-33006 Oviedo, Spain, Tel.: +34 985 104 951, Fax: +34 985 103 446, E-mail: EAH@uniovi.es

5–9 July 2009 • Polymers and Organic Chemistry • Montréal, Canada
13th International IUPAC Conference on Polymers & Organic Chemistry (POC-'09)
Prof. Will Skene, Université de Montréal, CP 6128, Succ. Centreville, Montréal, QC H3C 3J7, Canada
Tel.: +1 514 340-5174, Fax: +1 514 340-5290, E-mail: w.skene@umontreal.ca

19–24 July 2009 • Novel Aromatic Compounds • Luxembourg City, Grand Duchy of Luxembourg
International Symposium on Novel Aromatic Compounds (ISNA-13)
Prof. Carlo Thilgen, ETH Zürich, Laboratorium für Organische Chemie, Wolfgang-Pauli-Strasse 10, CH-8093 Zürich, Switzerland, Tel.: +41 1 632 2935, Fax: +41 1 6321109, E-mail: thilgen@org.chem.ethz.ch

Visas

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

How to Apply for IUPAC Sponsorship

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

www.iupac.org/symposia/application.html

Mark Your Calendar

26–30 July 2009 • Organometallic Chemistry • Glasgow, UK
15th International IUPAC Conference on Organometallic Chemistry Directed Towards Organic Synthesis
Prof. Pavel Kocovsky, University of Glasgow, Department of Chemistry, Glasgow, G12 8QQ, United Kingdom
Tel.: +44 141 330 4199, Fax: +44 141 330 4888, E-mail: pavelk@chem.gla.ac.uk

26–31 July 2009 • Ionic Polymerization • Lodz, Poland
19th IUPAC International Symposium on Ionic Polymerization (IP '09)
Prof. Stanislaw Penczek, Polish Academy of Sciences, Centre of Molecular and Macromolecular Chemistry, Sienkiewicza 1123, PL-90 363 Lodz, Poland
Tel.: +48-42-681 9815, Fax: +48-42-684 7126, E-mail: ip09@bilbo.cbmm.lodz.pl

31 July–6 August 2009 • IUPAC 45th General Assembly • Glasgow, UK
IUPAC Secretariat, Tel.: +1 919 485 8700, Fax: +1 919 485 8706, E-mail: secretariat@iupac.org
www.iupac.org/symposia/conferences/ga09/

2–7 August 2009 • IUPAC 42nd Congress • Glasgow, UK
Chemistry Solutions
IUPAC 2009, Royal Society of Chemistry, Thomas Graham House, Science Park, Milton Road, Cambridge, CB4 0WF, UK, Tel.: +44 (0) 1223 432380, Fax: +44 (0) 1223 423623, E-mail: iupac2009@rsc.org
www.iupac2009.org

2–7 August 2009 • Heterocyclic Chemistry • St. John's, NewFoundland and Labrador, Canada
22nd International Congress on Heterocyclic Chemistry (ICHC-22)
Prof. Mohsen Daneshtalab, School of Pharmacy, Memorial University of Newfoundland, St. John's, NL A1B 3V6, Canada, Tel.: +1 709-777-6958, Fax: +1 709-777-7044, E-mail: mohsen@mun.ca

21–25 August 2009 • Solution Chemistry • Innsbruck, Austria
31st International Conference on Solution Chemistry (ICSC 2009)
Prof. Bernd M. Rode, University of Innsbruck, Theoretical Chemistry Division, A-6020 Innsbruck, Austria
Tel.: +43 512 507 5160, Fax: +43 512 507 2714, E-mail: bernd.m.rode@uibk.ac.at

14–18 September 2009 • High Temperature Materials • Davis, CA, USA
High Temperature Materials Chemistry Conference–XIII (HTMC-XIII)
Alexandra Navrotsky, University of California at Davis, One Shields Avenue, Davis, CA 95616 USA
Tel.: +1 530 752-3292, Fax: +1 530 752-9307, E-mail: ANavrotsky@UCDavis.edu

10–14 October 2009 • Molecular Environmental Soil Science • Hangzhou, China
International Symposium of Molecular Environmental Soil Science at the Interfaces in the Earth's Critical Zone
Prof. Jianming Xu, Zhejiang University, College of Environmental & Resource Sciences, Hangzhou, 310029, China
Tel.: +86 571-8697-1955, Fax: +86 571-8697-1955, E-mail: jmxu@zju.edu.cn

18–22 October 2009 • Novel Materials and Their Synthesis • Shanghai, China
International Symposium on Novel Materials and Their Synthesis (NMS-V)
Prof. Yuping Wu, Fudan University, Department of Chemistry, Shanghai, 200433 China
Tel.: +86 21 55 664 223, Fax: +86 21 55 664 223, E-mail: wuyp@fudan.edu.cn

2010

IUPAC poster prizes to be awarded

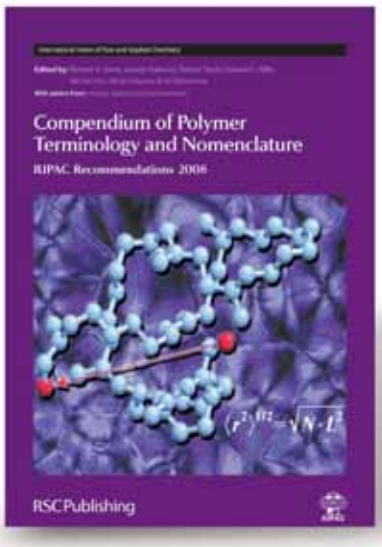
7–10 March 2010 • Heterocyclic Chemistry • Gainesville, Florida, USA
11th Florida Heterocyclic and Synthetic Conference
Prof. Alan R. Katritzky, University of Florida, Department of Chemistry, Gainesville, FL 32611-7200, USA
Tel.: +1 352-392-0554, Fax: +1 352-392-9199, E-mail: katritzky@chem.ufl.edu

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

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

IUPAC and RSC Publishing

Compendium of Polymer Terminology and Nomenclature



IUPAC Recommendations 2008

NEW edition

This new edition of the "Purple Book" is one of a series of books issued by the International Union of Pure and Applied Chemistry. It collects into a single volume the most important position papers on the nomenclature and terminology of several types of polymers, such as Regular Single-Strand Organic Polymers, Regular Double-Strand (Ladder and Spiro) Organic Polymers, and Irregular Single-Strand Organic Polymers.

A handy compendium for scientists, the book is also invaluable for those professionals working in this field.

ISBN 9780854044917 | 2009 | £129.95

In Memoriam

Val Metanomski (3rd October 1923 - 11th December 2008) – In honour of his notable achievements in IUPAC, especially his editorial work in the publication of the original 1991 edition of the "Purple Book."

Other IUPAC References

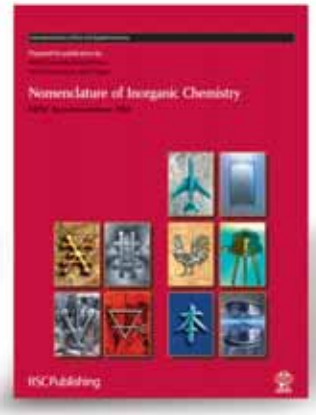
Quantities, Units and Symbols in Physical Chemistry

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

ISBN 9780854044337 | 2007 | £39.95

Nomenclature of Inorganic Chemistry

IUPAC Recommendations 2005



The 'Red Book' is the definitive guide for scientists requiring internationally approved inorganic nomenclature in a legal or regulatory environment.

ISBN 9780854044382 | 2005 | £49.95

International Union of Pure and Applied Chemistry

Advancing the worldwide role of chemistry for the benefit of Mankind

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

National Adhering Organizations

Australian Academy of Science *(Australia)*
Österreichische Akademie der Wissenschaften *(Austria)*
Bangladesh Chemical Society (*Bangladesh*)
National Academy of Sciences of Belarus (*Belarus*)
The Royal Academies for the Sciences and Arts of Belgium *(Belgium)*
Brazilian Chemistry Committee for IUPAC *(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)*
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 Federation of Science and Technology Societies *(Korea)*
Kuwait Chemical Society *(Kuwait)*
Koninklijke Nederlandse Chemische Vereniging *(Netherlands)*
Royal Society of New Zealand *(New Zealand)*
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)*
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Serbian Chemical Society (Serbia)
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Svenska Nationalkommittén för Kemi *(Sweden)*
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Royal Society of Chemistry *(United Kingdom)*
National Academy of Sciences *(USA)*
Programa de Desarrollo de Ciencias Básicas *(Uruguay)*