Quality of Chemical Measurements

International Evaluation Program Reveals True Situation

IUPAC's Committee on Chemistry and Industry (COCI) has submitted the following article, prepared by Dr. Philip D. P. Taylor (Joint Research Centre-European Commission, Institute for Reference Materials and Measurements, Retiesweg, B-2440 Geel, Belgium; E-mail: taylor@irmm.jrc.be), Dr. Ioannis Papadakis (papadakis@irmm.jrc.be), Mrs. Lutgart Van Nevel (vnevel@irmm.jrc.be), Dr. Ciaran Nicholl (nicholl@irmm.jrc.be), and Prof. Paul De Bièvre (Duineneind 9, B-2460 Kasterlee, Belgium; E-mail: paul.de.bievre@skynet.be). COCI Chairman Dr. A. Nelson Wright (12539 Ranger, Montreal, Quebec H4J 2L7, Canada; E-mail: anwright@citenet.net) contributed the Introduction.

Introduction

The wide variation in chemical trace measurements was first brought to my attention by Prof. De Bièvre at the 1998 meeting of the Committee on Chemistry and Industry (COCI) in Johannesburg, South Africa. During our 1999 meeting in Berlin, Germany, he again presented data demonstrating a huge (±50%) variation in trace element (Pb, Cd, Fe, and Zn) concentrations in water even from "accredited" laboratories. Similar problems were demonstrated for analysis of catalyst metals (Pt) in car exhaust material. Because such data are increasingly used in decision-making areas of industrial concern, our committee adopted "Reliability of Chemical Measurements" as a new, formal project, with Prof. De Bièvre as coordinator. Interest was immediately demonstrated by UNESCO (Dr. A. Pokrovsky), and cooperative information dissemination efforts began.

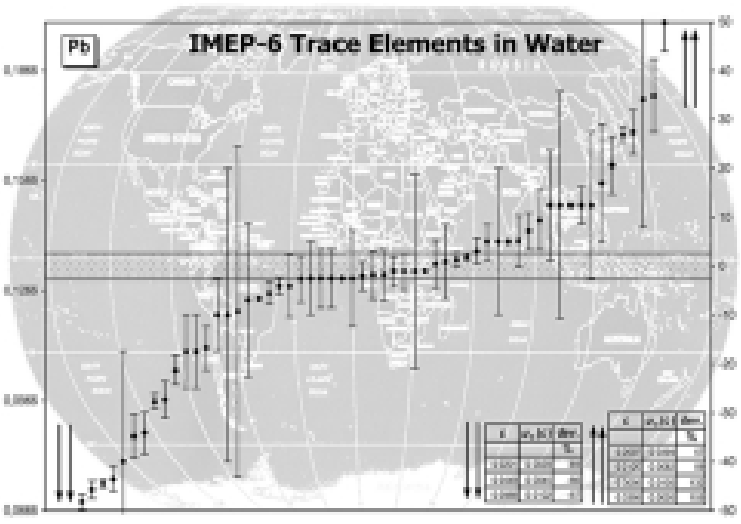
Although a brief summary of the concerns, "Metrology in Chemistry", had been published in *Chemistry and Engineering News* (*C&EN*, 31 May 1999, p. 29), COCI encouraged Prof. De Bièvre to submit a more detailed summary to *Chemistry International* (*CI*). This article provides "snapshot" pictures of chemical measurement (un)reliability, with many practical, societal implications.

Dr. A. Nelson Wright
Chairman, IUPAC Committee on Chemistry and Industry (COCI)

Background

Chemical measurements form the basis of many important economic, political, environmental, medical, and legal decisions. Each day, millions of such measurements are carried out throughout the world.

The real basis for decision-making and implementing regulations depends on the comparability and reliability of the results of these chemical measurements. The European Commission requires that measurements performed in one Member State must be acceptable to all other Member States in the Union. This process requires that such reliability be demonstrated. Moreover, the results of European chemical measurements must also be transparent and clearly understood by Europe's trading partners in the whole world and vice versa. Globalization of commerce and the need for fair trade require knowledge of the *degree of equivalence* of the measurement results as they affect the value of traded goods.



The Problem

The comparability of chemical measurement results demands, where possible, that they should be traceable to "stated references" (i.e., values) and preferably expressed in values of the International System of Units (SI—Système International d'Unités). Traceability to such values ensures comparability (results can be validly compared).

Many modern analytical methods are

A selection of certified isotopic reference materials.

based on comparative techniques that rely on measuring the ratio of an instrumental signal for an unknown sample with that of a known "standard". Very few chemical measurements are being performed with a clearly stated traceability of their results.

Accreditation schemes can improve the quality of measurements by making them comply with formal procedures, but the problem of the reliability and degree of equivalence of the results must be addressed, and this issue has been tackled only recently.

The essence of the problem lies in applying the principles of Metrology in Chemistry (MiC). Metrology is still rather new in chemistry but will grow according to the increasing emphasis on establishing the degree of equivalence and the need for demonstrating the true reliability of the measurement results.

The BIPM Gets Involved

The International Consultative Committee on Amount of Substance (CCQM—Comité Consultatif pour la Quantité de Matière) was set up in 1995 by the Paris-based International Bureau of Weights and Measures (BIPM—Bureau International des Poids et Mesures). Key tools of MiC are primary methods of measurement, defined by the CCQM as methods for which a complete uncertainty statement can be written down in terms of SI units and whose results are accepted without reference to a standard of the quantity being measured. So far, the CCQM recognizes five such methods, namely, titrimetry, coulometry, gravimetry, determination of freezing point depression, and—most versatile and widely used—isotope dilution mass spectrometry (IDMS), which has been applied and refined at the Institute for Reference Materials and Measurements (IRMM) for over 30 years.

The basis of IDMS is that one measures an unknown number of atoms of an element (or molecules of a compound) in a sample through direct comparison to a known number of atoms of the same element (or molecules of the same compound) in an amount of a spike added.

IRMM's International Measurement Evaluation Program (IMEP)

In 1988, IRMM founded the International Measurement Evaluation Program (IMEP) as an awareness program and as a tool to show the true state of chemical measurement results, both to practitioners and to end-users of chemical measurements.

The IRMM is part of the European Commission's Joint Research Centre, which is made up of eight research institutes spread over five sites. The mission of the IRMM is to promote a common European measurement system supporting the implementation and monitoring of Community policies, by

- developing and performing specific reference measurements,
- producing Certified Reference Materials (CRMs),
- organizing International Measurement Evaluation Programs,
- establishing community databases,
- performing prenormative research related to European norms or standards, and
- offering special high-level training in measurement sciences.

IRMM has developed its expertise and facilities to be able to deliver the highest quality of primary measurements. Host to the largest isotope mass spectrom-

IMEP-10 bottle for the determination of Cd, Cr, Hg, Pb, As, Cl, Br, and S in polyethylene.

etry facility in Europe, IRMM also has extensive technological material preparation facilities. This unique combination yields Certified Test Samples (CTS) in "real life" matrices fully characterized for homogeneity and stability.

IMEP runs in adherence to the IRMM mission. Today IMEP also runs under the auspices of IUPAC, Analytical Chemistry in Europe (EURACHEM), European Organization of Metrology (EUROMET), and Cooperation on International Traceability in Analytical Chemistry (CITAC).

IMEP enables field laboratories to compare their results against SI-traceable reference values. CTS with undisclosed values are sent to interested participants. The participants are asked to return values together with uncertainty statements claiming in writing to contain so-called "true" values. The undisclosed reference values are established by measurement procedures based (where possible) on IDMS applied as a primary method of measurement. Thus, IMEP basically demonstrates the degree of equivalence of results of chemical measurements for individual laboratories on the international scene as evaluated against results of primary methods of measurement.

- Laboratories evaluate themselves under normal conditions, and they may choose their own techniques, procedures, and instrumentation (preferably routine conditions). They are requested to report their results with a best estimate of combined uncertainty according to ISO/BIPM guidelines.
- IMEP is open to all laboratories, and full confidentiality with respect to results and participant's identity is guaranteed.
- IMEP focuses on "real life" samples that represent highly important areas (food, environment, health, etc.).
- IMEP graphically displays reference values and results from participating laboratories, but the conclusions are to be drawn by the laboratories themselves. Additional support can be offered by IRMM after the measurement round.
- IMEP is coordinated by IRMM. The establishment of reference values with their uncertainty (which gives a reference range) is a time-consuming and expensive task. It is accomplished in collaboration with several partners—worldwide "IMEP reference laboratories" that can demonstrate a track record of successful applications of IDMS as a primary method of measurement.
- IMEP is complementary to collaborative studies and proficiency testing schemes; the latter are more fre-

Table 1 Completed IMEP rounds.

IMEP	*Title*	*Time Period*	*Publication*
1	Li in human serum	1988	*Fres. Z. Anal. Chem.* **332**, 718–721 (1988)
2	Cd in polyethylene	1990–91	*Fres. Z. Anal. Chem.* **345**, 310–313 (1993)
3	Trace elements in water	1991–93	*Accred. Qual. Assur.* **1**, 71–82 (1996)
4	Trace elements in bovine serum	1991–95	*Accred. Qual. Assur.* **3**, 447–458 (1998)
5	Fe in human serum	1991–94	*Scand. J. Clin. Lab. Invest.* **53**, Suppl. 212, 38 (1993)
6	Trace elements in water	1994–95	*Accred. Qual. Assur.* **3**, 56–68, (1998)
7	Trace elements in human serum	1997–98	*Accred. Qual. Assur.* **4**, 463–472, (1999)
8	$n(^{13}C)/n(^{12}C)$ and $n(^{18}O)/n(^{16}O)$ in CO_2	1997–99	EUR 19060 EN
9	Trace elements in water	1998–99	EUR 18724 EN
10	Trace elements in polyethylene	1997–98	IRMM Report GE/R/SIM/11/98
11	Metals in car exhaust catalysts	1998–99	EUR 18735 EN
13	Trace elements in polyethylene	1999–2000	EUR 19562 EN
14	Trace elements in sediments	1999–2000	EUR 19595 EN

Table 2 Ongoing IMEP rounds.

IMEP	*Title*	*Time Period*	*Status of the project*
12	Trace elements in water	2001–2002	Samples available in 2001
16	Pb in wine	2000–2001	Samples distributed
17	Trace and minor constituents in human serum	2001–2002	Samples available in 2001
18	S in fuel	2001–2002	Samples available in 2001
19	Cd in rice	2001–2002	Samples available in 2001

Yetunde Aregbe (Austria) performing the highest quality isotopic measurements with IRMM's Avogadro II Mass Spectrometer, which is the world's first "amount comparator".

quent, but have a weaker metrological basis.

Since 1988, IMEP rounds have mainly concentrated on trace elements in various matrices such as water, polyethylene, serum, and sediment.

Thus far, 13 IMEP rounds have been completed, as described in Table 1. At present, IMEP rounds 12, 16, 17, 18, and 19 are ongoing, as listed in Table 2.

The first IMEP round, carried out over 10 years ago, addressed the issue of measuring lithium in human serum. Six analytical laboratories at prominent psychiatric institutes were asked to participate. Lithium is administered to patients suffering from mental disorders, and the alarming fact was that all laboratories reported incorrect measurements that were off by a factor of up to five in some cases. One laboratory reported a therapeutic concentration that was actually toxic.

A Practical Example: IMEP-9 Trace Elements in Water

The IMEP rounds related to water analysis (3, 6, and 9) traditionally have had a large number of participants, thus reflecting people's interest in water analysis. This interest is also expressed through several EU directives and national legislation that specifically addresses this topic.

Typically, each laboratory is requested to declare its level of competence as accredited/nonaccredited and/or self-declared experienced/less experienced to enable further interpretation of the data sets.

In all, three water IMEP rounds—and for most elements about 90% of the laboratories—reported values within 50% of the certified value. In a small numnber of cases, the reported values deviated from the certified value by more than 50%. Undoubtedly, these results should be judged by taking into account the required regulatory quality of the measurement (e.g., ±10% in EC Directive 98/83/EC). The data (see Fig. 2) show that for most laboratories, this requirement poses a problem.

In IMEP-9, several "regional coordinators" acted on behalf of IRMM to liaise with participants, bridge linguistic and cultural differences, and take local particularities into account. These coordinators were either people or institutions directly involved with chemical measurements, having a certain degree of experience and competence in metrology, and with links in the measurement systems of their country or region. Almost 85% of the participants were handled by the 13 regional coordinators, as shown in Table 3.

Results were reported by 201 participants from 35 countries and 4 continents. A distribution of the participants as a function of the country is shown in Table 4.

IMEP in Support of a Global Metrological Structure for Chemical Measurements

Samples used in IMEP-9 were offered to CCQM to be used in a key comparison (CCQM-K2), and nine National Measurement Institutes (NMIs) from all over the world measured these samples. Thus, the field laboratories (IMEP-9 participants) were able to compare their results with NMI results and vice versa. This exercise was one of the first-ever BIPM key comparisons in the

Ultra Clean Chemical Laboratory, with Michael Berglund (Sweden) performing an ion-exchange purification of IMEP-9 samples for the determination of Li amount content and Carmel Hennessy (Ireland) measuring air quality using a Climet CI 7400 particle counter.

Table 3 Regional coordinators of IMEP-9*.

*Institution/Organization**	*Origin*	*Coordinating Region*
BELTEST, Brussels	Belgium	Belgium
CCEN, Santiago	Chile	South America
CAI, **EA representative**, Prague	Czech Republic	EA participants
EMPA, St. Gallen	Switzerland	Switzerland
HIM, Thessaloniki	Greece	Greece/Balkans
IFA, Tulln	Austria	Austria/Donau basin
LGC, Teddington	United Kingdom	United Kingdom
NATA, Rhodes	Australia	Australia
NIMC, Tsukuba	Japan	Japan
NRC, Ottawa	Canada	Canada
NMI, Delft	Netherlands	Netherlands
NRCEAM, Beijing	China	China
SP, Borås	Sweden	Sweden

*Results were reported by 201 participants from 35 countries and 4 continents.

Table 4 Participants' country of origin.

Country	*Participants*	*Country*	*Participants*
Albania	1	Italy	1
Argentina	2	Japan	14
Australia	8	Korea	1
Austria	20	Norway	2
Belgium	22	Peru	1
Bulgaria	5	Republic of Moldova	1
Canada	7	Romania	2
Chile	23	Russia	4
China	5	Slovakia	1
Cyprus	1	Slovenia	1
Czech Republic	2	Spain	2
Denmark	2	Sweden	7
Finland	3	Switzerland	18
France	4	Netherlands	5
Germany	8	USA	1
Greece	5	United Kingdom	4
Hungary	5	Yugoslavia	10
Ireland	3	**TOTAL**	**201**

area of chemical measurements, and it was successfully completed with IRMM as the pilot laboratory.

The importance of applying metrology to chemical measurements is clearly demonstrated by comparing the results obtained by the NMIs (Fig. 1) to the results obtained by the field laboratories (Fig. 2). The certified value for lead in the IMEP-9 CTS was 62.3 ± 1.3 nmol/L.

Eighteen of the 181 participating laboratories that measured Pb reported values more than 50% above the certified value, while 4 laboratories reported values 50% below. On the other hand, the NMIs participating in CCQM-K2—using a PMM test instrument—reported values within a fraction of a percent of each other and of the reference value.

The Way Forward

IMEP illustrates the need for a structured measurement system for chemical measurements. In such a system, various organizations and laboratories need to take on their responsibility, e.g., by agreeing on who assures demonstrated measurement capability for a particular measurement. IMEP is unique because it enables one

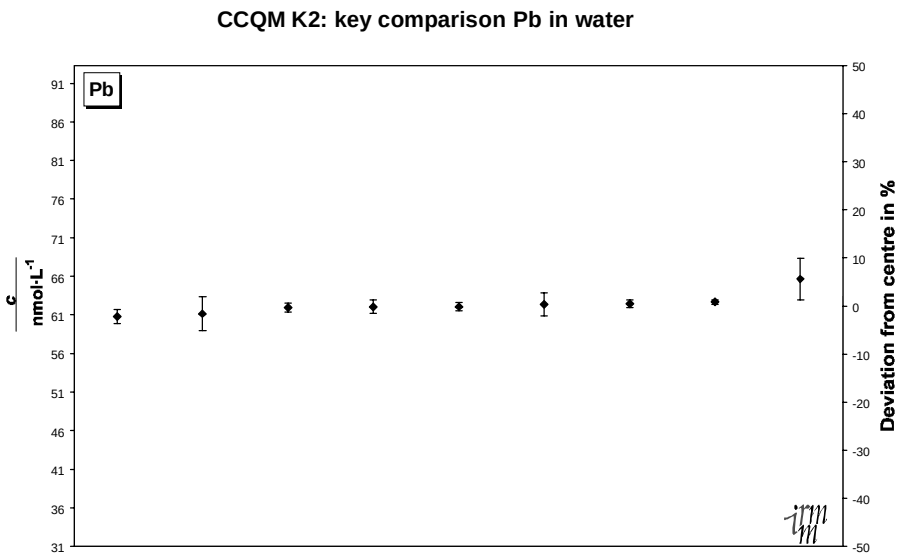


Fig. 1 Results from IMEP-9 NMIs.

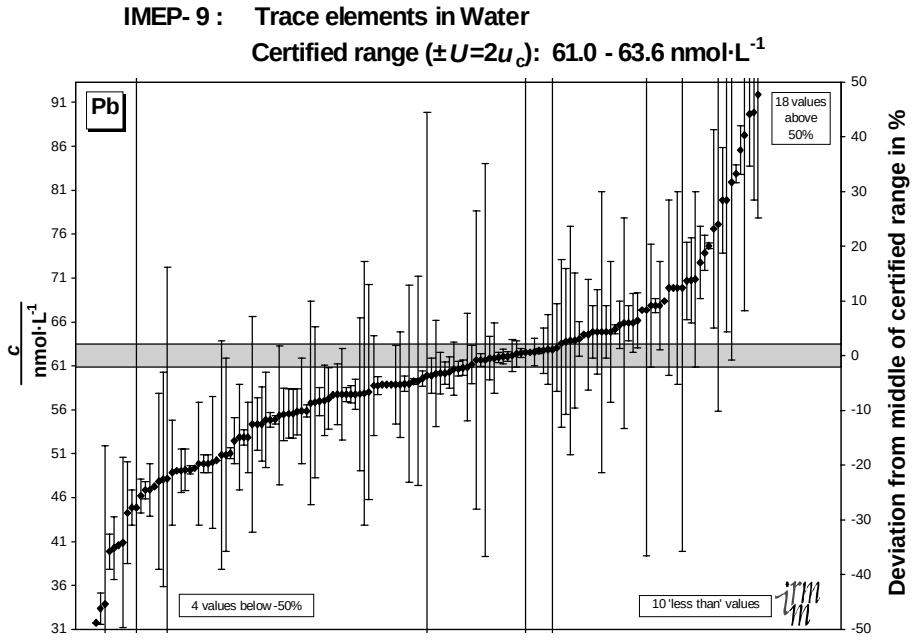


Fig. 2 Results from all laboratories.

to view the claimed measurement capability of different laboratories at various metrological levels, with an international perspective.

IMEP will continue to foster this perspective and grow, with particular focus on laboratories in the Member States of the EU as well as in the EU preaccession countries. In order to prepare the latter for integration into the EU's measurement and accreditation systems, IRMM is offering:

- postdoctorate fellowships (2–3 years)
- detached national experts
- visiting scientists

In this way, IRMM will give training/advice on trace-

ability and on uncertainty evaluation of chemical measurement results. Participants can take this expertise back to their home countries and/or become regional coordinators for IMEP in their respective countries. In collaboration with EUROMET and CCQM, IMEP samples are offered for the organization of EUROMET key or supplementary comparisons and, where appropriate, for the organization of CCQM key comparisons or pilot studies.

In its role as a neutral, impartial international evaluation program, IMEP displays existing problems in chemical measurement. IRMM is dedicated to tackling this problem and will, where possible, collaborate with international bodies, education and accreditation authorities, and NMIs to achieve more reliable measurements and contribute to setting up an internationally structured measurement system.

Ellen Poulsen (Denmark) preparing graphs for the IMEP-9 participants' report on trace elements in water.

Europe's Favorite Chemists?

Choosing Europe's Top 100 Chemists: A Difficult Task

This article by Prof. Colin Russell (Department of History of Science and Technology, Open University, Milton Keynes, England MK6 7AA, UK) was commissioned by *Chemistry in Britain* and published by that magazine in Vol. 36, pp. 50–52, February 2000. The list of Europe's 100 distinguished chemists was compiled by the Federation of European Chemical Societies (FECS), and additional information about each of the FECS 100 top chemists can be found at www.chemsoc.org/networks/enc/fecs/100chemists.htm. We thank Prof. Russell, *Chemistry in Britain*, and FECS for permission to reproduce the article in full here. Thanks also to Prof. Lauri Niinistö of the Helsinki University of Technology, Laboratory of Inorganic and Analytical Chemistry, for providing the illustrations and photographs.

Introduction

The millennium bug does not only bite computers. Human beings are susceptible to it, too. Occasionally, this bug may lead to bizarre behavior patterns that have only one thing in common: an irresistible desire for some kind of celebration in the year 2000. Often, there is only the foggiest idea as to what is actually being celebrated. That it is notionally 2000 years since the birth of Christ is quite forgotten in general. An additional irony lies in the fact that recent evidence from history, archaeology, and astronomy suggests a birthdate about seven years earlier, so the real millennium came and went unnoticed in the early 1990s. However that may be, the grand spirit of revelry and *bonhomie* cannot be quenched by such mundane considerations, and celebration there shall be. Nor are societies to be left behind in the general euphoria.

FECS Millennium Project

In 1998, the Federation of European Chemical Societies (FECS) proposed to celebrate in its own way and to mark the occasion by proclaiming to the world names of the top 100 European chemists. Inclusion in this hall of fame would do little for the individuals concerned for the simple reason that they all had to be dead. However, it might gladden the hearts of surviving relatives of a few. It would minister to the pride of nations whose sons and daughters were so honored, and (if handled properly by the spin doctors) could be a useful reminder to the general public of just how much they owe to the chemists of Europe. And that would be a very good thing, indeed!

The only problem was this: How on earth does one try to establish such a list and get general agreement for it? Ask 20 chemists for a short list of their own candidates and you will end up with 20 different answers.

Try to be objective and you just give up for lack of agreed criteria. Thus, quantitative data gleaned from citation indexes may testify to volume but not quality of a chemist's work. Being a Nobel prizewinner in chemistry was a possible criterion, but there were not enough of these from Europe—Nobel prizes only started in 1901—and all Nobel prizewinners are not equal. There are no sales figures to help us establish which releases are "top of the pops" (and no comparable audience reactions, come to that!). So what do you do? You ask the public.

In this case, one can hardly inquire of the whole population of Europe. Instead, FECS made the sensible decision to devolve the early stages of nomination to the member societies. Each was asked to provide its own list. It was suggested that working parties should be established, and guidelines were offered. Thus, persons proposed should have transformed chemical science and exerted a worldwide influence. They should have conducted the major part of their work in Europe, and so on. The surprising feature of this millennium celebration was that the period concerned stretched back not 2000 or even 1000 years, but a little over 200. At one stage, it was suggested that the Chemical Revolution (whatever that was) should be a good starting point. This milestone seemed generally understood to be the reforms associated with Lavoisier at the end of the 18th century, though in practice the list included a few who predated—or even opposed—this Chemical Revolution. So, at a stroke, chemical giants such as Paracelsus, Glauber, van Helmont, Hales—and even Robert Boyle—were excluded automatically. And there were certainly no alchemists. Still, rules are rules, and most countries produced a response broadly on the agreed lines.

The result was a spectacular demonstration of variable response. Eight countries did not reply at all. Whereas most that did (including the United Kingdom) made an effort to be fair to everyone and to supply an international list, the names provided by no fewer than 10 countries consisted exclusively of their own nationals. This possibility was quite unexpected, but not formally excluded by the rules. Possibly, these respondents thought that everyone would play the game this way. Or maybe they just felt the need to keep their own end up. But if all had done this, it is hard to see how a reasonable list could emerge, because each respondent was given equal weight in the analysis. It would have meant the same number of names from (say) France, Slovenia, Italy, Portugal, and Ireland. Therefore, for the early compilation stages, it seemed quite fair to set aside the submittals from these 10 societies. That left 20 others who had all tried to be genuinely international. Gratifyingly, these included some of the smaller societies, such as those from Finland, Slovenia, and Cyprus.

Working Party for the History of Chemistry

Thanks to the indefatigable efforts of the chairman of the Working Group for the History of Chemistry, a computer program was set up to collate these 20 lists. Although societies had been asked to grade their own nominations, at this stage mention at any point on someone's list meant that the individual would be counted. Thus, a single comprehensive table was generated, showing each name nominated with the number of societies giving that person their vote. The winners were at the top, the losers at the bottom. Only two chemists, Lavoisier and Berzelius, scored 100%, with 20 votes each. Few historians of chemistry would quarrel with that result. Yet the total number of names was a formidable 308, and now the matter was firmly in the hands of a nominated committee to come to a conclusion on the matter. All we had to do was to jettison two-thirds of the names proposed!

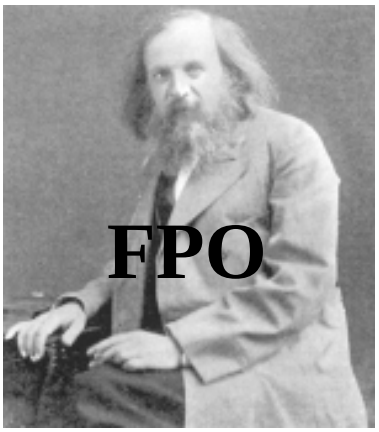
This committee, which met in Budapest in July 1999, took some fairly obvious steps at the outset. The first task was to eliminate all those who had a score of only one (i.e., had been mentioned by only one of the 20 societies). That immediately brought the numbers down to a manageable 112; to have excluded those who scored two would have taken numbers well below the required 100. But how to eliminate a mere 12 chemists? Far from being a simple task, it proved to be one requiring considerable subtlety and finesse. Each of the 112 contenders was considered individually.

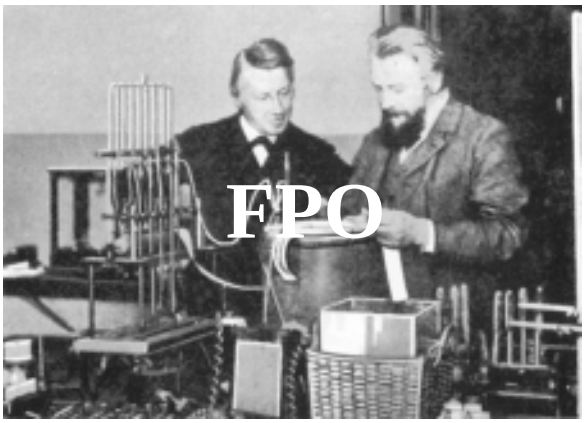
Some were removed because they were not deemed to be "chemists", although the use of "professional" titles raises huge problems before the mid-19th century. However, Volta as a physicist, Boerhaave as a medical man, and Krebs as a biochemist were deemed to be out of the running. Less contentiously, several names from the 20th century were dropped for the simple reason that their owners were still alive. Yet others disappeared from view because their main chemical work was performed outside Europe. And at this point, the "frozen" 10 lists were considered and a number of their high-scoring extra names were added to the main list. After all the additions and subtractions, we were within two or three names of our target, and almost there.

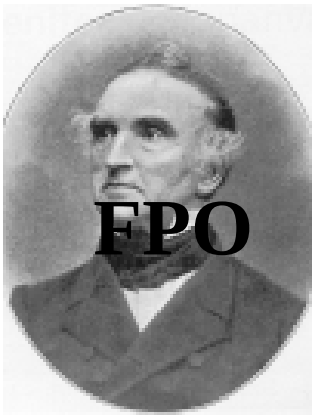
Final List

It would be tedious to recount the last stages of the debate, some of which had to be conducted by post after the committee had risen. By 8 July 1999, the final list had been agreed upon, and all that remained were the fine points of drafting. Lists for the three centuries were arranged in strictly alphabetical order, with no implication of relative merit. Our "100 best chemists" had emerged.

An exercise of this kind is bound to attract criticism. Perhaps the most ironic note of all was struck by one







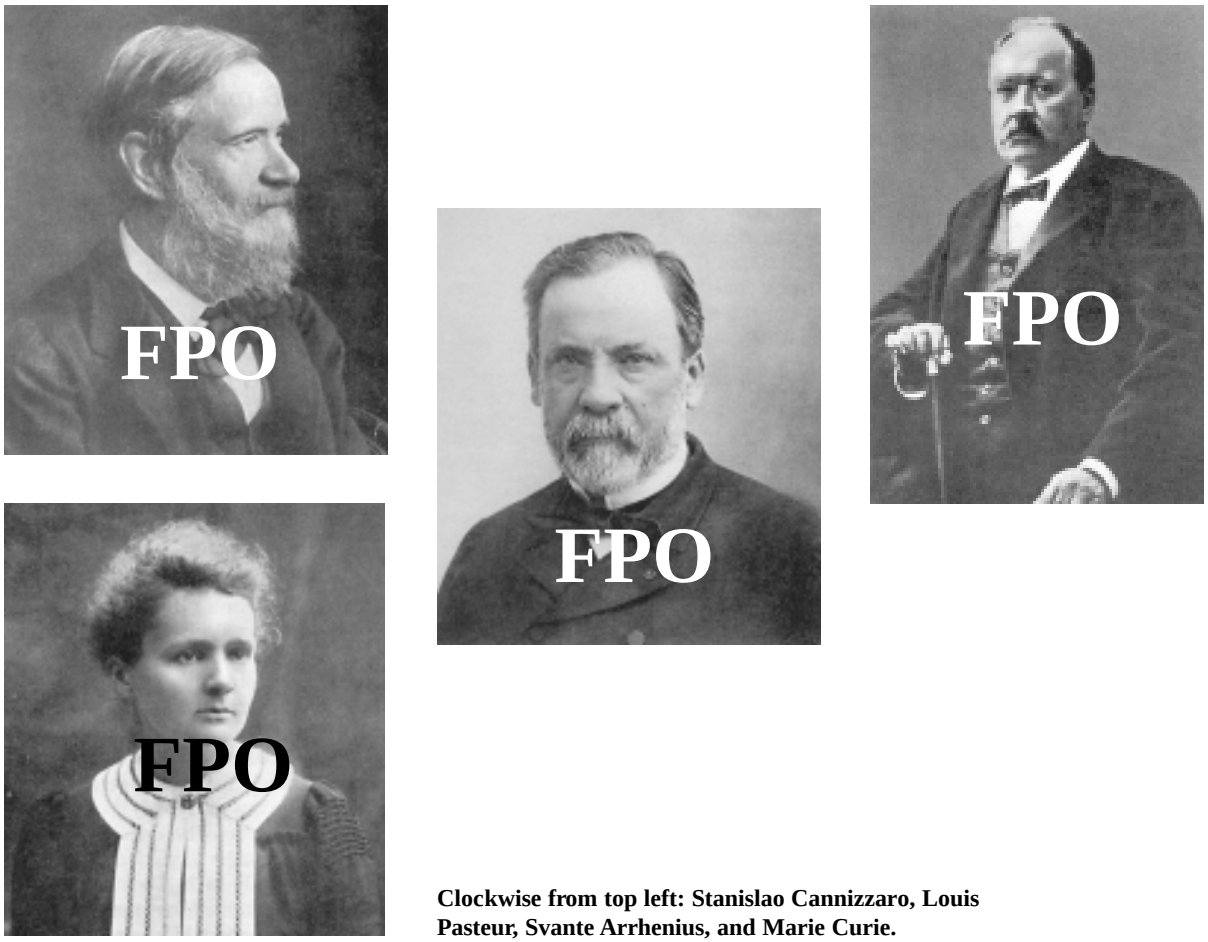
Clockwise from top left: Antoine Lavoisier, Jöns Jakob Berzelius, Dmitri Mendeléev, Justis Liebig, Jacobus van't Hoff and Wilhelm Ostwald

member of the committee who declared that he did not believe in the value of such exercises and would therefore play no part in them (although he remained as an observer). The rest of us, although sharing many of his doubts, still believed that a credible solution could be found, and pressed on accordingly. We were aware that many aspects of the methodology could be attacked, and ourselves had to make some decisions that did not keep strictly to it. Thus, Avogadro, the lawyer, was admitted, but not several worthy names in modern biochemistry. As often in discussions of this kind, the basic question "What is a chemist?" remains tantalizingly unanswered. Then again, the relative weightings of the three centuries (14/42/44) had more than an element of arbitrariness.

Most seriously, in my opinion, was the ambiguity as to whether contributions to applied chemistry were as valid as those to pure chemistry. The general view seemed to be that they were not, and thus many famous names from the chemical industry are absent. However, Auer, the inventor of the gas-mantle, was considered to have so profoundly affected Victorian society that he is included. Leblanc, whose process founded the alkali industry, does not appear, although his rival inventor Solvay is present. All these cases were subject to much fine-tuning, and reasons could be given (if anyone were sufficiently interested) for each one of them.

So has it all been worthwhile? As a competitive exercise or an end-of-term report, the answer must be decisively "no". We had neither the mandate, the data, nor even the inclination for such a project. Serious work is currently going on that attempts to acquire and organize quantitative data that may go some way to establishing criteria of excellence (among many other things). It is called prosopography. But this exercise is emphatically not part of that. Our overall conclusion must inevitably be impressionistic rather than precise. What we have recorded is not the value of individuals, but rather public perceptions about them. And these perceptions, of course, depend on many things other than sheer worth.

In terms of national contributions, there are few surprises. The "big three"—Germany, the United Kingdom, and France—have, respectively 28, 24, and 15% of the nominations. There is then a large gap until Sweden and Russia each gain 5%, and all the other countries are below that figure. But one hardly needed an exercise of this kind to establish these orders of magnitude. It would be rather a pity if anyone drew jingoistic conclusions from these data, and even more so if any of the low-scoring countries were to become discouraged. By all means, engage in critical historical analy-



Clockwise from top left: Stanislao Cannizzaro, Louis Pasteur, Svante Arrhenius, and Marie Curie.

sis to find what has been conducive to the successful prosecution of chemistry. Some historians of chemistry are already doing just that, and they deserve every encouragement. But do not suppose that this is what we have done.

What has emerged is a list of 100 men and women who have performed distinguished work in European chemistry, have helped to change the physical world that we inhabit, and have been widely recognized by their peers. On the question of peer recognition, the exercise displays another interesting insight. There is a huge gap between an understanding of chemical history gleaned *en passant* by ordinary chemists in the normal course of their work, and that derived from sustained historical study. It confirms the case for doing everything possible to make the historians' work accessible to the working chemist. But that is by the way.

The chief function of our labors will, we hope, be to supply a useful tool in the new century's efforts to foster the public understanding of chemistry. One thing is certain—without a strong human dimension in the communication of chemistry, that task will fail. Perhaps our list will be fuel for the popularizers of science and for chemistry teachers. Making it was fun. If we were to try again next week, we should probably come to about the same conclusions. But it would not be quite the same list.

The views expressed in this article are the author's own and do not represent an official report of FECS.

The Federation of European Chemical Societies (FECS) is a voluntary association, founded in 1970. It aims to promote cooperation in Europe between those non-profit-making scientific and technical societies in the field of chemistry whose membership consists largely of individual qualified chemists and whose interests include the science and/or practice of chemistry. Information on its activities can be found on the web site www.chemsoc.org/fecs.

Further information about the FECS 100 distinguished European chemists can be found on the web site.

FECS list of 100 distinguished European chemists

18th century

Bergman, Torbern Olof	(1735–1784)
Berthollet, Claude Louis	(1748–1822)
Black, Joseph	(1728–1799)
Cavendish, Henry	(1731–1810)
Gadolin, Johan	(1760–1852)
Kirwan, Richard	(1735–1812)
Klaproth, Martin Heinrich	(1743–1817)
Lavoisier, Antoine Laurent	(1743–1794)
Lomonosov, Mikhail Vasilievich	(1711–1765)
Priestley, Joseph	(1733–1804)
Richter, Jeremias Benjamin	(1762–1807)
Ruprecht, Antal	(1748–1818)
Scheele, Carl Wilhelm	(1742–1786)
Vauquelin, Louis Nicolas	(1763–1829)

19th century

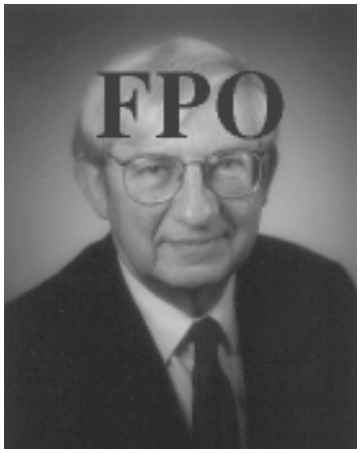
Arrhenius, Svante August	(1859–1927)
Auer, Karl	(1858–1929)
Avogadro, Amedeo	(1776–1856)
Baeyer, Johan Friedrich Wilhelm Adolf	(1835–1917)
Berthelot, Pierre Eugène Marcelin	(1827–1907)
Berzelius, Jöns Jakob	(1779–1848)
Bunsen, Robert Wilhelm Eberhard	(1811–1899)
Butlerov, Alexander Mikhailovich	(1828–1886)
Cannizzaro, Stanislao	(1826–1910)
Claisen, Ludwig	(1851–1930)
Dalton, John	(1766–1844)
Davy, Humphry	(1778–1829)
de Marignac, Jean Charles Galissard	(1817–1894)
Dumas, Jean Baptiste André	(1800–1884)
Faraday, Michael	(1791–1867)
Fischer Emil	(1852–1919)
Frankland, Edward	(1825–1899)
Fresenius, Carl Remigius	(1818–1897)
Gay-Lussac, Joseph Louis	(1778–1850)
Graham, Thomas	(1805–1869)
Hofmann, August Wilhelm	(1818–1892)
Kekulé, Friedrich August	(1829–1896)
Kolbe, Adolph Wilhelm Hermann	(1818–1884)
Laurent, Auguste	(1807–1853)
Le Chatelier, Henri Louis	(1850–1936)
Liebig, Justus	(1803–1873)
Mendeléev, Dmitri Ivanovich	(1834–1907)
Meyer, Julius Lothar	(1830–1895)
Moissan, Ferdinand Frédéric Henri	(1852–1907)
Ostwald, Friedrich Wilhelm	(1853–1932)
Pasteur, Louis	(1822–1895)
Perkin, William Henry (sr.)	(1838–1907)
Proust, Joseph Louis	(1754–1826)
Ramsay, William	(1852–1916)
Solvay, Ernest	(1838–1922)
Stas, Jean Servais	(1813–1891)
Ste-Claire Deville, Henri Etienne	(1818–1881)
Van't Hoff, Jacobus Henricus	(1852–1911)
Werner, Alfred	(1866–1919)
Williamson, Alexander William	(1824–1904)
Wöhler, Friedrich	(1800–1882)
Wurtz, Charles Adolphe	(1817–1884)

20th century

Aston, Francis William	(1877–1945)
Barton, Derek Harold Richard	(1918–1998)
Bosch, Karl	(1874–1940)
Brönsted, Johannes Nicolaus	(1879–1947)
Butenandt, Adolf Friedrich Johann	(1903–1995)
Curie, Marie	(1867–1934)
Debye, Peter Joseph Wilhelm	(1884–1966)
Diels, Otto Paul Hermann	(1876–1954)
Grignard, François Auguste Victor	(1871–1935)
Haber, Fritz	(1868–1934)
Hahn, Otto	(1879–1968)
Hantzsch, Arthur Rudolf	(1857–1935)
Hassel, Odd	(1897–1981)
Haworth, Walter Norman	(1883–1950)
Hevesy, Gÿorgy Charles	(1885–1966)
Heyrovsky, Jaroslav	(1890–1967)
Hinshelwood, Cyril Norman	(1897–1967)
Hodgkin, Dorothy Mary	(1910–1994)
Ingold, Christopher Kelk	(1893–1970)
Karrer, Paul	(1889–1971)
Kendrew, John Cowdery	(1917–1997)
Natta, Giulio	(1903–1979)
Noddack, Ida Eva	(1896–1978)
Nernst, Walther Hermann	(1864–1941)
Pregl, Fritz	(1869–1930)
Prelog, Vladimir	(1906–1998)
Reppe, Walter Julius	(1892–1969)
Robinson, Robert	(1886–1975)
Rutherford, Ernest	(1871–1937)
Ruzicka, Leopold Stephen	(1887–1976)
Sabatier, Paul	(1854–1941)
Semenov, Nikolay Nikolaevich	(1896–1986)
Soddy, Frederick	(1877–1956)
Sörensen, Sören Peter Lauritz	(1868–1939)
Staudinger, Hermann	(1881–1965)
Stock, Alfred	(1876–1946)
Svedberg, Theodor H.E.	(1884–1971)
Todd, Alexander Robertus	(1907–1997)
Tswet, Michail Semënovic	(1872–1919)
Wilkinson, Geoffrey	(1921–1998)
Willstätter, Richard Martin	(1872–1942)
Wittig, Georg Friedrich Karl	(1897–1987)
Ziegler, Karl	(1898–1973)
Zsigmondy, Richard Adolf	(1865–1929)

Secretary General's Report

It has been a rather long time since I have used the columns of *Chemistry International* to present an informal discussion of important activities within the Union. During most of the 1990s, the principal issue in IUPAC seemed to be "restructuring" or, more broadly, "the scientific policy of the Union." With the development of a mission statement and a set of long-range goals, the strategy of the Union came into focus. A far-reaching decision by the Bureau in 1998 and final approval by Council in 1999 changed the basic framework for carrying out scientific work in IUPAC from a system largely dependent on a number of Commissions to one driven primarily by the inception of individual projects.



Dr. Edwin D. Becker

Everyone involved in the governance of IUPAC spent a great deal of time and effort in developing proposals for the new structure and operational system, in arguing for or against various aspects, in making many modifications and improvements, and in seeing the program finally approved. However, the year 2000 was really much more demanding as we have begun to implement the new system. The seven Division Presidents, in particular, have borne a heavy load as they continue to guide their Commissions to successful completion of their work by the end of 2001 while concurrently they strive to broaden the base of expertise in their Division Committees and to encourage all current members of IUPAC bodies to propose good projects for the future. We all owe the Division Presidents a sincere vote of thanks for their superb response to these challenges and for their dedicated leadership during the 2000–2001 biennium.

In this report, I would like to point out some of the features of our new procedures and to focus particularly on the Union's efforts to reach out—to IUPAC Affiliates and Fellows, to national and regional chemical societies, and to the worldwide chemistry community.

What is new about a project system? IUPAC has always had projects, based on meeting some perceived need, and often resulting in the publication of a technical report, a recommendation, tables of evaluated data, and other outputs. Early Commissions were formed usually to attack some particular problem, but over time most Commissions came to represent primarily a particular subset of chemistry. Discussions within a Commission usually generated ideas for specific projects, and these were carried out within the financial resources made available to the Commission. The sequence might be summarized as follows:

Resources → Commission → Discussion → Ideas → Project

Now we have a system that is *driven* by the proposal to carry out a project. Only after the proposal is reviewed in detail and approved by a Division Committee are funds made available to the task group formed to carry out the project. The new sequence might be summarized:

Ideas → Proposal → Review → Resources → Task Group → Project

All of us who have advocated such a project-driven system believe that it will permit IUPAC to address problems more quickly, to provide funds where needed to expedite completion of a project as expeditiously as possible, and—perhaps most important—to seek ideas more broadly so that we can be certain to address those problems of greatest importance that are within IUPAC's scope.

Will the project system work? I hope and believe that it will—but not without some thought and effort. There are three necessary components to developing and completing an IUPAC project: good ideas, able and willing people, and adequate resources.

- The Union can provide the organizational framework, assistance from our professional Secretariat, and financial support (modest, but nevertheless real).
- A comparison of the two schemes illustrated above makes it clear that one advantage of the Commission system is the initial appointment of people interested in a particular area and the financial support for them to meet regularly for discussions that

might identify both suitable ideas for projects and people (usually from the Commission or its subgroups) who might carry out the project. Without going back to a system of permanent Commissions, IUPAC can and will convene *ad hoc* groups to "brainstorm" in particular areas, as identified at least partially by Division and Standing Committees. However, discussions leading to proposals for IUPAC projects need not be organized only by IUPAC. *Any* individuals or groups who identify problems that IUPAC might reasonably address are welcome to submit proposals or to seek more information and guidance from the Secretariat or the IUPAC web site, www.iupac.org.
- Ideas without scientists committed to carrying out the work will not go very far in an organization like IUPAC that depends on volunteers. So we need good ideas *and* scientists who are able and willing to devote some time to help improve worldwide chemistry.

What are suitable IUPAC projects? IUPAC's role involves *international* chemistry. Traditional projects include the international standardization of nomenclature and terminology, publication of glossaries in particular fields, setting standards for presentation of spectral and other data, establishing uniform scales for quantities such as pH, forging agreement on analytical methods, and a host of similar matters. Other IUPAC projects are directed at compilation and evaluation of quantitative (usually numeric) data in areas where there are international needs, such as thermodynamics, kinetics, metabolism, etc.

Even with limited resources, IUPAC can play a very important role in exchanging information among national groups and in coordinating activities that call for international leadership. For example, following the recent report of IUPAC's Education Strategy Development Committee (see article immediately below and *Chemistry International*, Vol. 22, No. 2, pp. 33–34, 2000 and Vol. 22, No. 3, pp. 70–71, 2000), the Union is considering areas in which it can usefully complement activities of national chemical societies and others. Innovative projects with an educational or training component can be considered, as can other proposals that emphasize IUPAC's international coordinating efforts in the broad area of the chemical sciences.

The Union does not have the resources to support research, and it does not wish to intrude on matters that are handled adequately by national or private organizations. However, we are interested in novel ideas, as well as in proposals in areas exemplified by the listing of current projects on the web site.

Who will propose and carry out projects? Even with its smaller structure after 2001, IUPAC will have hundreds of scientists participating in various bodies. Many will propose projects and will serve on task groups that carry out a project. However, IUPAC has a much broader base of knowledgeable and interested scientists—*IUPAC Fellows and Affiliate Members*. Moreover, scientists with no long-term affiliation with IUPAC may well be interested (individually or in groups) in tackling a project that will assist their research efforts or applications in chemical sciences.

- There are already nearly 500 Fellows, whose terms on IUPAC bodies have concluded, and after 2001 there will a significant increase in this number. Fellows have served IUPAC, and I believe that most retain considerable interest in the Union's programs. Fellows are in an excellent position to take on new projects.
- We have over 4 500 Affiliate Members, all of whom annually renew their interest in IUPAC. All receive *Chemistry International* as the principal means of communication, and many now receive *IUPAC e-News*, the e-mail newsletter that complements *CI*. I extend a special invitation to Affiliate Members to think about ways that IUPAC might assist chemistry and to consider initiation of proposals for suitable projects.
- Most chemists participate in many professional groups related to their special field and/or to geography, in national or regional organizations. Discussions in such groups may well lead to ideas that can be developed into IUPAC projects. For example, standards or guidelines established in a particular field or location might be "internationalized," or concepts tested in workshops or classes in one place might be transformed into a broader international context.

As IUPAC moves into a new mode of operation, we should all be alert to opportunities for the Union to enhance its contributions to the chemical sciences. In short, as you handle daily business, *Think IUPAC*.

Edwin D. Becker

Strategy for Educational Policy

Consideration of the ESDC Report

Following its second two-day meeting at the IUPAC Secretariat on 22–23 July 2000, the ad hoc IUPAC Education Strategy Development Committee (ESDC) concluded its task by preparing a report (posted on the IUPAC web site at http://www.iupac.org/news/archives/2000/edu_Report2.html) that puts forth recommendations for possible future directions of IUPAC's activities in chemistry education and the public appreciation of chemistry.

IUPAC has long had educational programs, both in the scientific Divisions and in the Committee on Teaching of Chemistry, but they have been somewhat fragmented. The proposals by the ESDC now provide a framework for developing an overall strategy for ways by which IUPAC can contribute to chemistry education in a way that complements the programs of national chemistry organizations.

Following a recent discussion at the IUPAC Bureau meeting in September 2000, the President has appointed a small working group, headed by IUPAC Past President Prof. Joshua Jortner, to evaluate the ESDC recommendations and to determine how they can best be implemented. Help and advice on how the recommendations can best be implemented will be requested from National Adhering Organizations, national chemical societies, and other relevant organizations. National chemistry organizations will clearly remain in the forefront, but the ESDC report suggests a number of IUPAC initiatives that could be synergistic with activities in individual countries.

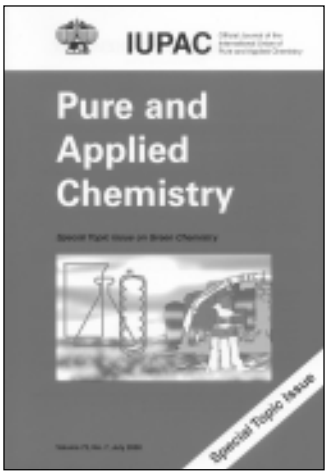
Pure and Applied Chemistry: Special Topic Issue on Green Chemistry

Copies of Vol. 72, No. 7, the July 2000 Special Topic Issue of *Pure and Applied Chemistry* (*PAC*) on Green Chemistry, continue to be available from the IUPAC Secretariat for USD 50 each (including shipping and handling) as long as supplies last. Order by e-mail (orderdesk@iupac.org) or by fax (+1 919 485 8706), if you are interested in obtaining a copy.

The *PAC* Special Topics Project was described earlier in *Chemistry International*, Vol. 22, No. 4, pp. 105–106.

The terminology "green chemistry" or "sustainable chemistry" is the subject of debate. The expressions are intended to convey the same or very similar meanings, but each has its supporters and detractors, since "green" is vividly evocative but may assume an unintended political connotation, whereas "sustainable" can be paraphrased as "chemistry for a sustainable environment", and may be perceived as a less focused and less incisive description of the discipline. Other terms have been proposed, such as "chemistry for the environment" but this juxtaposition of keywords already embraces many diversified fields involving the environment, and does not capture the economic and social implications of sustainability. The Working Party decided to adopt the term green chemistry for the purpose of this overview. This decision does not imply official IUPAC endorsement for the choice. In fact, the IUPAC Committee on Chemistry and Industry (COCI) favors, and will continue to use sustainable chemistry to describe the discipline.

Intent and content of the Special Topic Issue on Green Chemistry are summarized in the Foreword and Preface reproduced below:



Foreword

Modern chemistry is one of the essential tools in pursuing better medical care, more efficient telecommunications and informatics, and increased agricultural production.

However, certain chemicals produced and used in large quantities might cause various hazards in environmental sectors, owing to their global (trans-boundary) translocation, as well as their intrinsically hazardous properties. To reduce environmental risk of such chemicals, international regulatory measures have already been taken [e.g., in response to the initiatives of the Intergovernmental Forum in Chemical Safety (IFCS)], including legally binding implementations and national capacity building in developing countries. Herein lies the urgent need for promoting worldwide research into green chemistry (sustainable chemistry), in which the invention and application of chemical products and processes are designed to reduce or to eliminate the use and generation of hazardous substances.

Indeed, green chemistry should encompass a variety of disciplines of fundamental chemistry in IUPAC, to encourage new trends of chemical research. Moreover, results of this research could be effectively applied for solving environmental problems related to the production and use of chemicals and to create a new chemical industry in the future. As such, green chemistry research conforms completely to the mission-oriented activity of IUPAC to meet regulatory requirements for achieving environmentally sound management of chemicals. We sincerely hope that the present special issue highlighting the state of the art and future prospects of green chemistry research will encourage all chemists who intend to serve society through their research efforts.

Dr. Junshi Miyamoto
Past President, IUPAC Chemistry and the Environment Division VI

The increasing knowledge in natural sciences and the application of this knowledge are the driving forces for the development and welfare of mankind. Chemistry plays a central role in this development. Chemistry provides the molecular understanding of physical

properties of materials and other matters and thus closely interacts with physics. Chemistry also provides the molecular understanding of living systems and is the basis for modern biology and medicine. The development and opportunities of synthetic chemistry have opened a new dimension for tailor-made materials and compounds for specific purposes. The driving forces for developments in chemistry have been very strong, and there is a demand for new and efficient processes and chemicals. Aspects of sustainable and environmentally friendly processes and chemicals have sometimes been lagging behind this demand.

Fortunately, chemistry also provides the tools for a green and sustainable development. Knowledge in this general area has to be integrated into the planning of all research and development in chemistry. There are specific research topics related to the development of green and sustainable processes, which need the input of new technology and novel chemistry. The present Symposium-in-Print provides an overview of recent research and development in the field. We hope that it will stimulate further activities in the field. It is planned as a first step in an IUPAC action on this subject. The IUPAC Organic and Biomolecular Chemistry Division is grateful to its Subcommittee on Organic Synthesis, and particularly to Prof. Pietro Tundo, for initiating and engaging in this action, and to him and Profs. David StC. Black and Sofia Memoli for editing the Symposium-in-Print.

Prof. Torbjörn Norin
President, IUPAC Organic and Biomolecular Chemistry Division III

Preface

The evolving face of contemporary chemistry is characterized by unprecedented societal demand for the goods and services of the chemical industry, tempered by growing awareness that finite resources must be conserved and their exploitation optimized. At the same time, environmental protection has become a global concern, and the chemical industry is increasingly obliged to re-examine conventional methodologies, and to seek ways of developing and applying more efficient and environmentally benign strategies for future sustainable growth. The tandem concepts of discovery and exploitation are obviously as old as the industry itself, but there is new urgency in the quest for solutions that will halt and reverse some of the negative effects of historical development and, at the same time, seize the opportunities offered by the extraordinary advances in chemical sciences during recent years.

The twin challenges of increasing synthetic efficiency in chemical transformations and minimizing environmentally hostile waste offer irresistible opportunities for new-age ingenuity. It is in this climate that new approaches to these problems have coalesced into a distinctive discipline, which has been variously described and named but has, as its central thrust, the strategic objectives of increased efficiency, sustainability, and, ultimately, societal benefit. These objectives identify closely with the vision of IUPAC, which is eloquently expressed in two of the goals defined in the current strategic plan, namely, to *contribute to the advancement of research in the chemical sciences throughout the world* and to *assist chemistry-related industry in its contributions to sustainable development, wealth creation, and the improvement of the quality of life*.

A Working Party on Synthetic Pathways and Processes in Green Chemistry was established in 1996, under the auspices of the Commission on Physical Organic Chemistry (III.2) of the IUPAC Organic and Biomolecular Division, with a mandate to promote and disseminate awareness of environmentally compatible synthetic pathways (green chemistry), throughout the academic and industrial scientific research community. In 1999, this group, in close collaboration with the IUPAC Subcommittee on Organic Synthesis, initiated a project to publish a Symposium-in-Print on Green Chemistry, and undertook to compile a collection of expert reviews on aspects of the topic, underpinned by an introductory account of the evolution of the project, its rationale, and its interfaces with complementary initiatives and organizations.

This volume represents the culmination of that undertaking, and the introductory overview, comprising contributions by members of the Working Party, gives a detailed account of the role and interest of IUPAC in promoting this initiative, and sets the scene for the ensuing Symposium-in-Print, with an interpretation of the meaning of the term “green chemistry” and an account of the historical emergence of the concept. This history is followed by a synoptic preamble, in which the content and purpose of individual reviews in the Symposium-in-Print are summarized. Although the preamble adopts a sequence of presentation based upon the logic imposed by the title theme of synthetic pathways and processes, the influential role of the Organization for Economic Cooperation and Development (OECD) is recognized by adoption of their recommended delineation of topics for grouping the ensuing reviews.

The Symposium-in-Print sets out to capture the current status of the discipline and to project the boundless opportunities and challenges confronting contemporary organic synthesis and its practice in a changing world, increasingly sensitized to the finite bounds of natural resources and the vulnerability of the biosphere. It offers evidence that current problems are being addressed and can be solved, and engenders expectations that future problems can be anticipated and prevented. Most importantly, the collective expertise and commitment of the contributors is expected to furnish inspira-

tional guidance to practicing scientists and students of chemistry, to participate in shaping a more environmentally benign future, in which the synthetic pathways and processes in chemistry are fully reconciled with societal expectations for ever-improving quality of life.

Prof. James R. Bull
IUPAC Special Topics Editor

UNESCO/IUPAC Postgraduate Course in Polymer Science

Prof. Pavel Kratochvil (Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic, Prague, Czech Republic; E-mail: krat@imc.cas.cz), Associate Member of the IUPAC Macromolecular Division (IV) Committee, has contributed the following article:

A group of participants at the 4th UNESCO/IUPAC Postgraduate Course in Polymer Science 1999–2000. From right to left: Dr. Vlastimil Kůdela (Director of the Course), Milena Mihaylova (Bulgaria), Igor Koshets (Ukraine), Gueorgui Guinov (Bulgaria), Vessela Malinova (Bulgaria), Kateryna Dragan (Ukraine), Daria Andreeva (Russia), and Wojciech Jasiński (Poland).

The Institute of Macromolecular Chemistry of the Academy of Sciences of the Czech Republic in Prague, with its staff of 260, including 130 scientists, is one of the major centers of academic research in polymer science. From the early 1970s to the late 1980s, the Institute organized jointly with Charles University postgraduate training in polymer science for young scientists from emerging countries. After a pause of several years, in 1996, the Institute launched, under the joint sponsorship of UNESCO and IUPAC, a new series of postgraduate courses in polymer science. To date, four runs have been completed; a fifth run began in October 2000 (see http://www.iupac.org/projects/1999/1999-029-1-400.html).

One of the principal components of each 10-month course is 50 hours of lectures in modern polymer science. A few examples of lecture topics include advanced polymerization techniques, thermodynamics and solution properties of polymers, spectroscopy of polymers, and polymers in medicine. Several lectures are also devoted to basics of chemical English and principles of macromolecular nomenclature according to IUPAC recommendations.

Most of the participants in the course have a good background in principles of polymer science but only limited experience in experimental work with up-to-date equipment because of the difficult situation in their home countries. Therefore, the focus of their involvement is work on a research project under the supervision of a senior scientist. The participants can exploit all experimental facilities of the Institute. They are also invited to take part in all educational activities at the Institute, such as seminars, lectures of visiting scientists, conferences organized by the Institute, etc. It has turned out that this scenario is quite efficient. On the average, one paper in an international scientific journal and one communication at an international conference per participant result from each course, which indicates that some new skills have been acquired.

The number of participants in a run of the course varies between 5 and 13, depending upon available funds. Thus far, most of the participants have come from Eastern Europe and parts of the former Soviet Union. Recently, young university graduates from South Africa have applied for admission to the course. Participants enjoy free accommodations, free health care, and a tax-free stipend corresponding approximately to the average net per capita income in the Czech Republic. Travel expenses cannot be covered. If IUPAC supports a run of the course financially, the sum is used to pay a stipend to one or two participants, who are designated as IUPAC stipendiaries.

A certificate of graduation is issued to each successful participant. Followup has shown that graduation from the course is very helpful for professional promotion of the graduates in their home countries.

Reports from IUPAC-Sponsored Symposia

13th International Conference on Organic Synthesis (ICOS-13), 1–5 July 2000, Warsaw, Poland

This conference is the latest in a highly successful series, the most recent of which have been held in Venice (1998) and Amsterdam (1996). The Warsaw Conference was held under the auspices of the Polish Academy of Sciences, the State Committee for Scientific Research, and the Polish Chemical Society, in addition to IUPAC. The Chairman of the Organizing Committee was Prof. Mieczyslaw Makosza, and the Secretary was Dr. Andrzej Konowal. The almost 700 participants were treated to a wonderful conference, which lived up to the standards of its predecessors, both in terms of scientific content and social hospitality.

The scientific program was arranged in four sections covering new synthetic methods, stereoselective synthesis, metal-mediated synthesis, and target-oriented synthesis. Eight plenary lectures were given by Ryoji Noyori, Bernd Giese, Clayton Heathcock, Manfred Reetz, Alessandro Dondoni, Max Malacria, Janusz Jurczak, and Alan Katritzky, and there were 26 invited section lectures. (Manuscripts from ICOS-13 appear in the September 2000 issue of *PAC*, Vol. 72, No. 9.) The Thieme-IUPAC Award Lecture was given by Alois Fürstner, and was one of the highlights of the entire conference. The major contribution of this award by Thieme has become a central feature of the ICOS series. The Fürstner lecture, with its originality, brilliant insight, and clear exposition, was greeted with tremendous enthusiasm by the large audience. There was also a half-day minisymposium on green organic synthesis, which comprised 5 interesting and varied lectures on this fundamentally important area.

A very encouraging aspect of the conference was the presentation of 65 oral presentations and 215 posters, many by young postgraduate students. For the first time in this series, poster prizes were awarded—one for the best poster in each of the two evening sessions. The standard was extremely high, and the choice was almost impossible. The panel eventually awarded prizes to Faye Watson (Southampton) and Mateus Mach (Warsaw), who received the lasting value of a "Gold Book" from IUPAC, and a more immediately gratifying bottle of wine from the conference organizers. May these awards become another tradition!

The conference was held within the impressive and atmospheric Palace of Culture and Science, visible from most parts of Warsaw, and the scene of former major political events. The official social program included a splendid opening reception in the Congress Hall foyer, a delightful chamber music concert in the Congress Hall, and a very jolly conference dinner in the Sobieski Hotel. Unofficially, of course, there was much more.

Prof. Makosza and his team are to be congratulated on the great success of ICOS-13, especially as they agreed to stage this meeting on rather short notice. The main outcome of ICOS-13 is that synthetic organic chemistry is clearly a thriving and vibrant activity. The next meeting in this series, ICOS-14, is scheduled to be held in Christchurch, New Zealand from 14–19 July 2002.

Prof. David StC. Black
Secretary, IUPAC Organic and Biomolecular Chemistry Division III
School of Chemistry
University of New South Wales
Sydney, Australia

15th International Conference on Physical Organic Chemistry (ICPOC-15), 8–13 July 2000, Göteborg, Sweden

This conference was held at the University of Göteborg in Sweden, with all sessions at "Artisen", the performing arts center of the University. These facilities were ideal, with excellent acoustics, and the venue was in the heart of the city close to hotels and residences. Almost 300 participants were in attendance, and the welcome on behalf of IUPAC was given by T. Tidwell, Vice President of IUPAC's Organic and Biomolecular Chemistry Division (III). The importance of physical organic chemistry to IUPAC and to chemistry as a whole was stressed. For example, in the past decade, the Nobel Prizes in 1999, to Ahmed Zewail for femtosecond studies of reaction mechanisms; in 1998, to Walter Kohn and John Pople for computational chemistry; and in 1994, to George Olah for carbocation chemistry, are all in the mainstream of physical organic chemistry.

The topics noted above were featured in many of the lectures at ICPOC-15, most notably by Prof. Zewail himself, who, as the leadoff speaker, covered many exciting new applications of femtochemistry and femtobiology. Other plenary lectures dealt with molecular topology (F. Vögtle, Bonn), spin chemistry (A. L. Buchachenko, Moscow), atom transfer reactions (P. Beak, Urbana), quantum chemistry (B. O. Roos, Lund), molecular recognition (J. K. M. Saunders, Cambridge), ionic liquids (K. R. Seddon, Belfast), photochemistry in supramolecular systems (C.-H. Tung, Beijing), quinone methides (A. J. Kresge, Toronto),

synthetic peptide ligases (R. Ghadiri, San Diego), carbocations (J. Sommer, Strasbourg), metal activation of alkanes (H. Schwarz, Berlin), organosilicon chemistry (M. Kira, Sendai), and dendrimer chemistry (D. A. Tomalia, Ann Arbor). [Manuscripts from ICPOC-15 appear in the December 2000 issue of *PAC*, Vol. 72, No. 12.] There were also 35 invited lectures, 75 oral presentations, 119 posters, and a historical lecture on the development of free radical chemistry from 1900 to 1934, which noted the important contribution of the Swedish chemist H. L. J. Bäckström, who was a professor in Göteborg.

A feature of the conference was after-lunch concerts by local musical groups, which were well attended. Another innovation was an open meeting of IUPAC's Commission on Physical Organic Chemistry (III.2), which is responsible for the organization of these conferences. It is expected that the Commission will evolve into a Subcommittee with a new title, perhaps Structural and Mechanistic Organic Chemistry, to represent the focus of the field better, and to recognize important roles for materials and bioorganic chemistry. It was announced by C. Perrin, Chairman of Commission III.2, that the 2002 conference (ICPOC-16) would be held in San Diego.

Prof. Per Ahlberg of the University of Göteberg

The participants and speakers were most grateful to Prof. Per Ahlberg of the University of Göteborg, and to his efficient and helpful organizing committee, for an exciting and well-run conference.

Prof. Thomas T. Tidwell
Vice President, IUPAC Organic and Biomolecular Chemistry Division III
Department of Chemistry
University of Toronto
Toronto, Canada

New Projects

Visit http://www.iupac.org/projects/ for complete information and further links.

New Project Numbers

We are implementing a new project number scheme for all projects initiated since January 1999. The project number and the file name are identical and conform to the following format: yyyy-nnn-v-bbb [yyyy, the year submitted; nnn, a sequential number; v, version number; bbb, the 3-digit code associated with the body managing the project]. The corresponding file name and location are represented by /projects/yyyy/yyyy-nnn-v-bbb.html.

IUPAC Stability Constants Database

IUPAC has approved a three-year project to bring the IUPAC Stability Constants Database up to date by abstracting data from many new journals and rechecking mainstream journals for omissions. The database contains all data from book compilations of stability constants published by IUPAC and the Royal Society of Chemistry (London), and it is intended to be a definitive compilation of all significant published stability constants.

Data collection will be carried out mainly in New Zealand (under the supervision of Prof. K. Powell), with assistance from chemists in Russia and Great Britain. Data validation and database compilation will be carried out by Dr. L. Pettit. In addition to ligand names and empirical formulas, methods of including ligand structures will be investigated by Dr. Solov'ev (Russia).

Comments from the chemistry community are welcome and should be addressed to Dr. L. Pettit, Academic Software, Sourby Old Farm, Timble, Otley, Yorkshire, LS21 2PW, England, UK; Fax: +44 1943 880310; E-mail: scdbase@acadsoft.co.uk.

See http://www.iupac.org/projects/2000/2000-004-2-500.html for project description and update.

Ionic Strength Corrections for Stability Constants

IUPAC has approved a three-year project to produce a freely available computer program to correct activity coefficients and, hence, stability constants, for ionic strength changes over a wide range of molalities. Calculations will be based on Specific Interaction Theory (SIT).

The program will contain a small database of inter-

action coefficients for many common ions and media (not critically evaluated) and facilities for calculating approximate values when experimental values have not been reported in the literature. It will be possible for users to add new values to the database, or to correct existing values.

Comments from the chemistry community are welcome and should be addressed to Dr. L. Pettit, Academic Software, Sourby Old Farm, Timble, Otley, Yorkshire, LS21 2PW, England, UK; Fax: +44 1943 880310; E-mail: scdbase@acadsoft.co.uk.

See http://www.iupac.org/projects/2000/2000-003-1-500.html for project description and update.

University Education in Polymer Science

IUPAC has approved a 2-year project to collect and to exchange experience on education in polymer science at institutions of higher learning around the world. Specific objectives include the following:

- Collection of curricula in polymer science (for universities having *special educational programs* in this field), including the following materials:
  - preparation of transparencies of main lecture courses in polymer science to be posted on the web
  - development of electronic teaching facilities in polymer science
- Organization of *meetings* dedicated to exchange of experience in polymer education. The following meetings are within the framework of the project:
  - 28–29 June 2000, Copenhagen, Denmark (preparatory meeting on University Education in Polymer Science at a satellite meeting of the European Polymer Workshop "Polymer Surfactants")
  - 15–20 July 2001, Eindhoven, the Netherlands (at the Congress of the European Polymer Federation).
  - 7–12 July 2002, Beijing, China (Symposium on University Education in Polymer Science, as part of the IUPAC World Polymer Congress).
- Formulation of recommendations for education in polymer science for:
  - a minimum *set of topics* for lecture courses in polymer science
  - the most useful practicum problems
- Organization of *distant lecturing facilities* for specialists in polymer science
- Analysis of directions for *changes* in content of *polymer education* in the 21st century (in connection with changing trends in polymer research)

Comments from the chemistry and polymer community are welcome and should be addressed to the project coordinator, Prof. A. R. Khokhlov, Physics Department, Moscow State University, Moscow 117234 Russia; Tel.: +7 095 939 1013; Fax: +7 095 939 2988; E-mail: khokhlov@polly.phys.msu.su.

See http://www.iupac.org/projects/2000/2000-005-1-400.html for project description and update.

Thermodynamic Characterization of High-Temperature Superconductors in the Yttrium–Barium–Copper–Oxygen System

IUPAC has approved a new project to develop and present in tabular, graphical, and analytical form a set of self-consistent thermodynamic data for two solid solutions and one compound in the yttrium–barium–copper–oxygen system, that are superconductors at high temperatures. The results of this work will provide materials science, chemistry, and physics data for design and analysis of scientific research, as well as for practical applications, especially with respect to production and use of new superconducting materials.

Comments from the chemistry community are welcome and should be addressed to the project coordinator, Prof. Gennady Voronin, Department of Chemistry, Moscow State University, Moscow 119899 Russia; Tel. and Fax: +7 095 939 1205; E-mail: voronin@td.chem.msu.su.

See http://www.iupac.org/projects/1999/1999-049-1-200.html for project description and update.

News and Notices from Other Societies and Unions

African Association of Pure and Applied Chemistry (AAPAC)

The African Association of Pure and Applied Chemistry (AAPAC) has begun publishing a newsletter, with the first two issues dated February 2000 and September 2000. These newsletters, along with other interesting information about this relatively new professional organization for African chemists, may be viewed on their web site at http://www.africhem.org or via a link from http://www.iupac.org/links/ao/aapac.html.

AAPAC has the following objectives:

- to provide a forum for the exchange among scientists and development agents of scientific information on the state of the chemical sciences in Africa
- to foster research in the chemical sciences

- to cooperate with other international bodies that pursue aims and objectives similar to those of AAPAC
- to promote mutually beneficial interdependent links between industry and other entrepreneurial bodies on one hand and research institutes, including universities, on the other

AAPAC is committed to bring together African chemists, who have so much in common through the subject of chemistry, through the problems of teaching chemistry in Africa, and through industrial and other problems that have chemical solutions.

AAPAC is currently developing a database of chemistry in Africa comprising the following three parts:

- chemical science departments and the staff of these departments in the universities of Africa
- chemically related industries in Africa
- national chemical societies of Africa

For more information about AAPAC and/or to participate in developing the database by completing a questionnaire, contact Prof. Trevor M. Letcher (President of AAPAC and Titular Member of the IUPAC Commission on Thermodynamics, I.2, Tel.: +27 31 260 2616; Fax: +27 31 260 3091; E-mail: letcher@che.und.ac.za) or Dr. Bice Susan Martincigh (Secretary-General of AAPAC and South African National Representative on the IUPAC Commission on Photochemistry, III.3, Tel.: +27 31 260 1394; Fax: +27 31 260 3091; E-mail: martinci@scifs1.und.ac.za), School of Pure and Applied Chemistry, University of Natal, Durban 4041, South Africa.

New Books and Publications

New Books from IUPAC

***In Situ Monitoring of Aquatic Systems: Chemical Analysis and Speciation.* Vol. 6, IUPAC Series on Analytical and Physical Chemistry of Environmental Systems (Series Editors: Jacques Buffle and Herman P. van Leeuwen). Edited by Jacques Buffle and George Horvai. John Wiley & Sons Ltd. (2000), pp. xviii + 1–623. ISBN 0-471-48979-4.**

Contents

General Concepts; Electrochemical and Optical Oxygen Microsensors for *In Situ* Measurements; Sensors for *In Situ* pH and pCO_2 Measurements in Seawater and at the Sediment–Water Interface; Sensors for *In Situ* Analysis of Sulfide in Aquatic Systems; Potentiometric Microsensors for *In Situ* Measurements in Aquatic Environments; Biosensors for Analysis of Water, Sludge, and Sediments with Emphasis on Microscale Biosensors; Continuous Flow Techniques for On-Site and *In Situ* Measurements of Metals and Nutrients in Sea Water; Dynamic Aspects of *In Situ* Speciation Processes and Techniques; *In Situ* Voltammetry: Concepts and Practice for Trace Analysis and Speciation; Permeation Liquid Membranes for Field Analysis and Speciation of Trace Compounds in Waters; Dialysis, DET, and DGT: *In Situ* Diffusional Techniques for Studying Water, Sediments, and Soils; Microtechnology for the Development of *In Situ* Microanalytical Systems

To enable efficient interpretation of the functioning of ecosystems such as lakes, oceans, or ground water, the recording of large data sets is essential, in order to take into account natural spatial and temporal variations correctly. This undertaking requires the use of a network of *in situ* or on-field sensors or analytical devices, for continuous, real-time monitoring of major, minor, and trace components, simultaneously at a large number of locations in the ecosystem, and at various depths in the water columns or ground water. Such a huge number of analyses is not feasible by using the classical approach based on sample collection, storage, and transportation, followed by sample handling in the laboratory. Robust sensors and instruments for automatic *in situ* or on-site measurements should thus be developed. This approach is required not only for the reason of cost effectiveness, but also for scientific reasons. Indeed, determinations of minor and trace inorganic and organic compounds have become more and more important for water quality assessment. Classical analyses of these compounds, however, are often prone to many artifacts that can only be overcome by *in situ* measurements, avoiding the sampling step.

This book includes the most important *in situ* sensors and analytical systems. Chapter 1 discusses general concepts that should be considered for the development of any type of sensor, in order to get reliable and environmentally relevant information. It also helps the reader to place the various chapters in perspective to each other, inside a common frame. The next four

chapters deal with sensors for *in situ* measurements of major components: O_2 (Chapter 2), pH and CO_2 (Chapter 3), S^{2-} (Chapter 4), and Ca^{2+} and N species (Chapter 5). Chapters 6, 7, and 9–11 deal with sensors and analytical systems for minor or trace organic or inorganic components. In these cases, the signal most often depends on the speciation of the test analyte. All these chapters thus discuss speciation aspects relevant to each technique. Chapter 8 is specifically devoted to the physicochemical principles needed to understand how dynamic chemical equilibria, such as metal complexation, affect the signal of analytical devices based on flux measurements. Because most trace compound determinations are based on such flux measurements, we have found it important that a rigorous formulation of these general physicochemical concepts, and some examples of their applications to a few sensor types, be described in a specific chapter.

Finally, the book ends with the existing microtechniques that could be used for the fabrication of *in situ* sensors or microanalytical systems. Although very few complete analytical systems have yet been built based on this technology, and none of them for environmental application, it is clear that the fabrication of at least key components (such as microelectrodes, microreactors, etc.) of *in situ* analytical devices should thus greatly profit from microtechnologies. The main purpose of this chapter is to stimulate ideas for new microsensor or microanalytical system construction, by using the concepts of microsensors described in Chapters 2–6, which were built with more classical technologies.

This book should provide researchers interested in the development of *in situ* sensors and analytical systems with the appropriate updated literature and critically evaluated information. However, we hope that it will be even more helpful to laboratories in charge of water quality assessment, by providing them with updated information on existing sensors and analytical systems, their present capabilities, and the expected future developments. In most cases, either detailed technical information is given or the corresponding literature is cited, which should help any interested scientist to start using these analytical devices in an appropriate manner. Thanks to the theoretical background discussed in particular for methods related to speciation, correct interpretation of the data should also be made easier, even for the nonspecialist.

Jacques Buffle, University of Geneva, Geneva, Switzerland
George Horvai, Technical University of Budapest, Budapest, Hungary

Note: For the *Macromolecular Symposia* volumes listed below, the Table of Contents and Preface are available on the IUPAC web site at http://www.iupac.org/publications/macro/2000/index.html. See also http://www.wiley-vch.de/vch/journals/2265/index.html and http://www.interscience.wiley.com.

Macromolecular Symposia, Vol. 156: Macromolecule-Metal Complexes (MMC-8). Symposium Editor, Eishun Tsuchida; Coeditors, Masao Kaneko and Teruyuki Komatsu; Editor, I. Meisel; Associate Editor, S. Spiegel; Assistant Editors, H. Beattie and C. S. Kniep. Published by Wiley-VCH, July 2000, pp. 1–284. ISBN 3-527-30135-6 (ISSN 1022-1360).

This issue contains plenary and invited lectures delivered at the 8th IUPAC International Symposium on Macromolecule-Metal Complexes (MMC-8 Tokyo), which was held at Ibuka Memorial Hall, the International Conference Center of Waseda University, Tokyo, Japan, 5–9 September 1999 (see conference report by Prof. Kazuyuki Horie published in *Chemistry International* in March 2000, Vol. 22, No. 2, pp. 41–42).

The field of MMC is now receiving much attention not only in chemistry and macromolecular science, but also as a frontier material system with numerous molecular functions. Since the first symposium, MMC-1, that was held in Beijing in 1985, the biennial IUPAC MMC symposia have been providing a special opportunity for scientists in this research field to meet each other and to become aware of the most recent progress in MMC.

Around 280 delegates from 20 different countries attended MMC-8. In addition to 8 plenary and 27 invited lectures, contributed papers were presented in 6 oral contributions and 100 posters. The well-organized program and outstanding facilities of the conference center provided excellent possibilities for extended discussions among the delegates. The theme of this symposium focused on the role of MMC in the recent development of macromolecular sciences and technologies. The latest results in the fundamental part, which are related to *multielectron transfers, supramolecules, dendrimers,* and *molecular recognition,* and in advanced technologies, such as *photoenergy devices, sensors, catalysis, electronics,* and *biomaterials,* were widely discussed by a variety of scientists. Furthermore, the "priority session" took place with a strong involvement of industrial participants. This session focused on secondary batteries and portable fuel cells, which is a growing superior technology related to MMC science, especially in Japan.

One of the factors that made this symposium successful was the large number and the positive attitude of the younger participants who will bear the next generation. On the other hand, MMC prizes were awarded

to the eight representative senior scientists who contributed significantly to the development of MMC. It is hoped that delegates left MMC-8 with new knowledge and new friendships that will lead to many contributions for further progress in this research field in the forthcoming century.

The 9th IUPAC International Symposium on Macromolecule-Metal Complexes (MMC-9) will be held in Brooklyn, New York, USA, 19–23 August 2001. Finally, the editor would like to thank all who have contributed to this symposium and express particular appreciation to them.

Prof. Eishun Tsuchida
Department of Polymer Chemistry, ARISE
Waseda University
Tokyo, Japan

Macromolecular Symposia, Vol. 157: Ionic Polymerization. Symposium Editor, Shiro Kobayashi; Editor, I. Meisel; Associate Editor, S. Spiegel; Assistant Editors, H. Beattie and C. S. Kniep. Published by Wiley-VCH, July 2000, pp. 1–257. ISBN 3-527-30136-4 (ISSN 1022-1360).

The IUPAC International Symposium on Ionic Polymerization (IP'99) was held 19–23 July 1999 in Kyoto, Japan (see conference report by Prof. Stanislaw Penczek published in *Chemistry International* in May 2000, Vol. 22, No. 3, pp. 79–80). The symposium was also sponsored by the Chemical Society of Japan; the Society of Polymer Science, Japan; the Society of Synthetic Organic Chemistry, Japan; and the Japan Chemical Innovation Institute. IP'99 is regarded as the third symposium in the series of International Symposia on Ionic Polymerization, following up the successful symposia in Istanbul (1995) and in Paris (1997).

The symposium aimed to bring together scientists and engineers from all over the world who are interested in ionic polymerization and related areas and to promote research development in these fields by an exchange of information and stimulating new ideas. The research area covered in this symposium was directed toward the traditional field of cationic, anionic, and ring-opening polymerizations, as well as more broadly to polymer synthesis, including radical polymerization, metal-catalyzed polymerization, polycondensation, enzymatic polymerization, and new polymer architecture.

Approximately 260 active participants from 14 countries attended the symposium. A total of 94 oral reports, including invited lectures, were presented in two parallel sessions, and 61 posters were also presented. The presentations were of high quality and at the cutting edge of science and technology in these fields. Very vivid and excellent discussions took place during and after the scientific program, definitely contributing to the realization of the purpose of this symposium. This special issue of *Macromolecular Symposia* covers the papers from invited lectures, which will help scientists and engineers to find the future direction in ionic polymerization, as well as in other important fields in polymer synthesis.

The organization of this symposium was made possible with the help and collaboration of all the Committee and Board members. We deeply thank these people for their big effort. Our sincere thanks go to the following corporations for their support: Ajinomoto Co., Inc.; Asahi Chemical Industry Co., Ltd.; Asahi Glass Co.; Daicel Chemical Industries, Ltd.; Daikin Industries, Ltd.; Denki Kagaku Kogyo Kabushiki Kaisha; DuPont Kabushiki Kaisha; Harima Chemicals, Inc.; Hitachi Chemical Co., Ltd.; Japan Chemical Innovation Institute; Japan PMC Corporation; JSR Corporation; Kaneka Corporation; Kuraray Co., Ltd.; Lion Corporation; Mitsubishi Rayon Co., Ltd.; Mitsui Chemicals, Inc.; Nippon Zeon Co., Ltd.; Nissei Sangyo Co., Ltd.; Polyplastics Co., Ltd.; Sumimoto Bakelite Co., Ltd.; Sumitomo Chemical Co., Ltd.; and Toyo Ink MFG Co., Ltd.

Prof. Shiro Kobayashi
Department of Materials Chemistry
Graduate School of Engineering
Kyoto University
Kyoto, Japan

Macromolecular Symposia, Vol. 158: Rheology of Polymer Systems. Symposium Editor, Jaroslav Kahovec; Editor, I. Meisel; Associate Editor, S. Spiegel; Assistant Editors, H. Beattie and C. S. Kniep. Published by Wiley-VCH, August 2000, pp. 1–182. ISBN 3-527-30137-6 (ISSN 1022-1360).

Rheology of polymer systems in the molten state is an area of great scientific interest and practical importance. Molten polymer systems have fascinating rheological properties, which qualitatively differ from those of low-molecular weight liquids. Knowledge of the properties and understanding of their relations to the structure are necessary conditions for efficient processing of polymeric materials. Microrheological description of the phase structure formation in multicomponent polymer systems during their preparation by melt mixing and processing is needed for controlling their structure and, therefore, also their properties. For these reasons, in the last decade, the rheology of polymer systems has been an object of intensive studies. Owing to the complexity of studied problems, correct determination of rheological properties of polymer systems is not always easy, and many various approximations are used in the description of the rheological behavior or polymer systems. Therefore, the discussion of methods of measurements, as well as plausibility and consequences of vari-

ous approaches to the description of rheological properties and their relation to the structure of polymer systems, is extremely important.

Rheology of polymer systems was also the topic of the 19th Discussion Conference organized as the 58th meeting in the series of Prague Meetings on Macromolecules (PMM) on 19–22 July 1999 (see conference report by Dr. H. M. Laun published in *Chemistry International* in January 2000, Vol. 22, No. 1, p. 20). As usual, the meeting was held under the auspices of IUPAC at the Institute of Macromolecular Chemistry of the Academy of Sciences of the Czech Republic in Prague. A total of 66 participants from 22 countries contributed to the scientific program of the conference. There were 6 main lectures, 17 special lectures, and 23 poster communications. The most interesting panel discussions were devoted to problems of rheometry and processing in multiphase polymer systems (led by A. Ya. Malkin, Russia) and problems of the description of structure formation and evolution in molten multiphase polymer systems (led by J. Lyngae-Jørgensen, Denmark). All the contributions and discussions were very helpful for better understanding the problems of determination of rheological properties, of the prediction of relations between the structure and rheological properties of polymer systems, and of the description of the phase structure formation and evolution in multicomponent polymer systems. We believe that the main and special lectures collected in this volume will provide the same benefit to the readers.

The participants created not only an excellent professional forum, but also a very agreeable company. We wish to express our gratitude to all participants and sponsors for supporting the meeting, to the organizing committee for their very good job, and to the contributors for their carefully prepared papers.

Dr. Ivan Fortelný and Dr. Jaroslav Kahovec
Institute of Macromolecular Chemistry
Academy of Sciences of the Czech Republic, Prague

Awards and Prizes

CNC/IUPAC Travel Awards Announced

This article is paraphrased from the May 2000 issue of *Canadian Chemical News* (Vol. 52, No. 5, pp. 20–21).

The Canadian National Committee for IUPAC (CNC/IUPAC) established a program of Travel Awards in 1982. These awards are financed by the Gendron Fund (administered by the Canadian Society for Chemistry, CSC), supplemented by funds donated by CNC/IUPAC's Company Associates. The purpose of the awards is to help young Canadian chemists and chemical engineers (within 10 years of gaining their Ph.Ds) present a paper at an IUPAC-sponsored conference outside continental North America. Typically, six or seven awards of CAD 1 000–1 500 are made each year.

Winners of the 2000 CNC/IUPAC Travel Awards are Manuel A. S. Aquino, St. Francis Xavier University, Antigonish, NS (34th International Conference on Coordination Chemistry, 34-ICCC, 9–14 July 2000, Edinburgh, Scotland, UK); Heinz-Bernhard Kraatz, University of Saskatchewan, Saskatoon, SK (34-ICCC); Glen R. Loppnow, University of Alberta, Edmonton, AB (18th IUPAC Symposium on Photochemistry, 22–27 July 2000, Dresden, Germany); Susannah Scott, University of Ottawa, Ottawa, ON (34-ICCC); Brian D. Wagner, University of Prince Edward Island, Charlottetown, PE (18th IUPAC Symposium on Photochemistry); Steve A. Westcott, Mount Allison University, Sackville, NB; and Mark S. Workentin, University of Western Ontario, London, ON (18th IUPAC Symposium on Photochemistry).

Reports from Commissions and Division Committees

Physical Chemistry Division Committee

Summary of Minutes of Commission Meeting at Wageningen, Netherlands, 1–2 April 2000

The Physical Chemistry Division Committee met in April to review ongoing activities and to discuss how the Division can adapt to the new regime with drastically changed obligations for the Committee. The suggestion to the Secretary General in October 1999, that a half-time Scientific Liaison Officer should be assigned to the Division had not met with any enthusiasm. However, the Division President and Vice President will continue their efforts to acquire administrative support.

A tentative set of procedures and criteria for the review of new project proposals, prepared by the Division President, will be used on a provisional basis until adopted in some form at the IUPAC General Assembly in Brisbane, Australia in 2001.

The Committee is of the opinion that IUPAC needs to be more active in the field of databases, as there are

important unresolved questions about ownership, maintenance, cost, etc. IUPAC should appoint a group of people to look into the matter.

The Committee decided to start the procedure to create a new Commission to fill the function of Commission I.1 on Physicochemical Symbols, Terminology, and Units. The name suggested was "Commission on Quantities, Units, and Symbols in Physical Chemistry".

In view of the importance of biophysical chemistry and the fact that it covers the whole field of physical chemistry, the Committee decided to request that the name of the Division be changed to "Division of Physical and Biophysical Chemistry".

Gerd Olofsson
Secretary, IUPAC Physical Chemistry Division Committee

Commission on Soil and Water Chemistry—VI.3

Summary of Minutes of Commission Meeting at Tel Aviv, Israel, 3–5 June 2000

This meeting was held at the International Symposium on Atmospheric Deposition and Its Impact on Ecosystems, with Reference to the Mideast Region, which was organized jointly with the IUPAC Commission on Atmospheric Chemistry (VI.2). A report on the Symposium appeared in *Chemistry International*, Vol. 22, No. 6, pp. 168–169, 2000.

The Commission meeting focused on the status of projects that are currently on the agenda of Commission VI.3. New initiatives were taken for future actions within the working field of soil and water chemistry, and a position paper, "Soil and Water Chemistry: Environmental Issues and Research Needs", was discussed. The position paper is intended to provide guidance for future activities of Commission VI.3. Once again, the importance of completing projects was stressed, as well as the necessity to anticipate needs in the new project-driven structure of IUPAC, and to find ways of implementing new projects within this new structure. Altogether, there are five ongoing projects; two new task forces were established; and one potential task force was identified. Task groups were assigned for each project, and three draft reports (to be offered for publication this year) were discussed. Finally, the possibilities of joining the green chemistry activities within the IUPAC Organic and Biomolecular Chemistry Division (III) were considered.

Willie J. G. M. Peijnenburg
Secretary, IUPAC Commission on Soil and Water Chemistry VI.3

Conference Announcements


designates IUPAC sponsorship

IUPAC/ICSU Workshop on Electrochemistry and Interfacial Chemistry in Environmental Cleanup and Green Chemical Processes, 6–7 April 2001, Coimbra, Portugal

The objective of this workshop is to bring together industrial and academic experts on the role of electrochemistry and colloid and surface chemistry in environmental cleanup and green chemical processes, to discuss contributions to curing existing environmental problems and to preventing future problems through process-integrated environmental protection. What can be achieved using currently available technology will be discussed, as well as future tendencies in technological development.

This workshop is directed toward:

- specialists of international standing
- scientists from developing countries who will describe the particular problems that their countries face
- researchers and students concerned with environmental problems

Discussion will focus on how to reduce the negative impact on the environment of industrial chemical processes and other fabrication procedures by using "cleaner" and more energy-efficient processes with recycling and by appropriate effluent treatment. Attention will also focus on stored solid or liquid waste and remediation of contaminated land resulting from pollution problems in the past.

A half-day "tutorial" will be offered on the afternoon of 5 April 2000 before the workshop to introduce the following electrochemistry and surface chemistry topics:

- soil and water remediation
- metal ion and organic removal
- recycling of process liquors and materials
- clean synthesis
- monitoring and sensors
- catalysis of thermal oxidations
- catalytic photochemical processes

Results from the workshop will be disseminated through workshop proceedings and an IUPAC Technical Report to be published in *Pure and Applied Chemistry* (see also http://www.iupac.org/projects/1999/

1999-005-1-100.html).

For additional information, contact Prof. C. M. A. Brett, Department of Chemistry, University of Coimbra, 3004-535 Coimbra, Portugal; Tel./Fax: +351 239 835295; E-mail: brett@ci.uc.pt; Web site: http://www.iupac.org/symposia/conferences/environ_apr01/index.html.

2nd International Workshop on Thermochemical, Thermodynamic, and Transport Properties of Halogenated Hydrocarbons and Mixtures, 9–11 April 2001, Paris, France

This workshop, organized under the auspices of IUPAC's Commission on Thermodynamics (I.2), is intended to increase knowledge and understanding of equilibrium and transport properties of halogenated hydrocarbons and related compounds, and their mixtures with hydrocarbons and other compounds (see http://www.iupac.org/projects/2000/2000-027-1-100.html). The workshop will have four main themes, including:

- environmental constraints and regulation
- new products (in refrigeration, medicine, insulation, etc.)
- new measurements (physical property characterization)
- fundamentals (intermolecular potential calculations with O, F, and Cl as main heteroatoms of interest) and molecular simulations

The workshop, which will take place at École des Mines de Paris, will consist of plenary lectures, oral and poster presentations, and a poster discussion session, with publication of the proceedings in *Fluid Phase Equilibria*.

In addition, there will be a panel discussion to review progress and to recommend topics for theoretical and experimental studies for presentation at the final workshop to be held in 2002.

For more information, contact Dr. Dominique Richon, CEREP-École des Mines de Paris, 35 rue Saint-Honoré, F-770305 Fontainebleau, France; Tel.: +33 1 64 69 49 65; Fax: +33 1 64 69 49 68; E-mail: iupac_paris.wshop@cenerg.ensmp.fr; Web site: http://www-cenerg.ensmp.fr/iupac_paris.wshop/workshop.html.

14th IFCC-FESCC European Congress of Clinical Chemistry and Laboratory Medicine (EUROMEDLAB 2001), 26–31 May 2001, Prague, Czech Republic

This meeting, held in conjunction with the 5th Czech National Congress of Clinical Chemistry, will feature symposia devoted to the following topics:

- Education and management (management in the clinical laboratory, education in clinical chemistry and laboratory medicine, training and practice in evidence-based laboratory medicine, preanalytics, veterinary clinical chemistry as a part of laboratory medicine, minerals, and body fluids)
- Evidence-based medicine (EBM)—Clinical and laboratory aspects (A global perspective—Understanding the social, economic, and ethnic factors in the atherosclerosis epidemic; EBM in coronary heart diseases; analytical goals in relation to clinical needs; patient outcomes and laboratory medicine; cytokines in clinical diagnostics; coronary heart disease: from mechanism to prevention; EBM in diagnostics and therapy of metabolic bone diseases; EBM and cancer; EBM in lipid diagnostics; role of cardiac markers)
- Molecular biology (DNA microchips; molecular biology—technological aspects; cellular iron distribution: from genetic to clinical outcomes; pharmacogenetics, pharmacogenomics, and drug development; proteome analysis; molecular diagnostics of cancer; coagulation: molecular biology and genetics; inborn errors of metabolism; clinical chemistry of organ transplantation; markers of iron turnover)
- Toward quality in clinical chemistry and laboratory medicine (harmonization by registration, accreditation, and calibration in clinical chemistry; point-of-care testing in hospitals: a challenge for the clinical laboratory; computers and clinical chemistry; clinical toxicology and TDM; global aspects of regulation for *in vitro* diagnostics; errors in laboratory medicine; modern technologies; harmonization of EQA schemes)
- Hormonal regulations, metabolic markers, and immunity (biochemistry of aging, neuroactive steroids

and endocrine disruptors, fertility and pregnancy, endocrinology and diabetes, free radicals, nutrition, role and function of macrophages, signal transduction, cerebrospinal fluid analysis, allergy, and autoimmunity)

For further information, contact EUROMEDLAB Secretariat, Institute for Clinical Biochemistry and Diagnostics, University Hospital, CZ-50005 Hradec Kralove, Czech Republic; Tel.: +420 49 583 3040; Fax: +420 49 583 2003; E-mail: euromedlab@lfhk.cuni.cz; Web site: http://www.congress.cls.cz/euromedlab2001.

32nd Annual Short Course on Advances in Emulsion Polymerization and Latex Technology, 4–8 June 2001, Bethlehem, Pennsylvania, USA

This one-week program at Lehigh University is designed for engineers, chemists, other scientists, and managers who are actively involved in emulsion work and for those who wish to develop expertise in the area.

The course is an in-depth study of the synthesis and properties of high polymer latexes. The subject matter includes a balance of theory and applications as well as a balance between chemical and physical problems. Lectures, given by leading academic and industrial workers, begin with introductory material and review, and progress through recent research results. The course fee is USD 1 000 for the entire week or USD 350 per day for any part.

For additional information, contact Dr. Mohamed S. El-Aasser, Emulsion Polymers Institute, Lehigh University, 111 Research Drive, Bethlehem, PA 18015 USA; Tel.: +1 610 758 3082; Fax: +1 610 758 5880; E-mail: mse0@lehigh.edu.

6th International Workshop on High-Temperature Superconductors and Novel Inorganic Materials Engineering (MSU-HTSC-VI), 24–30 June 2001, Moscow to St. Petersburg, Russia

This workshop—to be held on a boat going from Moscow to St. Petersburg—will be the sixth in a series organized by Moscow State University since 1989. It has become an important event in solid-state chemistry and materials science; researchers from about 50 countries have attended these conferences in the past.

Like the previous workshops in the series, MSU-HTSC-VI will focus on chemical and engineering aspects of materials science of high-temperature superconductors and other electronics materials (such as giant magnetoresistance [GMR], ionic materials, low-dimensional magnetic materials, nonoxide materials, etc.) that may be relevant for their applications in electronics and power engineering.

Scientific sessions will cover new materials; crystal chemistry; structure–property relations; phase equilibria; processing of bulk, films, and crystals; and physical properties and applications. Leading scientists in the fields of materials science, inorganic chemistry, and physics from more than 20 countries have already agreed to make contributions to MSU-HTSC-VI. Approximately 200 scientific participants from around the world are expected to attend this workshop.

For more information, contact Prof. Yu. D. Tretyakov, Department of Chemistry, Moscow State University, Moscow 119899 Russia; Tel.: +7 095 939 20 74; Fax: +7 095 939 47 88; E-mail: yudt@inorg.chem.msu.ru; Web site: http://icr.chem.msu.ru/htsc6.htm.

13th International Conference on Crystal Growth (ICCG-13) and 11th International Conference on Vapor Growth and Epitaxy (ICVGE-11), 30 July–4 August 2001, Kyoto, Japan

This joint conference will feature the theme "Future Challenges for Crystal Growth". New developments in crystal growth science and technology will be reported and discussed in lectures, a film and video session, a commercial exhibit, a photo contest, and a display of crystals and crystal growth-related devices. Scientific sessions will cover crystal growth theory, bulk crystal growth, thin film growth and epitaxy, crystal growth under microgravity, industrial crystallization, protein crystal growth, pattern formation, nanostructure formation, fundamentals of melt growth, new magnetic semiconductor crystals, and new developments in wide-gap semiconductors (such as nitrides, SiC, and diamond).

For further information, contact Secretariat of ICCG-13/ICVGE-11, c/o Faculty of Engineering, Doshisha University, Kyotanabe-city, Kyoto 610-0321, Japan; Tel.: +81 774 65 6329; Fax: +81 774 65 6811; E-mail: info@iccg.doshisha.ac.jp; Web site: http://iccg.doshisha.ac.jp.

6th International Symposium on Adjuvants for Agrochemicals (ISAA 2001), 13–17 August 2001, Amsterdam, Netherlands

This symposium focuses on both tank-mix adjuvants and built-in adjuvants. It intends to attract researchers from academia and industry; pesticide manufacturers, formulators, and distributors; adjuvant and inert materials manufacturers; crop nutrient manufacturers; application technology specialists; and seed-coating specialists. Objectives of the symposium are to:

- identify progress in understanding mode of action of adjuvants when combined with agrochemicals (pesticides and nutrients)
- stimulate intensive discussion among those involved in adjuvant research, development, application, and regulatory issues
- offer a platform for agrochemical companies to exhibit new products or technologies
- offer the right atmosphere for establishing new cooperation between scientists and users on a global basis
- define future directions in adjuvant research, development, and application
- identify factors that restrict utilization of adjuvant technology
- set up a global communication structure in adjuvant research and development

Major adjuvant subject areas will include formulation technology, biological efficacy (of herbicides, fungicides, insecticides, growth regulators, macro- and micronutrients, and other agents), spray application technology, regulatory and registration aspects, mode of action in relation to wetting and foliar uptake, physical-chemical parameters for prediction of performance, physical properties in relation to foliar uptake, permeability of leaf and insect cuticles, translocation of active ingredients in plants, phytotoxicity, impact on emission, glyphosate adjuvants, adjuvants of natural origin, comparision of physical-chemical approaches in application of adjuvants (for pharmaceuticals, cosmetics, and agrochemicals), performance and weather conditions, effect on soil and water applications, degradability and its effect on viability of nontarget organisms, biological control agents, pesticide mixtures, cost/benefit ratios, use in nonagricultural areas, and impact of genetically modified crops on adjuvant use.

For additional information, contact Dr. Hans de Ruiter, ISAA 2001 Symposium Secretariat, P.O. Box 33, NL-6870 AA Renkum, Netherlands; Tel.: +31 6 51 38 07 96; Fax: +31 317 35 08 12; E-mail: info@isaa2001.com; Web site: http://www.isaa2001.com.

9th International Symposium on Macromolecule–Metal Complexes (MMC-IX), 19–23 August 2001, Brooklyn, New York, USA

This symposium is intended to provide a forum for expositions and discussions about recent topics of research on macromolecule-metal complexes (MMC). The newest results related to applications, preparation, characterization, properties, and technology of MMC will be exchanged and discussed by approximately 300 scientific participants from around the world.

Parallel sessions will be conducted at the symposium on biorelated MMC; metal ion conductive polymers; lanthanide metal ion-containing polymeric systems; electronic, magnetic, and optical properties of MMC; and green chemistry in MMC. It is hoped that contributions presented at MMC-IX will be the basis for further development of this important field in the 21st century.

For more information, contact Prof. Kalle Levon, Polymer Research Institute, Polytechnic University, 6 Metrotech Center, Brooklyn, New York 11201 USA; Tel.: +1 718 260 3339; Fax: +1 718 260 3125; E-mail: klevon@poly.edu; Web site: http://www.chem.umr.edu/%7Epoly/poly_link/meetings/mmc9.html.

Hungarian–German–Italian–Polish Joint Meeting on Medicinal Chemistry, 2–6 September 2001, Budapest, Hungary

In recent decades, the practice of medicinal chemistry has developed from an empirical science, involving organic synthesis of new compounds and based largely on modification of structures of known activity, to a more logical and less intuitive approach. Medicinal chemistry has, therefore, become a collaborative effort between a variety of chemists, biologists, spectroscopists, geneticists, and biotechnologists.

On the basis of the success of the Italian–Hungarian–Polish Joint Meeting on Medicinal Chemistry held 28 September–1 October 1999 in Giardini Naxos, it was decided to organize the next meeting in Budapest, Hungary, with the involvement of Germany.

Focal points of the conference cover the most important areas of medicinal chemistry from chemical,

biological, genetic, and biotechnological points of view. Interplay among medicinal chemists working in different fields and different countries will certainly lead to new collaborations with new scientific innovations and achievements, as well as to the encouragement of young researchers working in academic and industrial fields. Also, topics covered during the meeting and the presence of prominent scientists will provide strong support and stimulus for medicinal chemistry knowledge in developing countries such as Hungary and Poland. Approximately 250 scientific participants from around the world are expected to attend this meeting.

For further information, contact Prof. Dr. Péter Mátyus, Institute of Organic Chemistry, Semmelweis University, H-1092 Budapest, Högyes E. u. 7., Hungary; Tel. and Fax: +36 1 2170851; E-mail: matypet@szerves.sote.hu; Web site: http://www.mke/mtesz.hu/hgip/HGIPFrameSet.htm.

6th Brazilian Polymer Conference/ 9th International Macromolecular Colloquium, 11–15 November 2001, Gramado, Brazil

This conference will feature approximately 500 lectures and posters covering diverse academic and technological areas in the polymer field. The program is expected to appeal to academic and industrial researchers; engineers and technicians involved in research, product development, quality control, technical assistance, and industrial production; plastics and rubber consultants; and government scientists and technologists responsible for planning and industrial development. About 500 scientific participants from Brazil, other countries of South America, Europe, and the United States are expected to attend.

Simultaneous subsections of the meeting will focus on adhesives, additives, biopolymers, alloys and polymer blends, characterization/instrumentation, fillers and reinforcing fibers, composites, reinforcement loads and fibers, product design and development, marketing, elastomers, structure and properties, gels and membranes, polymerization methods, polymer processing, recycling, and synthesis.

In conjunction with the conference, a workshop will be held covering themes of industrial interest such as plastics technology; rubber and adhesives; recycling of plastics and rubbers; biodegradable polymers; generation and transfer of technology, including successful models in Brazil and abroad; and resources, strategies, and partnerships for fostering official support and private investment in technology.

For additional information, contact Prof. Raquel Santos Mauler, Institute of Chemistry/UFRGS, Av. Bento Gonçalves 9500, 91501-970 Porto Alegre, RS, Brazil; Tel.: +55 51 316 6296; Fax: +55 51 319 1499; E-mail: mauler@if.ufrgs.br.

4th International Symposium on Hormone and Veterinary Drug Residue Analysis, 4–7 June 2002, Antwerp, Belgium

This symposium will present an overview of recent techniques and legislation in the field of residue analysis. About 300 scientific participants from around the world are expected to attend.

Subsections will be organized on residue analysis, veterinary drugs and growth-promoting substances, aquaculture, human doping in sports, legislative aspects, and accreditation of laboratories.

For more information, contact Prof. Dr. C. Van Peteghem, Harelbekestraat 72, B-9000 Gent, Belgium; Tel.: +32 9 264 81 15; Fax: +32 9 264 81 99; E-mail: carlos.vanpeteghem@rug.ac.be.

17th International Conference on Chemical Education (17th ICCE), 18–23 August 2002, Beijing, China

This conference, with the theme "New Strategies for Chemical Education in the New Century", will attract chemistry teachers at all levels (university, college, secondary school, etc.), education researchers, chemistry researchers, and chemical engineers. The goal of the meeting is to discuss new ideas, thoughts, approaches, and techniques for chemical education in the future. Approximately 600 scientific participants from around the world are expected to attend the conference.

Symposia and exhibitions are planned to cover the following main topics: public education and chemical literacy education; chemistry and society; environment-oriented chemical education; green chemistry and environment-friendly chemistry experiments; the Internet, computers, and chemistry; modern technologies used for chemistry education; theoretical basis of chemical education; microscale chemistry and low-cost chemical instruments; chemical education and frontiers of chemistry research; teaching chemistry in secondary schools; continuing education; and chemistry Olympiad. Workshops will also be organized to acquaint participants with instruments, demonstration tools, textbooks, and teaching materials including CD-ROMs.

For further information, contact Prof. Chunli Bai, Chinese Academy of Sciences, San Li He, Beijing 100864, China; Tel.: +86 10 68597606; Fax: +86 10 68517458; E-mail: cibai@office.cashq.ac.cn; Web site: http://www.iupac.org/symposia/conferences/17icce/index.html.

18th International Congress of Clinical Chemistry and Laboratory Medicine (18th ICCC 2002 Kyoto), 20–25 October 2002, Kyoto, Japan

This meeting, held in conjunction with the 42nd Annual Meeting of the Japan Society of Clinical Chemistry (42nd JSCC), has the theme "50 Years of Clinical Chemistry Progress: Into the New Century—An Asian Perspective on a Global Theme".

Clinical chemistry has reached the point where data concerning body constituents are used not only to analyze patients' pathological states, but also to understand the underlying pathogenic processes. This trend reflects the general current of medicine away from treatment that is experiential, symptomatic, and average, to one that is scientific, etiological, and focused on the individual patient.

The 18th International Congress of Clinical Chemistry and Laboratory Medicine (18th ICCC 2002 Kyoto), being the first of these meetings in the third millennium and also the first in the Asian region, will provide a valuable opportunity for participants to discuss the impact of new technologies (such as gene diagnostics and medical informatics) on basic knowledge and clinical usefulness, as well as how scientific, technical, and organizational change and renewal could be advanced in Asia and throughout the world. Expanding spheres of clinical chemistry and laboratory medicine, such as clinical nutrition, clinical pharmacology, and environmental medicine, will also be at the core of the program.

This congress, which commemorates the 50th anniversary of the International Federation of Clinical Chemistry and Laboratory Medicine (IFCC), will highlight the increasing significance of clinical chemistry and laboratory medicine in health care all over the world.

For additional information, contact Secretariat of 18th ICCC 2002 Kyoto, c/o Center for Academic Societies Japan, Osaka, 14th Floor, Senri Life Science Center Building, 1-4-2 Shinsenrihigashi-machi, Toyonaka 560-0082, Japan; Tel.: +81 6 6873 2301; Fax: +81 6 6873 2300; E-mail: jscc@bcasj.or.jp; Web site: http://iccc2002.bcasj.or.jp/.

Conference Calendar

Visit http://www.iupac.org for complete information and further links.

NEW *designates a new conference since the last issue.*

2001

Polymer Characterization

9–12 January 2001
9th International Conference on Polymer Characterization (POLYCHAR), Denton, Texas, USA.
Dr. Witold Brostow, Department of Materials Science, University of North Texas, Denton, Texas, 76203-5310 USA.
Tel.: + 1 940 565 4358, -3262, or 4337
Fax: +1 940 565 4824
E-mail: brostow@unt.edu or polychar@marta.phys.unt.edu

Green Chemistry

10–13 January 2001
International Symposium on Green Chemistry, Delhi, India.
Dr. M. Kidwai, Organizing Convenor, Department of Chemistry, University of Delhi
Delhi 110007, India
Tel.: +91 11 725 6235
Fax: +91 11 725 6250
E-mail: mkidwai@mantraonline.com

Macromolecules

9–11 April 2001
4th Annual UNESCO School and South African IUPAC Conference on Macromolecules and Materials Science, Johannesburg, South Africa.
Prof. R. D. Sanderson, UNESCO Associated Centre for Macromolecules and Materials, Institute for Polymer Science, University of Stellenbosch, Private Bag X1, Matieland 7602, South Africa
Tel.: +27 21 808 3172
Fax: +27 21 808 4967
E-mail: rds@maties.sun.ac.za

Chemistry and Chemical Engineering

16–20 April 2001
IV International Congress on Chemistry and XIII Caribbean Conference on Chemistry and Chemical Engineering, Havana, Cuba.
Prof. Alberto J. Núñez Sellés, Sociedad Cubana de Química, Ave 21&200, Atabey, Apdo.

16042, CP 11600, Havana, Cuba.
Tel.: +537 218 178
Fax: +537 336 471
E-mail: cqf@cqf.co.cu

Free-Radical Polymerization

3–8 June 2001
3rd International Symposium on Free-radical Polymerization: Kinetics and Mechanism, Lucca, Italy.
Prof. M. Buback, Institute for Physical Chemistry, University of Göttingen, Tammannstr. 6, D-37077 Göttingen, Germany
Tel: +49 551 393141
Fax: +49 551 393144
E-mail: mbuback@gwdg.de

CHEMRAWN XIV

9–13 June 2001
Chemrawn Conference—Toward Environmentally Benign Processes and Products,
Boulder, Colorado, USA.
Dr. Dennis L. Hjeresen, Environmental Management Program, Los Alamos National Laboratory - Mail Stop J591, Los Alamos, NM 87545.
Tel.: +1 505 665 7251
Fax: + 1 505 665 8118
E-mail: dennish@lanl.gov

High-Temperature Superconductors NEW

24–30 June 2001
6th International Workshop on High-Temperature Superconductors and Novel Inorganic Materials Engineering (MSU-HTSC-VI), Moscow to St. Petersburg, Russia.
Prof. Yu.D. Tretyakov, Chairman, Dr. R.V. Shpanchenko, MSU-HTSC VI Secretary, Department of Chemistry, Moscow State University, Moscow 119899 Russia
Tel.: +7 (095) 939 34 90
Fax: +7 (095) 939 47 88
E-mail: roms@icr.chem.msu.ru

Polymer Dispersions

25–28 June 2001
15th International Conference on Polymers: Preparation of Non-Conventional Polymer Dispersions, Smolenice, Slovak Republic.
Prof. Ignac Capek, Polymer Institute, Slovak Academy of Sciences, SR-842-36 Bratislava, Slovak Republic
Tel.: +421 7 5477 2469
Fax: +421 7 5477 5923
E-mail: upolign@savba.sk

IUPAC 41st General Assembly

29 June–8 July 2001
Brisbane, Australia.
IUPAC Secretariat.
Tel.: +1 919 485 8700
Fax: +1 919 485 8706
E-mail: secretariat@iupac.org

IUPAC 38th Congress/World Chemistry Congress 2001

1–6 July 2001
Brisbane, Australia.
Congress Secretariat, P.O. Box 177, Red Hill Q 4054, Australia.
Tel.: + 61 7 3368 2644
Fax: + 61 7 3369 3731
E-mail: wcc2001@ccm.com.au

Coordination and Organometallic Chemistry of Germanium, Tin, and Lead

8–12 July 2001
10th International Conference on the Coordination and Organometallic Chemistry of Germanium, Tin, and Lead, Talence, France.
Dr. B. Jousseaume, Laboratoire de Chimie Organique et Organometallique, UMR 5802, Universite Bordeaux 1, 351 avenue de la Liberation, F-33405 Talence Cedex, France.
Tel.: +33 (0) 5 56 84 64 43
Fax: +33 (0) 5 59 84 69 94
E-mail: b.jousseaume@lcoo.u-bordeaux.fr

Scattering Methods and Polymers

9–12 July 2001
20th Discussion Conference on Scattering Methods for the Investigation of Polymers, Prague, Czech Republic.
Dr. Drahomir Vyprachticky, Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic, Heyrovskeho nam. 2, CZ-162 06 Praha 6, Czech Republic.
Tel.: +420 2 204 0332
Fax: +420 2 367 981
E-mail: sympo@imc.cas.cz

How to Apply for IUPAC Sponsorship

To apply for IUPAC sponsorship, conference organizers should complete an Advance Information Questionnaire (AIQ). The AIQ form is available at http://www.iupac.org or by request at the IUPAC Secretariat, and should be returned between 2 years and 12 months before the conference. Further information on granting sponsorship is included in the AIQ and available online.

Plasma Chemistry

9–13 July 2001
15th International Symposium on Plasma Chemistry (ISPC-15), Orléans, France.
Prof. Jean-Michel Pouvesle, Laboratoire GREMI, Université d'Orléans, BP 6744, Orléans Cedex 2, France
Tel.: +33 (0) 2 38417124
Fax: +33 (0) 2 38417154
E-mail: jean-michel.pouvesle@univ-orleans.fr

Polymer Membranes

16–19 July 2001
41st Microsymposium on Polymer Membranes, Prague, Czech Republic.
Dr. Drahomir Vyprachticky, Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic, Heyrovskeho nam. 2, CZ-162 06 Praha 6, Czech Republic.
Tel.: +420 2 204 03332
Fax: +420 2 367 981
E-mail: sympo@imc.cas.cz

Organometallic Chemistry

22–26 July 2001
11th IUPAC International Symposium on Organometallic Chemistry Directed
Towards Organic Synthesis (OMCOS 11), Tapei, Taiwan.
Prof. Tien-Yau Luh, Department of Chemistry, National Taiwan University,
Tapei 106, Taiwan.
Tel.: +886 2 23636288
Fax.: +886 2 23644971
E-mail: tyluh@ccms.ntu.edu.tw

Phosphorus Chemistry

29 July–3 August 2001
15th International Conference on Phosphorus Chemistry, Sendai, Japan.
Prof. Masaaki Yoshifuji, Department of Chemistry, Graduate School of Science,Tohoku University, Aoba, Sendai 980-8578, Japan.
Tel.: +81 22 217 6558
Fax: +81 22 217 6562
E-mail: yoshifj@mail.cc.tohoku.ac.jp

Analytical Sciences

6–10 August 2001
International Congress on Analytical Sciences 2001 (ICAS2001), Tokyo, Japan.
Prof. Tsuguo Sawada, Chairman, Department of Applied Chemistry, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Toyko 113-8656, Japan.
Tel.: +81 3 5841 7236 (or 7237)
Fax: +81 3 5841 6037
E-mail: icas2001@laser.t.u-tokyo.ac.jp

Macromolecules–Metal Complexes NEW

19–23 August 2001
9th International Symposium on Macromolecules-Metal Complexes (MMC-9), Brooklyn, New York, USA.
Prof. K. Levon Polymer Research Institute Polytechnic University Brooklyn, NY 11201, USA.
Tel.: +1 718 260 3339
Fax: +1 718 260 3125
E-mail: klevon@poly.edu

Solution Chemistry

26–31 August 2001
27th International Conference on Solution Chemistry (27ICSC), Vaals, Netherlands.
Dr. Christian Dux, Conference Secretary of 27th ICSC, Institute of Physical Chemistry, RWTH-Aachen, D-52062, Aachen, Germany
Tel.: +49 241 80 4752 or +49 241 80 4712
Fax: +49 241 8888 327 or +49 241 8888 128
E-mail: 27icsc@liquid.pc.rwth-aachen.de

Medicinal Chemistry

2–6 September 2001
Hungarian–German–Italian–Polish Joint Meeting on Medicinal Chemistry, Budapest, Hungary.
Dr. Péter Mátyus, Institute of Organic Chemistry Semmelweis University H-1092 Budapest, Hungary
Fax: +36-1-217-0851
E-mail: matypet@szerves.sote.hu

Ionic Polymerization

22–26 October 2001
4th International Symposium on Ionic Polymerization, Crete, Greece.
Dr. Nikos Hadjichristidis, University of Athens, Department of Chemistry, Panepistimiopolis, Zografou, GR-157 71 Athens, Greece
Tel.: +30 1 724 9103
Fax: +30 1 722 1800
E-mail: hadjichristidis@chem.uoa.gr

Biodiversity

3–8 November 2001
3rd IUPAC International Conference on Biodiversity (ICOB-3), Antalya, Turkey.
Prof. B. Sener, Department of Phamocognosy, Faculty of Pharmacy, Gazi University, P.O. Box 143 06572, Maltepe-Ankara, Turkey.
Tel.: +90 312 212 2267
Fax: +90 312 213 3921
E-mail: blgsener@tr-net.net.tr

Polymers NEW

11–15 November 2001
6th Brazilian Polymer Conference / IX International Macromolecular Colloquium, Gramado, RS, Barzil.
Prof. Raquel Santos Mauler, Instituto de Química, Universidade Federal do Rio Grande do Sul, Av. Bento Gonçalves, 9500, 91501-970 Porto Alegre, RS - Brazil
Tel.: +55 51 3166296
Fax: +55 51 319 1499
E-mail: mauler@if.ufrgs.br

Sweeteners

13–17 November 2001
2nd International Symposium on Sweeteners, Hiroshima-Shi, Japan.
Prof. Kasuo Yamasaki, Institute of Pharmaceutical Sciences, Faculty of Medicine, Hiroshima University Kasumi, Minami-ku, Hiroshima 734-8551, Japan.
Tel.: +81 82 257 5285
Fax: +81 82 257 5289
E-mail: yamasaki@pharm.hiroshima-u.ac.jp

2002

Polymer Characterization

7–11 January 2002
10th International Conference on Polymer Characterization (POLYCHAR), Denton, Texas, USA.
Dr. Witold Brostow, Department of Materials Science, University of North Texas, Denton, Texas, 76203-5310 USA
Tel.: + 1 940 565 4358, -3262, or 4337
Fax: +1 940 565 4824
E-mail: brostow@unt.edu or polychar@marta.phys.unt.edu

Chromatography

6–8 February 2002
7th International Symposium on Hyphenated Techniques in Chromatography and Hyphenated Chromatographic Analyzers (HTC-7), Bruges, Belgium.
This conference has declined IUPAC sponsorship.

Macromolecules

6–10 February 2002
5th Annual UNESCO School and South African IUPAC Conference on Macromolecules and Materials Science, Stellenbosch, South Africa.
Prof. R. D. Sanderson, UNESCO Associated Centre for Macromolecules and Materials, Institute for Polymer Science, University of Stellenbosch, Private Bag X1, Matieland 7602, South Africa
Tel.: +27 21 808 3172
Fax: +27 21 808 4967
E-mail: rds@maties.sun.ac.za

Drug Residue Analysis NEW

4–7 June 2002
4th International Symposium on Hormone and Veterinary Drug Residue Analysis, Antwerp, Belgium.
Prof. C. Van Peteghem, Ghent University, Faculty of Pharmaceutical Sciences,
Harelbekestraat 72, B-9000 Gent, Belgium
Tel: +32 9 264 81 15
Fax: +32 9 264 81 99
E-mail:
carlos.vanpeteghem@rug.ac.be

Macromolecules

7–12 July 2002
39th International Symposium on Macromolecules - IUPAC World Polymer Congress 2002 (MACRO 2002), Beijing, China.
Prof. Fosong Wang, The Chinese Academy of Sciences, Beijing 100864, China
Tel: +86 10 62563060
Fax: +86 10 62573911
E-mail: fswang@mimi.cnc.ac.cn

Organic Synthesis

14–19 July 2002
14th International Conference on Organic Synthesis (ICOS-14), Christchurch, New Zealand.
Prof. Margaret A. Brimble, Department of Chemistry, University of Auckland, 23 Symonds St., Auckland, New Zealand
Tel.: +64 9 373 7599, Ext. 8259
Fax: +64 9 373 7422
E-mail:
m.brimble@auckland.ac.nz

Chemical Thermodynamics

28 July–2 August 2002
17th IUPAC Conference on Chemical Thermodynamics, Rostock, Germany.
Prof. A. Heintz, FB Chemie, Universitat Rostock, Hermannstr. 14, D-18051 Rostock, Germany
Tel.:+49 381 498 1852
Fax: +49 381 498 1854
E-mail:
andreas.heintz@chemie.uni-rostock.de

Crop Protection

4–9 August 2002
10th IUPAC International Congress on the Chemistry of Crop Protection (formerly International Congress of Pesticide Chemistry), Basel, Switzerland.
Dr. Bernard Donzel, c/o Novartis CP AG, WRO-1060.3.06, CH-4002 Basel, Switzerland
Tel.: +41 61 697 22 67
Fax : +41 61 697 74 72
E-mail:
bernard.donzel@cp.novartis.com

Bioorganic Chemistry

11–14 August 2002 *(new dates!!)*
6th International Symposium on Bioorganic Chemistry (ISBOC-6), Toronto, Canada.
Dr. Ronald Kluger, Department of Chemistry, University of Toronto, Toronto,Canada M5S 3H6.
Tel.: +1 416 978 3582
Fax.: +1 416 978 3482
E-mail:
rkluger@chem.utoronto.ca

Visas

It is a condition of sponsorship 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.

Chemical Education NEW

18–23 August 2002
The 17th International Conference on Chemical Education (17th ICCE)—New Strategies for Chemical Education in the New Century, Beijing, China.
Prof. Xibai QIU, 17th ICCE c/o Chinese Chemical Society, P.O. Box 2709 Beijing 100080, China
Tel.: +86 10 62568157, 86 10 62564020
Fax: +86 10 62568157
E-mail: qiuxb@infoc3.icas.ac.cn

Polymer Science and Technology

2–5 December 2002
IUPAC Polymer Conference on the Mission and Challenges of Polymer Science and Technology, Kyoto, Japan.
Prof. Seiichi Nakahama, Faculty of Engineering, Tokyo Institute of Technology, 2-12-1 Ohokayama, Meguro-ku, Tokyo 152-8552, Japan.
Tel.: +81 3 5734 2138
Fax.: +81 3 5734 2887
E-mail:
snakaham@polymer.titech.ac.jp