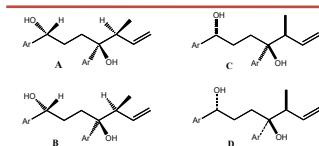


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IUPAC Periodic Table of the Elements *back cover tear off*

President's Column

Exciting and Challenging Times for Chemists and Chemistry

by Leiv K. Sydnes

On a number of occasions since the General Assembly (GA) in August 2003, I have wondered how ideas discussed in Ottawa to promote the chemical sciences and serve our societies can be implemented with maximum effectiveness. I now realize that there is more than one answer to the question because societies are organized very differently around the world and because national and personal priorities vary considerably. Of course, this has consequences for a global organization like ours: IUPAC can mainly be a provider that, to a large extent, has to rely on engaged chemists around the world to reach national stakeholders in a proper and adequate fashion.

In this perspective, opinions expressed during the discussion of my Vice President's Critical Assessment in Ottawa and input received afterwards have been most encouraging: People are willing to serve and become engaged in IUPAC activities. Therefore, I feel that an important task as president will be to act as a facilitator of initiatives and actions aimed at advancing the chemical sciences worldwide and contributing to the application of chemistry in the service of Mankind. As initiatives are required in a number of areas there should be plenty of opportunity for interested chemists to participate in IUPAC activities. I would like to focus on four such areas.

Projects

For the very existence of the Union, a most important task is to improve our means of generating new, good projects that address scientific issues requiring either international standardization (e.g., nomenclature, terminology, and quantities) or evaluation and critical assessment of quantitative data. In this work, the divisions must play an active role under the leadership of the division committees. This is in line with what a past president of the Analytical Chemistry Division, Folke Ingman, wrote in the last issue of the division's newsletter *Teamwork* <www.iupac.org/divisions/V/Teamwork>: "I believe that the division committee must take on the responsibility for producing project ideas and nursing them until a task group has been appointed and a proposal has been put forward."

Ingman's emphasis of the divisions' say in the composition of task groups is important. It is well docu-

mented, generally speaking, that the countries with the highest representation in IUPAC governing bodies have by far the most members in the project task groups. As stated by a number of participants at the GA, it is important to correct this imbalance. This is easier said than done, but it is my hope that by improving contacts between the divisions and the chemical communities in the IUPAC member countries—and through the work of the Union Advisory Committee and by meeting with the National Adhering Organizations of member countries—the geographic base of the task groups will broaden considerably. Let us be active in our search for qualified volunteers who are willing to serve IUPAC.

Conferences

I also would like to see IUPAC become more visible at conferences and utilize them more effectively to make our Union better known in the chemical profession; to disseminate recommendations, technical reports, and reports from task groups; and to develop ideas for new projects. In order to achieve this, IUPAC should, in fact, attach strings to its support of conferences, so that at least one session during a conference is dedicated to discussing the need for standardization or critical assessment of quantitative data, or for exploring if new, exciting scientific topics related to the conference theme and beyond, are about to emerge. If such sessions were organized skilfully by the appropriate division(s) they would gradually prepare younger chemists to develop new materials, devices, and methods for improving sustainable development and quality of life.

Public Appreciation

In today's media-sensitive societies, the issues of rating, standing, and reputation are important to consider. In doing so we realize that the chemical enterprise suffers from a dubious public image. Chemicals are too often associated with bad things happening to people and the environment, and in recent years, with chemical warfare. Unfortunately, the daily, positive contributions from chemistry and chemical engineering—to society and every one of us—are barely publicized, even though they are instrumental in feeding us, clothing us, housing us, healing us, and even entertaining us.


A number of industrial and chemical organizations have tried—on their own—to alter this perception by presenting a more balanced picture of the benefits and risks of chemicals. Considering the relatively low return from all of these efforts and expenses, it seems reasonable to ask whether some coordination of the activity would be beneficial. Secondly, could IUPAC, an organi-

zation with a global reputation of providing authoritative and unbiased chemistry information, offer added value and be regarded as more trustworthy in such an effort. In order to try to answer these and a number of related questions, IUPAC has funded a feasibility study entitled "Chemistry's Contributions to Humanity." The task group, chaired by Dr. Edwin D. Przybylowicz, has a wide membership, including several chemists involved in the Committee on Chemistry Education, led by Prof. Peter Atkins. The project description, available at <www.iupac.org/projects/2003/2003-022-1-020.html>, reveals the enormity of the task. Any input that will help make the feasibility study more complete will be very much appreciated. Therefore, I urge you to read the project description and supply information to Dr. Przybylowicz, any other member of the task group, or the IUPAC secretariat, in due course.

The Web

IUPAC is blessed with an outstanding Web site, which we hope will become even better and more valuable. One thing that is missing, however, is a complete set of links to the homepages of all the chemical societies in the IUPAC member countries. Such links—frequently sought by chemists in academia and industry (as well as by representatives at the last GA)—are very useful, but are often hard for individuals to obtain because they may not know the name of an organization in the language of the country it represents. I therefore urge every reader to check <www.iupac.org/links/> to see if the information from his or her country is complete, and if it is incomplete, to encourage the right person(s) in his or her country to furnish the information to IUPAC.

Contact

As mentioned in the beginning, I regard facilitation to be an important task for the president of the Union. In order to help the chemical community use IUPAC more actively, adequate input is required. Of course a fair amount of information comes through the divisions and active task groups, but I know that IUPAC's officers appreciate constructive comments and ideas from individuals who care to write. Such messages are most welcome, and I therefore challenge you to write to me <leiv.sydnes@kj.uib.no> or to any of the other officers and present what you have in mind during my presidential appointment. I am looking forward to a fruitful relationship for the benefit of IUPAC! 

Leiv K. Sydnes <leiv.sydnes@kj.uib.no> is the current IUPAC president, a member of the Norwegian Chemical Society, and professor at the University of Bergen.



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Atomic Weights

Just 20 years ago, while completing his chairmanship of the IUPAC Commission on Atomic Weights, Norman Holden prepared and published in *Chemistry International* (1984, issue No.1) an early historical review of the International Commission on Atomic Weights. Since then, his interest of the topic has not faded, and *au contraire*, he has now reviewed, extended, and updated the historical review to a length far beyond the space available here. The excerpts below are extracted from the historical review, which is available online at www.iupac.org/publications/ci/2004/2601/1_holden.html. The full text is equivalent to about 20 pages and includes more than 100 references.

Atomic Weights and the International Committee: A Brief Historical Review

by Norman E. Holden



Norman E. Holden, when chairman of the commission from 1979-1983.

The International Committee on Atomic Weights (ICAW) has a long and colorful history dating back for over a century. Initially, the task was to provide the chemical community and trade and commerce with the most accurate atomic weight values for the chemical elements. For over the past half century, the isotopic composition of the stable (or very long-lived) isotopes of those elements has taken on a larger role, until today the atomic weight values are determined by mass

weighting the isotopic abundance values. There was much interest in the atomic weight values when they were considered constants of nature and the building blocks of the periodic table and even more now that they are known to be variable.

Background

Just two hundred years ago, the English school-teacher, John Dalton, presented the first table of atomic weight values in a paper entitled *On the Absorption of Gases by Water and Other Liquids*. (The table was first read on 21 October 1803 to the

Manchester Literacy and Philosophical Society, and then published in 1805.) Since hydrogen had the smallest atomic weight value, Dalton chose that element as his reference scale unit, hydrogen = 1, and he calculated atomic weights by comparing weights of other atoms with that of hydrogen. Values given in the table indicate that Dalton grasped the ideas of constant composition in compounds and of multiple proportions. However, he did not account for the valence of each element in the compound. Dalton's later tables, published in 1808 and 1810, show a marked improvement in accuracy but the values are still difficult to recognize because of these errors in valence (i.e., some equivalent weights [atomic weight/valence] are quoted rather than atomic weights).

By the end of the nineteenth century, atomic weight had taken on the concept of a constant of nature like the speed of light, but the lack of agreement on accepted values created difficulties in trade. All parties were not translating quantities measured by chemical analysis into weights in the same way. With so many different values being reported, the American Chemical Society (ACS), in 1892, appointed a permanent committee to report on a standard table of atomic weights for acceptance by the Society. Frank W. Clarke, who had been appointed a committee of one, presented his first report at the 1893 annual meeting.

In 1897, the Deutsche Chemische Gesellschaft appointed a working committee to report on atomic weights. The committee, chaired by Hans Landolt (Berlin), published its first report in 1898. In contrast to Clarke, who presented a review of every atomic weight value published during the year along with his recommended values, the German committee merely gave the table with its estimated best value for each element. The committee argued for the adoption of the O = 16 scale and invited other chemistry organizations to appoint delegates to an international body. The resulting International Committee on Atomic Weights (ICAW) began with 57 chemists. The committee's first report, published in 1901, was a table on the O = 16 scale, which appeared as a flyleaf in issue 1 of the *Chemische Berichte* in 1902.

The ICAW soon decided to elect a smaller committee of three members to avoid the difficulties and delays of corresponding among a large group. The top three vote getters, Clarke, Karl Seuber, and Thomas Edward Thorpe, were elected. This commit-

tee reported annually (except for 1918) until 1921. In 1913, the committee became formally affiliated with the International Association of Chemical Societies (IACS), which had been formed two years earlier. The ICAW was charged with publishing an updated Table of Atomic Weights every year. Although the IACS was formally dissolved in 1919, the ICAW continued to publish its annual tables until 1922.

In 1918, a conference of scientists from allied (countries at war with the Central Powers) scientific academies withdrew from the IACS and formed the International Research Council (IRC). A year later, at the Inter-allied Chemical Conference in London, the allied chemical societies of Belgium, England, France, Italy, and the United States formed the International Union of Pure and Applied Chemistry (IUPAC), which would function—with autonomous powers—as the chemical section of the IRC.

At the first IUPAC conference, held in 1920 in Rome, the IUPAC Council met and established a series of committees: one on atomic weights, one on tables of constants, and one on patents, as well as an Institute of Chemical Standards. The council requested that the old ICAW be asked to continue its work. In 1921, the committee on atomic weights was reorganized, enlarged, and renamed the Committee on Chemical Elements. This committee, in addition to providing atomic weight values, was also asked to cover the discovery of isotopes in radioactive and non-radioactive elements. Tables of radioactive elements and their principal constants, a table of isotopes, and a table of atomic weights were to be prepared.

At a meeting in Paris in 1922, the Committee on Chemical Elements voted to publish the table of isotopes and of radioactive elements

the following year and to continue the old committee's table of 1921–1922 if a new general table of atomic weights could not be completed in time. The committee published a completely revised atomic weight table in 1925, but did not revise the table again until after 1930. In 1928, after being criticized for failing to publish an annual table of atomic weights for many years, the

committee was reorganized into three separate committees: one dealing with atomic weights, one with atoms, and one with radioactive constants.



Frank W. Clarke

The Atomic Weights Scale

The atomic weights scale of $H = 1$ was originally used by Dalton and (except for Berzelius' time) had been used for approximately 100 years when the ACS and the German committees began reporting their tables. Lothar Meyer (one of the first developers of the periodic table) and Seubert had published on the hydrogen scale, but Wilhelm Ostwald (a member of the German committee who later won the Nobel Prize for chemistry for catalysis) and Bohuslav Brauner (member of the Committee on Chemical Elements) strongly urged the adoption of the $O = 16$ scale. Clarke reported his table on both scales, while the German committee used the $O = 16$ scale exclusively and argued for its adoption. As a result of a vote within the German Committee in 1899, the first international table was published on the $O = 16$ scale. However, after vigorous protests from certain parties, doubt was expressed as to whether a majority opinion could ever be accepted as final in such theoretical matters. As a result, the smaller ICAW continued publishing the annual tables on both scales until a consensus could be reached.

Beginning with the 1906 report, however, the ICAW used the $O = 16$ scale following a new survey of the larger committee. Thus, the scale was settled for some 30 years, except for a brief discussion in 1920 on going back to the hydrogen scale. Beginning in the 1930s, when the neutron was discovered and the structure of nuclei was accepted to be a combination of protons and neutrons, $H = 1$ became a near impossible choice as a reference for atomic weights. The atomic number of heavy elements would not represent the number of nuclides in the nucleus in an $H = 1$ scale.

In 1929, the discovery of the two oxygen isotopes, ^{17}O and ^{18}O by Giauque and Johnston led to a situation in which the chemist's scale of $O = 16$ differed from the physicist's scale of $^{16}\text{O} = 16$. When Dole reported the variation in oxygen's atomic weight value in water versus air, this implied a variation in the isotopic composition of oxygen and the two scales took on a small but a variable difference. The ICAW briefly discussed the atomic weight standard in their 1932 report, where they considered $^1\text{H} = 1$, $^4\text{He} = 4$, $^{16}\text{O} = 16$ and $O = 16$ before choosing to follow Aston, who argued that the two scales satisfied everyone's requirement.

The variable scale difference was of great concern to Edward Wichers (president of ICAW beginning in 1949) and for a number of years he attempted to have

Atomic Weights and the International Committee

the ICAW fix the difference between the two scales by definition. This would effectively define the isotopic composition of oxygen to be a particular value in nature. Failing with this solution, he solicited proposals for an alternate scale that would be acceptable to both the physics community as well as to the chemists worldwide.

In April 1957, Alfred Nier suggested to Josef Mattauch (both were members of ICAW) that the $^{12}\text{C} = 12$ mass scale be adopted because of carbon's use as a secondary standard in mass spectrometry. Also, $^{12}\text{C} = 12$ implied

acceptable relative changes in the atomic weight scale, (i.e., 42 parts-per-million [ppm] compared to 275 ppm for the $^{16}\text{O} = 16$ scale [which would not be acceptable to chemists]). Enthusiastically, Mattauch made a worldwide effort in the late 1950s to publicize the $^{12}\text{C} = 12$ scale and obtain the physicist's approval, while Wichers obtained the chemist's approval.

Following the approval of the International Union of Pure and Applied Physics General Assembly in Ottawa, Canada, in 1960 and the IUPAC General Assembly at Montreal, Canada, in 1961, the atomic weights were officially given on the $^{12}\text{C} = 12$ scale for the first time in the 1961 report. Mattauch and his colleagues combined data on direct nuclidic mass measurements with data on measured binding energies and beta decay energies derived from the masses to produce a consistent least squares fit of all nuclidic masses. This mass data was combined with the isotopic compositions to provide atomic weight values used in that 1961 Atomic Weights report.

Expanded Topics for the Commission

In the years between when the mass scale change occurred and 1969, there were relatively few changes in the atomic weights table. In the 1969 report, a table of radioactive isotopes with half-life values and a table of atomic masses of selected isotopes were included, and definitions of terms of atomic weight, isotope, nuclide, and normal material were introduced. These definitions led to an interdivisional fight

within IUPAC with various terminology committees about these terms, not the least of which was "atomic weights" itself. The various discussions that followed would continue over a decade until the IUPAC General Assembly at Davos, Switzerland, in 1979.

The fallout from the terminology wars was discussed

in the commission's meetings at both the 1971 IUPAC Washington, D.C., General Assembly and the 1973 IUPAC Munich, FRG, General Assembly. In the 1971 report, there was a discussion as well as a graph of the relative

precision of the atomic weight values of all elements across the periodic table. The two tables of half-life values and atomic masses from the 1969 report were combined into a single table in the 1971 report.

With the increased importance of the isotopic abundance measurements in the determination of the atomic weights, the commission's name was changed at the 1979 IUPAC General Assembly in Davos, Switzerland, to Commission on Atomic Weights and Isotopic Abundances. A new definition of atomic weight was presented, which indicated that atomic weights could be defined for a sample. Tables of standard atomic weights published by the commission referred to best knowledge of the elements in natural terrestrial sources (this is still the case today). Atomic weight (mean relative atomic mass) of an element from a specified source was defined as "the ratio of the average mass per atom of the element to $1/12$ of the mass of an atom of ^{12}C ." From this point on, the commission presented the most accurate available values for those who needed to use them, but the concept of accuracy implies the existence of a true value and the definition doesn't recognize the existence of one true value for every element.

The Growing Importance of Isotopic Compositions

For the 1981 IUPAC General Assembly in Leuven, Belgium, the Commission decided to publish its report in *Pure and Applied Chemistry* in two separate parts for the first time (i.e., the *Atomic Weights of the*



Edward Wichers



Alfred Nier



Josef Mattauch

A Brief Historical Review

Elements, 1981 and the *Isotopic Compositions of the Elements*, 1981).

At the 1983 IUPAC General Assembly in Lyngby, Denmark, the Commission changed its method for expressing uncertainties in atomic weight values. Previously these uncertainties were restricted to one of two values, (i.e., either ± 1 or ± 3). Beginning with the 1983 report, these uncertainties could now take on any digit from ± 1 up to ± 9 . Another change with the 1983 report dealt with the treatment of elements with no stable isotopes. For radioactive elements with no unique naturally occurring isotopic composition from which an atomic weight could be calculated with five or more figure accuracy without prior knowledge of the sample, the concept of a standard atomic weight has little meaning. So scientists dealing with non-terrestrial samples were warned to exercise caution when the isotopic composition or atomic weight of a non-terrestrial sample was required.


At the 1999 IUPAC General Assembly in Berlin, Germany, the Working Party on Non-terrestrial Data reported on the processes explaining isotopic variations and provided a table of anomalous isotopic compositions in extra-terrestrial materials due to decay of radioisotopes.

More recently, at the 2001 IUPAC General Assembly in Brisbane, Australia, the commission emphasized the great importance of the isotopic abundance values as the sole source (along with the atomic mass values of the stable isotopes) for determining atomic weight values for the elements. The commission once more changed its name to the Commission on Isotopic Abundances and Atomic Weights (CIAAW). At the conclusion of the Brisbane General Assembly, changes to the IUPAC bylaws and statutes resulted in the termination of all commissions, but after discussions, the IUPAC Council approved the reestablishment of the CIAAW.

Normally in the period between IUPAC General Assemblies, the members of the commission and the various subcommittees perform the literature search for data from the journal and document sources and an initial assessment of the results and impact on the database. In the period after the Brisbane General Assembly, it was determined that although IUPAC approved continuation of the commission, it was to be without commission funding. It had been concluded that without adequate funding, there would be no commission meeting in 2003. This thinking continued

for more than one and one half years, until the president of the IUPAC Inorganic Chemistry Division, Gerd Rosenblatt, made funds available to bring together all members of the commission and subcommittees in Ottawa to discuss the future course of the commission.

As a result of the above confusion, no preparatory work for the scientific agenda had been done to analyze the data and recommend updated values for the Table of the Standard Atomic Weights. At the 2003 IUPAC General Assembly in Ottawa, Canada, the commission chose not to publish a report on Atomic Weights for 2003 (for the first time in almost 40 years). The commission and the subcommittees discussed the future work of these bodies and a mechanism for the funding for continued operation either within IUPAC or outside of the IUPAC framework. Tiping Ding (Chinese Academy of Geological Sciences, Beijing, China) was elected chairman to replace Philip Taylor and Michael Wieser (University of Calgary, Alberta, Canada) was elected secretary to replace Robert Loss at the conclusion of the meeting.

One atomic weights publication that did appear in a pre-print form at the time of the Ottawa General Assembly was another element-by-element review called *EXER-2000*. This 115-page document had been the result of the six-year effort by the members of the 1997 working party and it was written in a similar manner to the earlier Subcommittee on the Assessment of Isotopic Composition review. 

Norman Holden <holden@bnl.gov> has been involved with IUPAC for over 30 years and is today a titular member on the Inorganic Chemistry Division. Since 1974, he has been at the National Nuclear Data Center of the Brookhaven National Laboratory, in Upton, New York, USA.

The full version of this historical review, which includes sections on Uncertainties and Annotations and The Naming of Natural and Synthetic Elements, is available at

 www.iupac.org/publications/ci/2004/2601/1_holden.html

NH thanks the many members of the Atomic Weights Commission, who took time to provide comments on the review including, Tyler Coplen, Paul De Bievre, John De Laeter, Norman Greenwood, Steffen Peiser and Etienne Roth. This research was carried out under the auspices of the U.S. Department of Energy, Contract No. DE-AC02-98CH10886.

The Periodic Table of the Elements

The president of the Inorganic Chemistry Division, Gerd Rosenblatt, recognizing that the periodic table of the elements found in the "Red Book" (Nomenclature of Inorganic Chemistry, published in 1985) needed some updating—particularly elements above 103, including element 110 (darmstadtium)—made a formal request to Norman Holden and Tyler Coplen to prepare an updated table. This table can be found below, on the IUPAC Web site, and as a tear-off on the inside back cover of this issue.

by Norman Holden and Ty Coplen

The Russian chemist Dmitri Ivanovich Mendeleev constructed his original periodic table in 1869 using as its organizing principle his formulation of the periodic law: if the chemical elements are arranged in the ascending order of their atomic weights, then at certain regular intervals (periods) elements occur having similar chemical and physical properties.

Mendeleev sensed that chemical behavior was more fundamental than atomic weight and left empty spaces in his table when chemical properties did not fit. He predicted that these missing elements would be discovered with appropriate atomic weight values and having the required properties. When gallium, scandium, and germanium were discovered over the next 15 years with the properties that Mendeleev predicted, the scientific world began to take his periodic table seriously.

In 1913, the English physicist Henry Gwyn Jeffreys Moseley compared the energy of the X-ray spectral lines of various elements against their atomic weight. He obtained an approximate straight-line graph. To avoid breaks in this graph, he found it necessary to place elements in the order demanded by the chemical properties rather than increasing atomic weight. Moseley's curve of X-ray lines indicated that every element has a constant value, its ordinal or atomic number, that increases by a constant amount from element to element. In 1920, Chadwick showed that the

atomic number was the same as the number of protons in each element.

A problem for Mendeleev's table was the positioning of the rare earth or lanthanoid* elements. These elements had properties and atomic weight values similar to one another but that did not follow the regularities of the table. Eventually, they were placed in a separate area below the main table.

The Danish physicist Niels Henrik David Bohr proposed his electronic orbital structure of the atom in 1921, which explained the problem of the rare earth elements. The electrons in the outermost and the penultimate orbits are called valence electrons since generally their actions account for the valence of the element (i.e., electrons capable of taking part in the links between atoms). Chemical behavior of an element depends on its valence electrons, so that when only inner orbit electrons are changing from one element to another, there is not much difference in the chemical properties between the elements.

The elements from actinium through uranium (along with neptunium through curium when they were first synthesized) were originally placed with the main table elements, in spite of problems with their chemical properties. In 1946, the American chemist Glenn

1												12	
1 H hydrogen 1.007 94(7)												2	
3 Li lithium 6.94(12)	4 Be beryllium 9.012 182(3)												
11 Na sodium 22.989 770(2)	12 Mg magnesium 24.3050(6)												
		3	4	5	6	7	8	9	10	11	12		
19 K potassium 39.0983(1)	20 Ca calcium 40.078(4)	21 Sc scandium 44.955 910(8)	22 Ti titanium 47.867(1)	23 V vanadium 50.9415(1)	24 Cr chromium 51.9961(6)	25 Mn manganese 54.938 049(9)	26 Fe iron 55.845(2)	27 Co cobalt 58.933 200(9)	28 Ni nickel 58.6934(2)	29 Cu copper 63.546(3)	30 Zn zinc 65.409(4)		
37 Rb rubidium 85.4678(3)	38 Sr strontium 87.62(1)	39 Y yttrium 88.905 85(2)	40 Zr zirconium 91.224(2)	41 Nb niobium 92.906 38(2)	42 Mo molybdenum 95.94(2)	43 Tc technetium [97.9072]	44 Ru ruthenium 101.07(2)	45 Rh rhodium 102.905 50(2)	46 Pd palladium 106.42(1)	47 Ag silver 107.8682(2)	48 Cd cadmium 112.411(8)		
55 Cs caesium 132.905 45(2)	56 Ba barium 137.327(7)	57-71 lanthanoids		72 Hf hafnium 178.49(2)	73 Ta tantalum 180.9479(1)	74 W tungsten 183.84(1)	75 Re rhenium 186.207(1)	76 Os osmium 190.23(3)	77 Ir iridium 192.227(3)	78 Pt platinum 195.078(2)	79 Au gold 196.966 55(2)	80 Hg mercury 200.59(2)	
87 Fr francium [223.0197]	88 Ra radium [226.0254]	89-103 actinoids		104 Rf rutherfordium [261.1088]	105 Db dubnium [262.1141]	106 Sg seaborgium [266.1219]	107 Bh bohrium [264.12]	108 Hs hassium [277]	109 Mt meitnerium [268.1388]	110 Ds darmstadtium [271]	111 Uuu ununium [272]		
57 La lanthanum 138.9055(2)	58 Ce cerium 140.116(1)	59 Pr praseodymium 140.907 65(2)	60 Nd neodymium 144.24(3)	61 Pm promethium [144.9127]	62 Sm samarium 150.36(3)	63 Eu europium 151.964(1)	64 Gd gadolinium 157.25(3)	65 Tb terbium 158.925 34(2)	66 Dy dysprosium 162.500(1)				
89 Ac actinium [227.0277]	90 Th thorium 232.0381(1)	91 Pa protactinium 231.036 88(2)	92 U uranium 238.028 91(3)	93 Np neptunium [237.0482]	94 Pu plutonium [244.0642]	95 Am americium [243.0614]	96 Cm curium [247.0704]	97 Bk berkelium [247.0703]	98 Cf californium [251.0796]				

For a printable version of this table, see <www.iupac.org/reports/periodic_table/>. A tear-off copy is attached to the backcover of this issue of CI.

Theodore Seaborg suggested that these elements formed an actinoid group similar to the lanthanoid. Lawrencium completed the actinoid series and element 104 was placed in the seventh row of the main table.


There were conflicting claims of who first synthesized element 104 and the next few elements of the table for almost a quarter century. During this long impasse, Joseph Chatt (of IUPAC's Inorganic Chemistry Division) suggested the use of a Greco-Roman naming scheme to provide a provisional IUPAC name with a three letter symbol (e.g., element 111 would have the name ununium with a symbol Uuu). Eventually, a joint working party from IUPAC and from the International Union of Pure and Applied Physics (IUPAP) was formed to review the scientific data for elements 104 through 109 and to resolve the impasse. The joint IUPAC/IUPAP working party decided to continue resolving the problem of determining the first synthesizer for future elements. The group determined that element 110 was initially made by the German group at the Heavy Ion facility in Darmstadt, Germany. The Germans suggested the name darmstadtium with the symbol Ds, which are now accepted both by IUPAC and IUPAP.

In keeping with the traditional use of atomic weight

values in the periodic table, the latest (2001) IUPAC approved Standard Atomic Weight values are listed on the table with the uncertainty in the last figure shown in parentheses. These values are taken from table 1 of the "Atomic Weights of the Elements 2001" (IUPAC technical report, *Pure Appl. Chem.* **75**, 1107–1122 [2003]). For elements without stable nuclides or long-lived nuclides with normal terrestrial abundances of those nuclides, the atomic weights

report provides table 3 with either the atomic mass or, when that parameter is unknown, merely the atomic mass number (number of protons and neutrons in the nucleus) of the most stable nuclide of that element (i.e., the nuclide having the longest half-life). This value from table 3 of the report is shown on the periodic table in square brackets for many of the elements, including all elements above uranium. Thus, element 100 is listed as "[257.0951]." Otherwise, the mass number of the longest lived nuclide is listed, such as [277] for hassium. One element deserves a special comment in this regard. Element 110, darmstadtium (Ds), is listed in table 3 of the report [281]. Because the half-life of 1.6 min for ²⁸¹Ds was determined from only a single decay, it was decided instead to give in the periodic table the mass number of a nuclide that has the longest half-life and that confirms the discovery of Ds. This is ²⁷¹Ds; thus, [271] is listed for element 110.

Element 111 has also been acknowledged by the joint IUPAC/IUPAP working party to have first been synthesized by the same German group at Darmstadt, but a name has not yet been suggested. It is shown on the table with its IUPAC provisional name and symbol "Uuu." The elements with atomic numbers 112, 114, and 116 have been reported in the scientific literature, but have not yet been authenticated by the IUPAC/IUPAP working party, so they do not yet merit a place in the table.

Finally, for American readers, it is noted that alternate English language spellings for the names of aluminum and cesium are used in the USA and do not constitute erroneous spellings. 

*The 1985 "Red Book" (p. 45) indicates that the following collective names for groups of atoms are IUPAC-approved: actinoids or actinides, lanthanoids or lanthanides. The note that accompanied that statement explained that although actinoid means "like actinium" and so should not include actinium, actinium has become common usage. Similarly, lanthanoid. The ending "-ide" normally indicates a negative ion, and therefore "lanthanoid" and "actinoid" are preferred to "lanthanide" and "actinide." However, owing to wide current use, "lanthanide" and "actinide" are still allowed.

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 www.iupac.org/general/FAQs/elements.html

					18 2 He helium 4.002 602(2)
5 B boron 10.811(7)	6 C carbon 12.0107(8)	7 N nitrogen 14.0067(2)	8 O oxygen 15.9994(3)	9 F fluorine 18.998 4032(5)	10 Ne neon 20.1797(6)
13 Al aluminum 26.981 538(2)	14 Si silicon 28.0855(3)	15 P phosphorus 30.973 761(2)	16 S sulfur 32.065(5)	17 Cl chlorine 35.453(2)	18 Ar argon 39.948(1)
31 Ga gallium 69.723(1)	32 Ge germanium 72.64(1)	33 As arsenic 74.921 60(2)	34 Se selenium 78.96(3)	35 Br bromine 79.904(1)	36 Kr krypton 83.798(2)
49 In indium 114.818(3)	50 Sn tin 118.710(7)	51 Sb antimony 121.760(1)	52 Te tellurium 127.60(3)	53 I iodine 126.904 47(3)	54 Xe xenon 131.293(6)
81 Tl thallium 204.383(2)	82 Pb lead 207.2(1)	83 Bi bismuth 208.980 38(2)	84 Po polonium [209.9824]	85 At astatine [209.9871]	86 Rn radon [222.0176]

67 Ho holmium 164.930 32(2)	68 Er erbium 167.259(3)	69 Tm thulium 168.934 21(2)	70 Yb ytterbium 173.04(3)	71 Lu lutetium 174.967(1)
99 Es einsteinium [252.0830]	100 Fm fermium [257.0951]	101 Md mendelevium [258.0984]	102 No nobelium [259.1010]	103 Lr lawrencium [262.1097]

Chinese Terms for Chemical Elements

Characters Combining Radical and Phonetic Elements

by Chang Hao

When a chemical element is translated into Chinese, the character usually contains a radical that indicates the physical properties of the element according to the Chinese philosophy of nature. This idea dates back to the year 1871. For example, the term argon was translated into *ya* with an air-radical, barium into *bei* with a metal-radical, and so on.

The Chinese language has very little in common with European languages. When the nineteenth-century Chinese translated chemical elements that had been named after countries, places, their form, or their distinctive properties, tremendous effort was required to create a whole nomenclature from scratch.

The modern concept of a chemical element as a “substance that cannot be split up by any known means into something simpler” did not exist in traditional Chinese natural philosophy. When the concept of the four elements was introduced into China in the late Ming dynasty (1368–1644), the translation *yuanxing* (original-phase) for the term “element” was influenced by the theory of the five phases. There are five *xing* (phases) in China, namely, metal, wood, water, fire, and earth, which have an interdependent cyclic relationship. In the Chinese view of nature, fire represents not only the real fire, but also the substances bearing characteristics of fire. Although there were different Chinese translations for “element” in the nineteenth-century, those terms are mostly forgotten nowadays. Only the word *yuansu* (original-element), which is derived from the Japanese language and was introduced into China after the Sino-Japanese war (1894–95), is still in use today.

Although the introduction of modern Western chemistry into China began in the middle of the nine-

teenth century, a large number of theories were not translated into Chinese until the 1870s. The translation of the elements was one of the earliest problems, especially when it came to explaining the reaction of substances. The use of traditional, already existing Chinese names was in the beginning considered an advantage. However, only a few terms could be used for the new elements. There weren't many chemists in nineteenth-century China, so translating chemical terms was a big problem. Most translators were not experts and they didn't know anything about the chemical properties of an element, which often made their translations misleading. Others just put the pronunciation of the English terms into Chinese characters, a method that was temporarily accepted, but the resulting words didn't sound very Chinese and couldn't convey any real information about the element to which they pointed.

In 1871, John Fryer (1839–1928) and his Chinese colleague Xu Shou (1818–1884), both of them working for the translation office of the Jiangnan Arsenal, created a principle for the translation of chemical elements according to which one Chinese character was to be assigned to each element. The impact of their translations on the fields of chemistry and chemical engineering proved to be enormous. In *Huaxue Jianyuan* (*Mirror of Chemical Science*), the most influential textbook on chemistry in nineteenth-century China, Fryer and Xu explained their ideas on the translation of the elements. Traditional terms for elements like gold, silver, copper, iron, lead, tin, mercury, sulfur, phosphorus, and carbon remained unchanged. If they considered an existing term for an element suitable (examples are oxygen, hydrogen, and nitrogen), it was retained as well. They would not translate according to the mere meaning of a term, because this was often hard to determine. For the

The impact of Fryer and Xu's translations on the fields of chemistry and chemical engineering proved to be enormous.

H	He	Li	Be	B	C	N	O	F	Ne
氫	氦	鋰	鈹	硼	碳	氮	氧	氟	氖

Chinese characters for some of the elements.

other elements, they created new characters. Their method consisted of translating the pronunciation of the first syllable of the original term. If this was not suitable, they translated the second syllable, and combined it with the radical in order to indicate the properties of the element. The character's pronunciation could then be ascertained by looking at the phonetic part. Fryer and Xu emphasized that they would not directly translate the sound of the Western terms. These long rows of Chinese characters were purely onomatopoeic and were not only a great burden to read, write, or remember, but they had no meaning whatsoever.

Except for 9 Chinese traditional terms and 5 accepted translations, Fryer and Xu invented 50 of the 64 characters for chemical elements. Forty-eight of them were composed of a root and the sound of one syllable of the original English term. Fryer and Xu's method was a considerable challenge to their contemporaries. Using traditional names was the preferred translation method of the time, since these terms were easily accepted by the Chinese. For example, the terms for aluminum, arsenic, boron, calcium, potassium, silicon, and sodium had been translated by others using traditional Chinese names or other already established terms.

Fryer found both the use of established terms or invented characters difficult. He once described his decision on the translation method as being a choice between "two evils." Philologists would criticize the "incorrect" use of traditional terms and on the other hand, Chinese patriots would condemn the use of terms that too clearly derived from products of Western science. In order to avoid such misunderstandings, Fryer chose to invent new characters that hadn't existed in any Chinese dictionary. However, the disadvantage of such invented characters was that they were not officially authorized and therefore not easily accepted.

However, Fryer and Xu's principle of character creation was soon widely accepted by their contemporary translators. But many of their phonetic-based terms were also criticized. Many Chinese found Fryer and Xu's terms awkward, and the missionary transla-

Root radical with original meaning	Combinations using root classifiers			
金 metal	鈣 calcium	鋰 lithium	鎳 nickel	鈹 palladium
汽 air (gas)	氧 oxygen	氫 hydrogen	氮 nitrogen	氟 fluorine
石 (metalloid) stone	砷 arsenic	硼 boron	碘 iodine	硅 silicon
水 water(liquid)	汞 mercury			

One Chinese character is assigned to each element; this is a compound character in two parts: (1) a root radical, classifying the element as of the "metal," "air," "stone," or "water" groups; (2) a single descriptive word or an imitation of the sound of one syllable in the English name of the element.

... Fryer and Xu invented 50 of the 64 characters for chemical elements.

tors considered them inconvenient. In *The Revised List of Chemical Elements*, most terms were translated as descriptive names. This list of elements was published in 1898 and was the first achievement of the Educational Association of China, which strived to create a Chinese scientific terminology. In determining these names, the Committee on the Nomenclature of the Educational Association stated its conviction that the terms should tell something about the properties of an element rather than imitate its original pronunciation. Only in the early twentieth century did Fryer's phonetic names eventually gain

Chinese Terms for Chemical Elements

acceptance. Fryer himself had predicted that it would take a while for his creations to become widely accepted.

In 1915, the Ministry of Education published a list of the names of elements based on Fryer and Xu's terms. Two years later, the General Committee on Scientific Terminology, which was appointed by the Chinese Government to translate scientific terminology, adopted most of their names for the chemical elements.

During the process of unifying the Chinese chemical nomenclature, the cooperation between the National Institute for Compilation and Translation and the Chinese Chemical Society played a significant role. The Institute was established in 1932 with the task of unifying school textbooks and scientific terminology. The same year, the Ministry of Education organized a chemistry forum where issues regarding

The historical record of the translations . . . demonstrates the extreme difficulties the Chinese encountered trying to understand Western chemistry.

the translation of chemical terms, chemistry education, and chemical engineering in the military were discussed. One result of the forum was the establishment of the Chinese

Chemical Society. The chemical terms that were agreed upon in the forum laid the foundation for a commonly accepted terminology. One year later, the National Institute for Compilation and Translation published *Principle of the Chemical Nomenclature* in which the names of chemical elements were standardized. Most of the chemical terms are still in use today. The value of Fryer and Xu's work had finally been recognized.

Today in Taiwan, the Nomenclature Committee of the Chinese Chemical Society is appointed by the Ministry of Education to draw up a standard list of chemical terms in Chinese. For example, darmstadtium (Ds), element 110, has been translated as *da* according to the first sound of its term.

Oxygen, Hydrogen, and Nitrogen

Apart from studying the historical development of the translation of chemical elements, the Chinese names for oxygen, hydrogen, and nitrogen are also worth

investigating. Since their first translations in 1855, the terms *yangqi* (nourishing gas), *qingqi* (light gas), and *danqi* (diluting gas)—oxygen, hydrogen, and nitrogen, respectively—had been applied by Fryer and Xu and became widely accepted in the nineteenth century. During that time, *yang* (nourishing), *qing* (light), and *dan* (diluting) were considered more suitable and more elegant than the translations derived from the German terms *sauerstoff*, *wasserstoff*, and *stickstoff*. In the twentieth century, many Chinese scholars thought that *yang*, *qing*, and *dan* were also more suitable than the Japanese terms *sanso* (acid element), *suiso* (water element), and *sasso* (lethal element), which also derived from the Germano-Dutch nomenclature. The historical record of the translations of these three elements shows that Lavoisier's chemical theories and nomenclature were never fully accepted in China. It also demonstrates the extreme difficulties the Chinese encountered trying to understand Western chemistry.

In its ancient past, China's chemistry was basically alchemy, and only a few names for new elements could be taken from the alchemical vocabulary. The Chinese naturally preferred descriptive terms whenever possible, but there are only five such terms. Many new terms for chemical elements have become a natural part of the Chinese language, which today proves to be more open toward importing new ideas and concepts. And the work of Fryer and Xu is still bearing fruit: The 44 terms they conceived continue to be in use today. 🌱

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Pronunciation Guide

In Chinese, different characters are often pronounced the same way. Even though the four tones serve as a means of distinction, the Chinese usually distinguish the characters by their forms. In the table of chemical elements 12 terms derive from traditional names: carbon, sulfur, iron, copper, silver, tin, gold, mercury, lead, boron, phosphorus, and platinum. A number of terms carry a "gas" radical: hydrogen, nitrogen, oxygen, fluorine, chlorine, helium, neon, argon, krypton, xenon, and radon. Other terms have an "earth" radical: carbon, boron, silicon, phosphorus, sulfur, arsenic, selenium, tellurium, iodine, and astatine. The "water" radical was attributed to the following elements: bromine, mercury. The rest of the elements have a "metal" radical. The second part of the characters is phonetic and provides a hint to the pronunciation of the term.

Atomic number	Element	Pronunciation of the character	Atomic number	Element	Pronunciation of the character
1	Hydrogen	qing	56	Barium	bei
2	Helium	hai	57	Lanthanum	lan
3	Lithium	li	58	Cerium	shi
4	Beryllium	pi	59	Praseodymium	pu
5	Boron	peng	60	Neodymium	nyu
6	Carbon	Tan	61	Promethium	po
7	Nitrogen	dan	62	Samarium	shan
8	Oxygen	yang	63	Europium	you
9	Fluorine	fu	64	Gadolinium	ga
10	Neon	nai	65	Terbium	te
11	Sodium	na	66	Dysprosium	di
12	Magnesium	mei	67	Holmium	huo
13	Aluminium	lyu	68	Erbium	er
14	Silicon	Xi	69	Thulium	djou
15	Phosphorus	lin	70	Ytterbium	yi
16	Sulphur	liu	71	Lutetium	liu
17	Chlorine	lyu	72	Hafnium	ha
18	Argon	ya	73	Tantalum	tan
19	Potassium	jia	74	Tungsten	wu
20	Calcium	gai	75	Rhenium	jai
21	Scandium	kang	76	Osmium	er
22	Titanium	tai	77	Iridium	yi
23	Vanadium	fan	78	Platinum	bo
24	Chromium	ge	79	Gold	jia
25	Manganese	meng	80	Mercury	gong
26	Iron	tie	81	Thallium	ta
27	Cobalt	gu	82	Lead	qian
28	Nickel	nie	83	Bismuth	bi
29	Copper	tong	84	Polonium	pu
30	Zinc	xin	85	Astatine	e
31	Gallium	jia	86	Radon	dong
32	Germanium	zhe	87	Francium	fa
33	Arsenic	shen	88	Radium	lei
34	Selenium	xi	89	Actinium	a
35	Bromine	chou	90	Thorium	tu
36	Krypton	ke	91	Protactinium	pu
37	Rubidium	ru	92	Uranium	you
38	Strontium	si	93	Neptunium	nei
39	Yttrium	yi	94	Plutonium	bu
40	Zirconium	gao	95	Americium	mei
41	Niobium	ni	96	Curium	ju
42	Molybdenum	mu	97	Berkelium	bei
43	Technetium	ta	98	Californium	ka
44	Ruthenium	liao	99	Einsteinium	ai
45	Rhodium	lao	100	Fermium	fei
46	Palladium	ba	101	Mendelevium	men
47	Silver	yin	102	Nobelium	nuo
48	Cadmium	ge	103	Lawrencium	lao
49	Indium	yin	104	Rutherfordium	lu
50	Tin	xi	105	Dubnium	du
51	Antimony	ti	106	Seaborgium	xi
52	Tellurium	di	107	Bohrium	po
53	Iodine	dian	108	Hassium	hei
54	Xenon	shan	109	Meitnerium	mai
55	Caesium	se	110	Darmstadtium	da

FECS 2003 Award for Service Presented to Leiv Sydnes

The FECS—Federation of European Chemical Societies and Professional Institutions—Award for Service was presented to IUPAC President Leiv Sydnes of the Norwegian Chemical Society, in recognition of his significant contribution to European cooperation in chemistry and the public appreciation of chemistry. The Award, consisting of a medal and a scroll, was presented to Sydnes at the General Assembly of FECS member societies in Barcelona, Spain, in October 2003.

Sydnes has been instrumental in developing the educational and professional activities of FECS and in promoting the European Chemist designation. He was recognized by FECS for his contribution to the public appreciation of chemistry, especially his focus on bringing the excitement and value of chemistry to children and to society in general. Examples include the numerous public lectures he has given and the prime-time television programs he has made for the general public on chemistry-related topics. He has been involved in FECS for 10 years, serving as a member of the Executive Committee, as vice-chairman of the former European Communities Chemistry Council, and as chairman of the European Chemist Registration Board.

Sydnes has been involved with IUPAC for about 10 years. From 1992 to 1996 he served as president of the Norwegian Chemical Society. He has been professor at the University of Bergen, Norway, since 1993.



IUPAC President Leiv Sydnes (left) receives the FECS Award from FECS President Gábor Náray-Szabó.

Prior to that he was at the University of Tromsø. His research is currently concentrated on organic synthesis with emphasis on the application of cyclopropane chemistry and photochemistry to introduce useful structures into organic molecules.

 www.fecs-chemistry.org

The International Association of Chemical Thermodynamics Gains Associated Organization Status

At its most recent meeting in Ottawa in August 2003, the IUPAC Council approved the application of the International Association of Chemical Thermodynamics (IACT) to become an Associated Organization. Associated Organizations are international organizations that share common goals and interests with IUPAC.

IACT was set up to pursue and expand the role of the former IUPAC Commission on Thermodynamics in maintaining the highest standards in teaching and research in this key area of chemistry, which encompasses both equilibrium and non-equilibrium studies. Thermodynamics continues to be of utmost importance as it finds application in a wide range of developing subject areas such as new materials and biosciences.

According to IACT Secretary J. H. Dymond, IACT is convinced that its Associated Organization status will be of great mutual benefit, and is looking forward to close cooperation on many fronts.

Among the objectives of the IACT, as stated in its constitution, are the following:

- advance education in thermodynamics
- encourage young scientists to work in the area of chemical thermodynamics
- advance the application of thermodynamics in science, technology, and education
- develop a better theoretical understanding of thermodynamic properties
- encourage the measurement of thermodynamic properties of pure compounds and mixtures which have industrial importance and/or are of special academic interest
- improve experimental techniques in thermodynamics
- establish standards of excellence in the conduct of thermodynamic research and in its reporting in the scientific literature

IUPAC Conferences on Chemical Thermodynamics

A major responsibility for IACT is its involvement in the biennial IUPAC-sponsored International Conferences on Chemical Thermodynamics (ICCT). The next ICCT, which will take place 17–21 August 2004 in Beijing, China, will include symposia on electrolyte and non-electrolyte solution thermodynamics; new materials (including polymers); phase equilibria, supercritical fluids, and separation technologies; and surfactants, colloids, and interface science. A list of symposia and workshops and more information can be found at <www.ccs.ac.cn/ICCT2004.html>. The conference also features the Rossini Award and Lecture. The award is given by IACT for excellence in chemical thermodynamics.

Projects

One of IACT's principle goals is to encourage projects, particularly between different groups of thermodynamicists. Following are examples of recent projects (see IUPAC Web site for details):

- Vapour Liquid Critical Properties of Elements and Compounds (K.N. Marsh; 2000-026-1-100)
- Chemical Thermodynamics for Industry (T.M. Letcher; 2002-063-1-100) (see page 17)

- Recommended values for the viscosity of molten iron and aluminium (W.A. Wakeham; 2003-005-1-100)
- XML-Based IUPAC Standard for Thermodynamic Property Data Capture and Storage (M. Frenkel; 2002-055-3-024) (see page 17)

Membership

Membership in IACT is open to all qualified applicants. Members receive a discount in the registration fee for the ICCT, are sent announcements of meetings and reports from business meetings, and are eligible to vote for the Board of Directors.

For more information, contact J. H. Dymond <Johnd@chem.gla.ac.uk>, IACT secretary.

In August, the IUPAC Council also approved the applications of the **International Plasma Chemistry Society** and the **Southern and Eastern Africa Network of Analytical Chemists** for Associated Organization status.

Inquiries about becoming an Associated Organization of IUPAC should be directed to the executive director at <secretariat@iupac.org>.

 www.iupac.org/links/ao.html

Up for Discussion

Questionable Stereoformulas of Diastereomers

by Gerd Kaupp and M. Reza Naimi-Jamal

Wedge bonds are still in use for the characterization of relative configurations of asymmetric centers in racemic diastereomers (e.g., in *Angew. Chem. Int. Ed. Engl.* **2003**, *42*, 2550). Furthermore, there seems to be an increasing misuse of such formulas as eye-catchers in graphical abstracts, when the paper itself deals with achiral compounds or racemates, but not with absolute stereochemistry or enantioselectivity (e.g., *Angew. Chem. Int. Ed. Engl.* **2003**, *42*, 384; **2003**, *42*, 151; **2003**, *42*, 549 [does not deal with the usage of wedges in metal complexes]).

Our inquiry with journal editors points to a kind of desperate unwillingness to unify the usage of wedges

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Send your comments by e-mail to <edit.ci@iupac.org>.

for an unambiguous description of diastereomers. The violation of pertinent IUPAC recommendations prompts us to point out to the scientific community what we feel is a widespread bad habit and to urge an efficient remedy. Wedged and hatch-wedged bonds are excellent and unambiguous devices for the identification of absolute configurations in organic structural formulas. A chemical formula drawn in that manner is thus immediately attributed with *R/S*-descriptors by databases such as CAS/REG/SCIFINDER and stored for retrieval. There is no room for a debate that a structural formula must be correct by itself, irrespective of textural context or specifications (frequently it is not mentioned that a racemate was formed).

Indeed, the Beilstein database keeps with interpreting stereochemistry from the context of the formula or on its own judgment, adds and stores the word "racemate" if appropriate for its stereosearch

Up for Discussion

facility not in the field “absolute” but in the fields “relative” and “racemic.” However, the database adheres to the wedged formulas and this may be the reason for frequent data errors by embracing epimers under one and only one “racemate” (Scifinder also frequently does this), as can be experienced with examples from papers cited below.

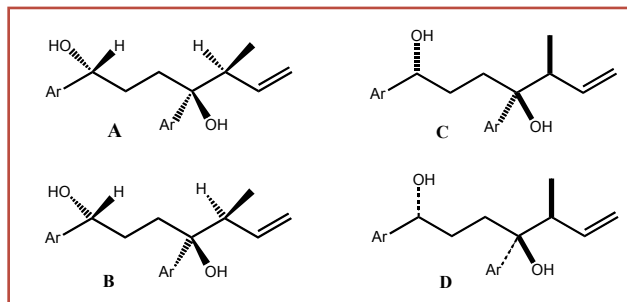
If an actual racemic diastereomer is published with one single-wedged formula (e.g., in *J. Am. Chem. Soc.* **2003**, 125, 158; *Eur. J. Chem.* **2003**, 1779; *Tetrahedron* **2003**, 59, 3769; Schemes 3-5 in *Angew. Chem.* **2003**, 42, 549), authoritative databases will at the end “pretend” absolute configurations and asymmetric syntheses. Still more disturbing is the reference of an unambiguous wedge formula to a single molecular structure image from an X-ray analysis under textual usage of starred *R*- and *S*-descriptors (e.g., [*2R**,*3R**,*4S**,*5R**] in *Angew. Chem. Int. Ed. Engl.* **1991**, 30, 420), which are stored in the CAS/REG/SCIFINDER databases with the descriptors (*2R,3R,4S,5R*) (with suffix or prefix “rel”). In review articles this unambiguously formulated enantiomer may then easily appear unlabeled (e.g., in *Chem. Rev.* **2000**, 100, 1025; on p.1048) and an absolute asymmetric synthesis is “pretended.” In that situation only the application of stereochemical principles and the analysis of the reported X-ray data can unambiguously reveal that in fact a racemate had formed and not only the depicted enantiomer. Numerous problems can be envisaged.

We therefore propose to face this widespread long-term nuisance and use wedged chemical formulas only for indicating absolute configuration. Thick and hatched (alternatively broken) bonds should be used for the representation of relative configurations in racemic diastereomers, as these, contrary to the

wedges, do not necessarily indicate an absolute orientation in space. They are therefore more suited for the characterization of racemates with only one formula. Enantiomers of diastereomers with known absolute configuration should always be drawn using wedges (e.g., different than the usage in *J. Am. Chem. Soc.* **2003**, 125, 3534). The automatic recording of configurations will then easily recognize the information “racemate” or “enantiomer.”

We wish to take the liberty to ask authors, referees, and editors to act accordingly in order to avoid further harm to our science. In the figure below, formula **A**, or even more distinct formula **B** (traditionally with exactly the same meaning), will then rightfully look like formula **C** (alternatively like formula **D**), if it is not the (*1R,4S,5S*)-enantiomer, but the racemate of this diastereomer.

We have noticed that some authors apparently feel



the same discomfort and already draw their formulas in the suggested manner (e.g., in *J. Am. Chem. Soc.* **2003**, 125, 761; *Eur. J. Chem.* **2003**, 1733; *Angew. Chem.* **2003**, 42, 694).

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Response from the IUPAC Chemical Nomenclature and Structure Representation Division (VIII)

Division VIII is well aware of the problem pointed out by Drs. Kaupp and Naimi-Jamal, and will be addressing it in the course of a substantial project on Graphical Representation Standards for Chemical Structure Diagrams currently under consideration. There are published IUPAC recommendations on the depiction of stereoformulae in “Basic Terminology of Stereochemistry” (*Pure Appl. Chem.*, **68**, 2193–2222 [1996]) and these will be reviewed and expanded as part of this new project.

The specific problem raised in the letter from Drs. Kaupp and Naimi-Jamal is addressed by some organisations, such as the World Health Organization, drawing the *R* isomer (i.e., the isomer with the *R* configuration at the lowest locant if there is more than one centre of chirality) and adding, where relevant, “or enantiomer” or “and enantiomer.” There is a difficulty with the proposal to restrict the use of “thick” and “hatched” bonds to represent relative configurations, in that the reader would have no means of recognizing that this convention was being used.

Alan McNaught <adm@rsc.org> is president of the IUPAC Chemical Nomenclature and Structure Representation Division.

XML-Based IUPAC Standard for Experimental and Critically Evaluated Thermodynamic Property Data Storage and Capture

IUPAC has approved a project to develop an XML-based IUPAC standard for thermodynamic data communications as one of the activities of the Committee on Printed and Electronic Publication. Thermophysical and thermochemical property data represent a key foundation for development and improvement of all chemical process technologies. These data are also critical for support of fundamental research in physics, chemistry, biology, and material science.

The unprecedented growth in the number of custom-designed software tools for various engineering applications has created an interoperability problem between the formats and the structures of the thermodynamic data files and required input/output structures of different software products. This problem is reflected in the extremely time- and resource-consuming efforts required to collect the data within a particular data management environment using numerous data sources of different types. Within the last 20 years this problem has become a major obstacle to developing efficient process-design software tools, requiring generation of extensive thermophysical and thermochemical property data packages. The major objective of this project is to provide a practical solution to the problem by establishing an international standard for thermophysical/thermochemical data storage and exchange.

A standardized XML-based dictionary will provide the most powerful, interoperability solution for interpretation and use of thermodynamic data. Such a dictionary has to be able to describe the complete set of thermophysical and thermochemical properties (more than 120), their uncertainties, and related metadata. XML (Extensible Markup Language) avoids common pitfalls in language design: it is extensible and platform-independent. Since XML files are essentially textual files, they can be easily analyzed without the use of specific customized software products and can be read by a variety of text editors. The XML-based structure will represent a balanced combination of hierarchical and relational elements. It will explicitly incorporate structural elements related to basic principles of phenomenological thermodynamics: thermochemical and thermophysical (equilibrium and transport) properties, state variables, system constraints, phases, and units. The structural features of

the metadata records will ensure unambiguous interpretation of numerical data as well as data-quality control based on the Gibbs Phase Rule. The developed dictionary will provide elements for storage and exchange of experimental, critically evaluated, and predicted data. The schema will have provisions for the expressions of various measures of the thermodynamic data uncertainties, such as standard uncertainty, combined standard uncertainty, combined expanded uncertainty, and different types of precision (e.g., repeatability, deviation from the fitted curve, or device specifications).

Establishment of the XML-based IUPAC standard will provide an easy-to-use and extremely efficient pipeline for transferring data from data producers to data users. The standard will serve as a hub tool and assure interoperability between various data management systems and operation platforms.

For more information, contact the Task Group Chairman Michael Frenkel <frenkel@boulder.nist.gov>.



www.iupac.org/projects/2002/2002-055-3-024.html

Chemical Thermodynamics for Industry

For over a century, chemical thermodynamics—the history of which stretches back 150 years—has been the foundation for much of chemistry. Despite this historical importance, there is an attitude among many chemists that thermodynamics has little relevance to modern day chemistry and will have little importance in the future development of chemistry. To counteract this view, the former IUPAC Commission on Chemical Thermodynamics, published in 1999 a volume entitled *Chemical Thermodynamics for the 21st Century*. It consisted of 27 chapters, all focusing on the applications of thermodynamics to very recent developments in chemistry. The aim was to highlight the role of thermodynamics at the forefront of chemical research.

In 2002, the International Association of Chemical Thermodynamics, the successor to the commission, decided to publish a collection of 25 essays on applied chemical thermodynamic topics. The aim of this publication is to highlight the role of thermodynamics in chemical industry and to show that it not only helps us understand the world we live in, but also

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helps to create a better world. Among the topics to be covered in the new volume are the following:

- multiphase thermodynamics
- reactive distillation
- thermodynamic properties from *ab initio* quantum chemistry
- molecular modeling
- properties of clathrates
- ionic liquids in separation processes
- calorimetry
- transport properties
- bioseparation
- nano-particles and nano-technology

The volume will be published in 2004 with the Royal Society of Chemistry (UK). The editor is Professor Trevor Letcher, who edited the previous volume (*Chemical Thermodynamics for the 21st Century*, 1999 [ISBN 0-632-05127-2], <www.iupac.org/publications/books/author/letcher.html>). The new collection is aimed at those working in this field as well as general chemists, prospective researchers, and those involved in funding chemical research.

For more information, contact the Task Group Chairman Trevor Letcher <letcher@nu.ac.za>.



www.iupac.org/projects/2002/2002-063-1-100.html

Pesticide Science—Harmonization of Data Requirements and Evaluation

The IUPAC Chemistry and the Environment Division has had a sustained interest in pesticide science. The recent IUPAC-Korean Society of Pesticide Science International Workshop on Pesticides was not only an integral project, but it was an occasion for reviewing other IUPAC projects in this field. In this article, Kenneth Racke reports on the workshop.

More than 300 scientists, government regulators, and industry leaders representing 28 countries gathered in Seoul, Korea, 13–15 October 2003, to participate in the IUPAC-Korean Society of Pesticide Science International Workshop on Pesticides 2003.¹ The theme of the workshop was “Harmonization of Data Requirements and Evaluation.”

The workshop was co-organized by the Korean

Society of Pesticide Science (KSPS) and the IUPAC Division of Chemistry and the Environment (DCE). Cosponsors included the Korea Rural Development Administration, Korea Institute of Toxicology, Korea Crop Protection Association, CropLife Asia, and several additional national organizations. Dr. Byung-Youl Oh, president of KSPS, coordinated local arrangements. IUPAC contributions were coordinated by Dr. Yong-Hwa Kim of the DCE and myself.

Participants in the workshop had the opportunity to attend 33 invited lectures and view approximately 100 posters. Main program topics included “Pesticide Regulatory Harmonization,” “Residue Behavior and Fate,” and “Risk Assessment and Management.” The program also included 12 IUPAC lecturers from the DCE Subcommittee on Crop Protection Chemistry, who highlighted the findings and recommendations of a number of recently concluded^{2,3,4} and ongoing^{5,6} IUPAC projects. Lectures were also presented by representatives of the Organisation for Economic Co-operation and Development (OECD), the



The workshop addressed pesticide residues on food.

Food and Agriculture Organization of the United Nations (FAO), the International Atomic Energy Agency, and Codex.

Topics addressed at the workshop were diverse and included research reports on chemistry investigations, establishment of standards (food, water), toxicity characterization, risk assessment (dietary intake, occupational exposure, and ecological impacts), pesticide evaluation schemes, risk indicators and risk reduction, and standard formats for submissions and reviews. It was clear that there is a need to concentrate efforts and resources toward activities with the greatest benefit to all stakeholders. Participants also noted that perhaps the greatest challenges to be surmounted involve legislative and political barriers. A final workshop discussion session highlighted a series of overall observations and future considerations, and these are briefly summarized below.

First, the high-quality **research and monitoring** activities occurring within Korea and the surrounding countries were discussed at the workshop session.

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The specific examples clearly employed state-of-the-art approaches toward studies dealing with environmental fate, worker exposure, and residue behavior. In addition, advanced residue monitoring techniques are being applied toward enforcement of regulatory standards for food commodities and water. The technical sophistication of the region was also evident from the more than one dozen research institutes and private contract laboratories that exhibited analytical equipment and advertised advanced testing services, including those conducted according to good laboratory practices. It was clear that continued pursuit of such advanced approaches should be encouraged, but it was also noted that developments must keep pace with rapidly advancing technologies and issues.

International Approaches and Standards

Speakers highlighted the IUPAC-sponsored projects on harmonized approaches to the establishment of regulatory standards for pesticide residues in water and for evaluation of dietary risk of pesticide residues in food.^{2,3} Also discussed were highly relevant international approaches, including the OECD harmonized testing guidelines and dossier structure, the FAO product specification process for active ingredient quality and impurity limits, and the Codex maximum residue limits for food commodities. It was noted that countries in the region would be well served by adopting such available approaches and standards where applicable to avoid redundant or barrier-creating efforts. In some instances, however, there is clearly a need for better communication on the part of the international organizations. It was noted, for example, that the Codex Alimentarius Commission is years behind in updating its Web-based database to reflect the most current MRL (maximum residue limits) standards for pesticide residues in food.

Pesticide Residues and MRLs

On one hand, monitoring information indicated a low overall rate of residue limit violations in the marketplace (e.g., 1–2% of samples analyzed). However, even such a low incidence can result in trade barriers within the region and with trading partners in North America and Europe. This is because national regulatory authorities are primarily focused on setting MRLs based on their own good agricultural practices (GAP), and typically give a relatively low priority to consideration of the GAP of current or potential trading partners. Minor crops are a major concern since many have no MRLs established nationally or in importing countries. The value of Codex

MRLs as internationally harmonized standards was highlighted and it was noted that national authorities should adopt or reference these whenever possible. A drawback at the moment is that, because of the slowness of the Codex system and heavy focus on reevaluation of older MRLs, the majority of crop and pesticide combinations have not yet had Codex MRLs established. Countries in the Asia-Pacific region were also encouraged to consider the GAP of trading partners when setting national MRLs. Finally, it was noted that a recently initiated IUPAC project regarding regulatory approaches for minor crops would offer future suggestions regarding practical approaches at the national and international levels.⁶

Cooperative Approaches to Research and Regulation

A key example of cooperative approaches was the centralized EU pesticide evaluation system. The system encourages the reduction of barriers and increases harmonization across countries, despite some inefficiencies and growing pains. Within the EU, the various FOCUS (Forum for the Coordination of Pesticide Models and Their Use) working groups offered a particularly striking model for cooperation between government, industry, and academia. During the past 10 years, such cooperation has resulted in significant advances in environmental assessment and fate modeling methods for pesticides. Also noted were the international efforts of FAO, WHO, and IUPAC in bringing together various stakeholders to address scientific and regulatory challenges related to pesticide evaluation. There appear to be opportunities within the Asia-Pacific region for an increased emphasis on cooperative approaches and work sharing. The recently initiated activities of the ASEAN working group on regulatory harmonization offered a glimmer of hope for the type of discussions that will be required.

Transparency and Risk Communication

It was noted that pesticides are one of the most widely and thoroughly tested chemical classes, and that they are generally safe when used responsibly according to label directions. However, all stakeholders in the manufacturer-user chain must combine their efforts to ensure that risks and precautions for workers involved in the application of pesticides are well communicated, particularly for users in developing countries. The extensive testing and regulatory evaluation underlying pesticide approvals is under-appreciated by the public. In addition, the considerable benefits of pesticide use are also often overlooked.

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The contributions of crop protection chemistry to world food production, human health protection, prevention of environmental degradation or natural area loss to cultivation, and economic return need to be better communicated to an often skeptical public and press. An example of a common misperception concerns the interpretation of MRLs as safety rather than trade and GAP-control standards.

A book of proceedings containing contributed papers was distributed to all participants. Slide presentations from the presented lectures are also being made available via CD-ROM. Also, some popular and trade publications will be publishing simplified summaries of key workshop presentations.

The IUPAC-KSPS workshop in Seoul was the fifth in a series organized by the DCE since 1988. Past workshops have been held in China, Thailand, Brazil, and Taiwan. Plans for an international workshop to be held in San Jose, Costa Rica, are now being finalized for 2005.⁷

For more information on these projects, contact Dr. Ken Racke <kracke@dow.com>, senior research scientist at Dow AgroSciences in Indianapolis, USA. Racke was chairman of the international organizing committee for the 2003 pesticide workshop and is now the incoming president of the IUPAC Division on Chemistry and the Environment.

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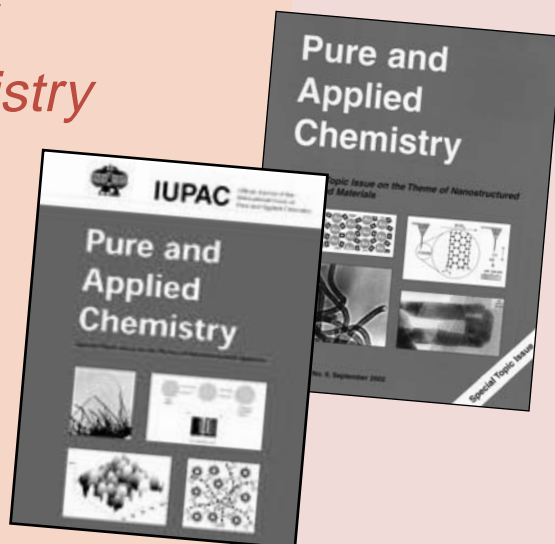
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Special Topic Issues of *Pure and Applied Chemistry*

The special topic issues of *Pure and Applied Chemistry* are comprised of research papers and short, critical reviews organized around a central, compelling theme. Recent issues have covered the following topics:

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- ◆ Green Chemistry
- ◆ Nanostructured Systems

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Properties and Units for Transfusion Medicine and Immunohematology

K. Varming, U. Forsum, I. Bruunshuus, and H. Olesen

Pure and Applied Chemistry

Vol. 75, No. 10, pp. 1477–1600 (2003)

Basic research in biology and medicine and innovations in laboratory methodology have increased greatly the range of properties available to medical staff to help them in decisions involving the diagnosis and prevention of disease and the treatment of patients. The plethora is now such that the individual doctor may have insight into or understanding of only a few of the properties offered to him from the various clinical laboratory specialties. Further, recent developments tend to blur the boundaries between the various disciplines of clinical laboratory sciences; the same properties are being reported differently in different disciplines.

The terminology used by one laboratory specialty may vary even within the specialty, and even be incomprehensible to another area. This is a minor inconvenience to the laboratory specialties, each being concerned essentially with its own area of activity. However, for the user, this is unsatisfactory and it may even hinder treatment of the patient.

To alleviate this problem, coding schemes combining a definition of a specific property with a particular code have been developed in the various specialties of the domain of clinical laboratory medicine. This allows the requester of analyses, and the producer and the receiver of the results, to express the concept as is most convenient locally.

Often the format of presentation is restricted by the number of signs allocated for this purpose in the database. For example, the definition "Blood (capillary Blood)-Glucose; substance concentration = ? mmol/l" is coded by NPU10113. A request for "Blood sugar" identified by the code NPU10113, may be reported back as "NPU10113: B(cB)-Glucose; subst.c. = 6,5 mmol/l" or "NPU10113: 6,5", and be registered in the patient file of a general practitioner as "NPU10113: Gluc. 6.5". The concept identified by "Erythrocytes(Blood)-Erythrocyte antigen; taxon(ABO;RhD; procedure) = ?" is coded by NPU01945. A request for "NPU01945 blood-typing" may elicit the report "NPU01945: Ercs(B)-Erythrocyte antigen; taxon(ABO; RhD; proc.) = A; RhD negative", and be registered in the patient file as "NPU01945: A; RhD negative".

Each of the clinical laboratory specialties adapts well to the general structure for presentation of properties and the adhering kinds-of-property. However, often a particular kind-of-property, not used in any other specialty, is required; for transfusion medicine and immunohaematology the kind-of-property "compatibility" is unique.

The coding scheme for clinical laboratories is operating in Denmark and in Sweden. It has shown both practicability and usefulness; it has eliminated a number of ambiguous presentation formats and it adapts well to electronic patient records.

This document is part of an ongoing effort to standardize transmission of laboratory data across cultural and linguistic domains, without attempting to standardize the routine language used by clinicians and laboratory practitioners. It comprises a general introduction and an alphabetic list of properties. The list is based on the syntax for properties recommended by the International Federation of Clinical Chemistry and Laboratory Medicine (IFCC) and IUPAC. The nomenclature is primarily from the Working Party on Terminology of the International Society of Blood Transfusion.

A manuscript on molecular biology has been finalized and is pending acceptance by IUPAC and IFCC. If it is accepted, the coding scheme covers clinical chemistry, with the exception of chromosome studies and the molecular biology of mitochondria. The scheme comprises some 35 000 entries, or sets of definition and code.



www.iupac.org/publications/pac/2003/7510/7510x1477.html

Implications of Endocrine Active Substances for Humans and Wildlife

A special topic issue edited by

J. Miyamoto and J. Burger

Pure and Applied Chemistry

Vol. 75, Nos. 11–12, pp. 1617–2615 (2003)

Understanding the scientific issues surrounding endocrine-active substances (EASs) is an international priority. Endocrine disruptors affect not only humans, but also other living organisms. They affect not only our generation, but also future generations. Though the adverse effects of endocrine disruptions (EDs) were noted as far back as 30 years ago, inten-

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sive studies of endocrine disruptors have only begun in the last decade. The present SCOPE/IUPAC project on endocrine active substances is the only project looking at these potentially harmful substances on a world-wide basis, with emphasis on the specific situation in each region.

An endocrine disruptor may be defined as “. . . an exogenous substance that causes adverse health effects in an intact organism, or its progeny, secondary to changes in endocrine function.” Simplified models exist that can be used to assess hazards and risks, but should be a priority to adjust these models as new insights on larger scales impact the accuracy and relevance of the basic methodologies.

In 1998, a committee involving representatives from IUPAC, IUTOX (International Union of Toxicology), and IUPHAR (International Union of Pharmacology) made recommendations in the “White Book” on endocrine disruptors. One recommendation was to establish a better understanding of the impact of particular chemicals on the environment, as well as a need for better screening, testing, and risk-assessment methods.

In the project Environmental Implications of Endocrine Active Substances: Present State-of-the-Art and Future Research needs, there were four focus areas: nuclear receptor mechanisms, fate and metabolism of EASs, effects in rodents and humans, and effects in wildlife species.

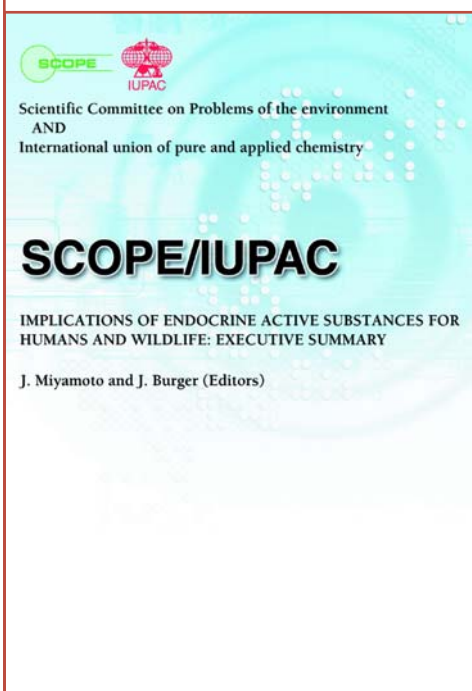
Recent studies have indicated that exposure of humans to EASs potentially can have many effects, ranging from abnormal maturation to cancer.

However, it is difficult to establish whether these conditions are caused by, related to, or in actuality, completely independent of EASs. Though several tests are designed to detect ED disease conditions, as some diseases are evident only after chronic exposure or long latency, it is necessary to revise testing techniques as scientists become more knowledgeable of cause-effect relationships. During the last decade, it is notable that there have been no conclusive findings of human disease caused by low-level environmental exposures to EASs.

In addition to humans, over 200 wildlife species either are known, or are suspected to have been, affected by EASs. Though most examples of ED in wildlife have been reported from Europe, North America, Japan, and Australasia, it is possible that this reflects the current global distribution of research efforts. Highly contaminated areas with significant human populations typically show the most significant effects on wildlife, but even lower levels of exposures to particular substances can occur in less-developed areas. The greatest exposure has been shown in aquatic life, but again, it is possible that this is due to the concentration of current investigations on this area.

The project culminated in a symposium held 17–21 November 2002 in Yokohama, Japan. Scientists, managers, and public policy-makers presented papers on human effects, wildlife effects, exposure assessment, and testing for EASs and ED effects. There were six workshops dealing with the effectiveness of QSAR toxicogenomics, integrated monitoring systems, rapid assays, precautionary principle/weight of evidence approaches, and risk management options for endocrine disruptors. Overall, 408 scientists gathered from 31 countries, giving 84 talks and contributing an additional 84 posters. The papers presented form the basis of this special issue of *Pure and Applied Chemistry* (Vol **75**, Nos 11/12, 2003). The issue also includes an executive summary edited by J. Miyamoto and J. Burger.

At the meeting, a range of needs was identified that applies to all aspects of the study of ED and EASs. The field of ED is rich in unexpected observations-consistent with evolving methodologies and the state of our understanding of the underlying biology of the endocrine systems. However, the science will be aided by a renewed commitment of researchers to



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follow the scientific method.

Assessing the exposure of living organisms means uncovering the sources, transport, and fate of EASs in environmental media through organism contact, bioavailability and absorption, and distribution to target tissues or receptors. The substantial literature on chemical exposure assessment, in general, may be applied to EASs. Long-term cryobanking of human and wildlife specimens will allow for retrospective evaluation when new priorities arise. By sampling indicator species and measuring biomarkers, researchers should have advance warning of problems. Sustained programs for monitoring EASs—that emphasize substances of high-potency and high-exposure potential that may pose a real risk for humans or the environment—require sustained investment and public support.

It is important to note that *in vitro* tests, alone, cannot be used to define ED activity, as no endocrine system is being monitored. To uncover whether an EAS will show ED activities, it is necessary to use assays based on a whole organism. Uncertainty regarding whether some EASs may possess the ability to induce effects at doses below those considered safe using current testing methodologies should be evaluated urgently and resolved.

In all areas of study, there may be sensitive subgroups of exposed individuals that may show much greater responses than the majority. This could lead to a loss of information if this potential is not recognized. It is therefore important to obtain better statistical methods for detecting such effects, which may be obscured by population-based, parametric statistical analysis alone.

Methodologies need to be developed to improve quantitation and understanding of both the certainties and the uncertainties associated with extrapolating experimental animal data, derived from multiple studies using different endpoints, to effects expected at ambient levels of environmental exposure.

Consensus on definitions and applications of the *precautionary principle* and the *weight of evidence approach* should be sought. At present, these two concepts compete for attention and are subject to a range of definitions. The precautionary principle also allows action when the probability of an adverse effect may be low, but consequences are considered large and/or irreversible, and the cost of preventive

action is acceptable to society. Some believe that this represents action when a hazard should exist, but is not necessarily evidenced; others believe it to indicate the evidence is overwhelming, but ultimate proof does not exist. Meanwhile, the weight of evidence approach is regarded by some as a numerical averaging of positive and negative data sets, while others regard it as an expert integration of all available data (which may include the explicit consideration of clear but isolated findings).

Because screening assays provide qualitatively different information than definitive tests, the results from these dissimilar assays should be used in a manner that is consistent with the scientific basis and purpose of each. To advance our understanding of the relative merits and disadvantages of these different approaches to risk management, it is essential to examine some examples of actions that have been taken on EASs, compare the different outcomes, and decide which are preferable.

Scientific gaps and uncertainties remain large, and will continue for some time. However, the in-depth, comprehensive, authoritative review by SCOPE and IUPAC of EASs and their environmental and health effects will facilitate risk assessment and assist governmental and intergovernmental authorities, industry, and the wider public in framing policies to address these issues.

What is the future of research in EASs and EDs? While past and present research and techniques are useful, the methods and approaches must be continuously modified and perfected to incorporate new discoveries. We have learned that the global effects attributed to EASs are not as all pervading or fearsome as some have asserted, nor as trivial as others would wish. The beauty of science is that “more research is always needed,” and our quest for understanding the world around us is boundless. However, the most important question regarding ED is: What are the significant effects of EASs in terms of health, well-being, and population stability of humans and wildlife? As humans continue to evolve, so will the study of endocrine-active substances.



www.iupac.org/publications/pac/2003/7511/

www.iupac.org/news/archives/2003/pr-031030.html

Physicochemical Kinetics and Transport at Biointerfaces

Wolfgang Koester and H. P. van Leeuwen (editors)
Series on Analytical and Physical Chemistry of Environmental Systems, Vol. 9
John Wiley & Sons, 2004
ISBN 0-471-49845-9

The IUPAC *Series on Analytical and Physical Chemistry of Environmental Systems* provides a critical evaluation of state-of-the-art knowledge on physicochemical properties and processes in environmental systems, as well as on the analytical techniques required to study and monitor them. The series is aimed at promoting rigorous analysis and understanding of physicochemical functioning of environmental and bioenvironmental systems.

The effects and fate of organic and inorganic materials in environmental systems are determined by their distribution and transport within and between biotic and abiotic reservoirs. Development of mechanistic models to describe these processes requires an integrated approach with functional links between the various modes of transport of bioactive chemical species and the biophysical processes to which they are subjected. Until now, much of the key knowledge

in this area has been dispersed over several rather poorly interacting disciplines. This timely book integrates these activities and highlights key directions for future research.

The book focuses on the physicochemical kinetics of processes in the interphasial region between organisms and their external medium, and coupling of these processes with the mass transfer of the chemical species involved. Specialized subtopics encompass:

- structure and permeative properties of biomembranes and their aqueous interfacial layers
- diffusive and convective processes at the biointerface
- routes for transport of chemical compounds across membranes
- biological chemistry of organisms

Physicochemical Kinetics and Transport at Biointerfaces will be a valuable resource for researchers and students interested in understanding the fundamentals of chemical kinetics and transport processes in bioenvironmental systems. The content is required reading for chemists, physicists, and biologists in environmentally oriented disciplines.

 www.iupac.org/publications/books/author/koester.html

Biodegradable Polymers & Plastics

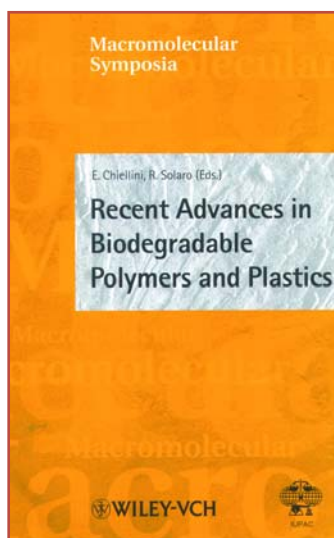
Emo Chiellini and Roberto Solaro (editors)
Macromolecular Symposia, Vol. 197
Wiley-VCH, 2003, pp. 1-466
ISBN 3-527-30701-x

Demand for plastic consumer products is expected to double or triple over the coming decades, which will increase concern about the environmental impact of plastic waste. Environmentally degradable polymeric materials and plastics based on renewable resources, as well as on crude oil feedstock, are attracting more and more interest from plastic manufacturers and consumers. These materials have structural and functional attributes that nicely match the current emphasis on sustainable industrial development.

With these developments in mind, the 7th World

Conference on Biodegradable Polymers & Plastics (7th BP&P) was held 4-8 June 2002 in Tirrenia, Pisa (Italy). The conference is a continuation of the former series of six International Scientific Workshops on Biodegradable Polymers and Plastics that started in 1989. The conference was aimed at highlighting progress in the field and exploring new issues relevant to the design and production of polymeric materials that can be converted into environmentally degradable plastic items.

The present issue of *Macromolecular Symposia* comprises some of the selected contributions presented at the 7th BP&P. Remaining contributions constitute the body of the book *Biodegradable Polymers & Plastics* published by Kluwer Academic/Plenum Press.



 www.iupac.org/publications/macro/2003/197_preface.html

Chemicals in Products: Safeguarding the Environment and Human Health

Royal Commission on Environmental Pollution
TSO (The Stationery Office), London, 2003
ISBN 0-10-158272-2

Following is an abridged version of a much longer review that may be read on IUPAC's Web site at <www.iupac.org/publications/ci/2004/2601/bw3_duffus.html>

reviewed by John Duffus

This report carries with it a great deal of authority because it was produced by the Royal Commission on Environmental Pollution (RCEP). The RCEP is an independent standing body in the United Kingdom, established in 1970 to advise Queen Elizabeth II, government, Parliament, and the public on environmental issues. The commission sees its role as reviewing and anticipating trends and developments in environmental policies, identifying fields where insufficient attention is being given to problems, and recommending action that should be taken. The members of the RCEP are drawn from a variety of backgrounds in academia, industry and public life. Members serve part-time and as individuals, not as representatives of organizations or professions.

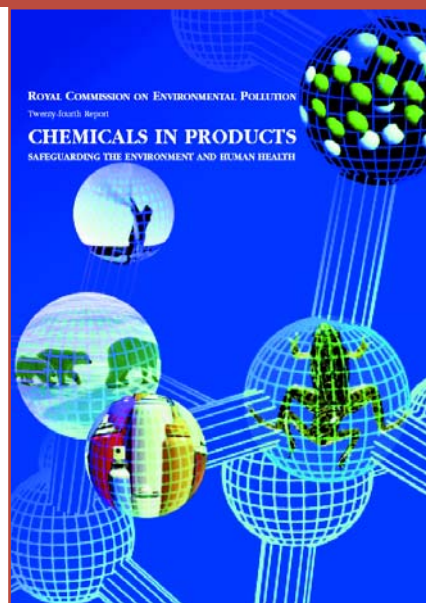
The findings and recommendations from a commission study are published in a report such as the one being reviewed here. Aimed at a general readership, the commission's reports are written so that no particular scientific or other expertise is needed to understand them. Most commission recommendations are addressed to U.K. government departments, and a U.K. government response to a commission report is prepared and published by one or more of the relevant U.K. government departments. The parliament is informed of the government response, usually a detailed paper setting out the government's decision on each recommendation.

The present report starts from the premise that "after more than a century of chemicals production, and decades of legislation attempting to deliver environmental safety from these chemicals, we still do not have a good understanding of the fate and effects of chemicals in the environment." The RCEP believes that "only a substantial paradigm shift will allow a start to be made to rectify this situation, and . . . that such a

start needs to be made now." Hence, the objective of the report is to offer a new approach to chemicals assessment and management. A major question for the reviewer is therefore whether this objective has been attained. A question which puzzles the reviewer, and for which no answer is given in the report, is

why the Royal Commission changed its focus from "Study on Long-Term Effects of Chemicals in the Environment," the original title (see Appendix A), to "Chemicals in Products: Safeguarding the Environment and Human Health." Personally, I should have found the originally proposed study more valuable than the present report and I regret that it was not pursued.

The first important point to make about this report is that it focuses on manmade synthetic organic chemicals. In doing this, it effectively ignores inorganic chemicals and even naturally occurring organic chemicals. This self-imposed limitation may be realistic in that it simplifies the problem faced by the Commission, but it is unrealistic in that it ignores the fact that environmental exposure to potentially toxic substances is not compartmentalized into synthetic or natural, organic or inorganic, air or water, soil or sediment, food or pharmaceutical etc. The ultimate logical objective of chemical safety regulation, however difficult to attain, ought to be broadbased regulation of exposure to all potentially toxic substances, of whatever kind and within all environmental media. To reach this objective requires bringing together existing piecemeal legislation within a single harmonized legislative approach. There are many practical reasons why this cannot be achieved easily but it ought to be the long-term objective of both regulators and scientists.



www.rcep.org.uk/chreport.html

www.iupac.org/publications/ci/2004/2601/bw3_duffus.html

Bookworm

On the Practice of Safety, Third Edition

Fred A. Manuele
Wiley Interscience, Hoboken, NJ, 2003
ISBN 0-471-27275-2

reviewed by John Duffus

This book is already well established through its previous editions as a classic text for baccalaureate and master's degree safety programs. However, I come to it as someone who has never read it before and so can review it as though I were a new student to whom it had been recommended. My first impression was of a textbook that looked dated in layout and, when compared with most modern textbooks, was not very welcoming. This is a pity because the book is a distillation of many years of experience by the author, thoughtfully reviewed and carefully analyzed. Many of his statements remain in the mind after reading: "safety is culture driven," "finance is the language of management," and "safety is freedom from unacceptable risk."

From my personal point of view as a toxicologist, I find it difficult to understand how a book on safety can define a curriculum for the safety professional (Chapter 5), which omits toxicology. In fact, I don't think the subject is mentioned anywhere in the book. This is particularly surprising in a book which considers risk assessment and management very thoroughly. Assessing risk of chemical exposure is often a major part of the risk assessment process.

In spite of the above reservation, I think that some parts of this book could well be prescribed as compulsory reading for safety professionals. Chapter 17, "Guidelines: Designing for Safety," and Chapter 18, "System Safety: the Concept," fall into this category. The relationship of "quality management" to "safety practice" is another important concept developed here.

Although I found this book, as one might expect, very much based on practice in the USA, I was pleased to find attention drawn to the ILO/OSH Guidelines on Occupational Safety and Health Management, which are available on the Web for download at <www.ilo.org/public/english/protection/safework/cops/english/download/e000013.pdf>.

The final discussion of the nature of a safety audit and the guiding thoughts derived by the author from his lifetime experience again should be essential reading for all those concerned with safety.

Having started to read this book with a little reluctance because its layout and appearance were somewhat off putting, I finished reading it with an admiration for the way in which the author had distilled wisdom from his lifetime involvement in practical safety management. This is a book to be read now for its educational value and also to be kept on the shelf for easy future reference. If only it said a bit more about my own area of expertise in toxicology, I should have little to find wrong with it!

 www.wiley.com/WileyCDA/WileyTitle/productCd-0471272752.htm

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Conference Call

Bioinorganic Chemistry

by Stephen J. Lippard

The Santa María Workshop, organized by the University of Havana and the Cuban Chemical Society, took place 7–11 July 2003 in Havana, Cuba. This event takes place every year, during the first half of July. In the even years it is devoted to supramolecular chemistry and during the odd ones to bioinorganic chemistry. Prof. Roberto Cao, chairman of the workshop, and his laboratory of bioinorganic chemistry were mainly responsible for organizing the conference.

The workshop takes its name from the marvelous beach Santa María del Mar, which is located 20 km east of Old Havana. Such a location guarantees a quiet and pleasant environment. The first day of activities occurs at the University of Havana, with the opening ceremony at its Aula Magna, a beautiful neo-classic building.

Five main topics were covered in the workshop: metal interactions with DNA and nucleotides, metalloporphyrins, copper compounds, metal nitrosyls, and the influence of genomics on bioinorganic chemistry.

Prof. Stephen Lippard (MIT, USA) presented the opening address, an excellent overview on cisplatin, a topic on which he is a world leader. Another view of metal-DNA interactions was given by Prof. Helmut Sigel (U. Basel, Switzerland) in his plenary lecture on "Adenosine 5'-triphosphate (ATP4-): Aspects of the Coordination Chemistry of a Multi-Talented Biological Substrate."

Prof. Ivano Bertini, in his plenary lecture on "Perspectives in Inorganic Structural Biology," discussed how genomics is influencing further development of bioinorganic chemistry. Dr. Kirill Degtyarenko (European Bioinformatics Institute, UK) complemented Bertini's considerations on genomics in his invited lecture "The Ontology of Bioinorganic Proteins." Dr. Roberta Pierattelli also discussed this topic (Univ. Florence, Italy) in her invited lecture entitled "Perspectives in NMR of Paramagnetic Copper Proteins." Prof. Gianni Valensin (Univ. Siena, Italy) presented his invited lecture on "1H-NMR Studies of Copper(II) Complexes with Histidine-Containing Peptides."

Studies of metalloporphyrins were presented by Prof. Jonathan L. Sessler (Univ. Texas at Austin, USA),

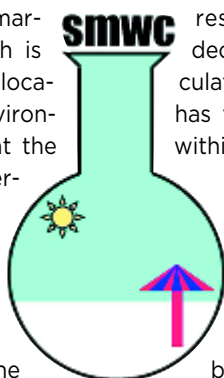
who discussed results achieved at the University of Texas and Pharmacyclics, Inc., on lanthanide(III) texaphyrins (Tex), a family of expanded porphyrins containing five nitrogen donor atoms.

NiF₄₃₀, a nickel tetrahydrocorphinoid cofactor of methyl-coenzyme M reductase (MCR), was analyzed in two invited lectures from different points of view. Prof. Joshua Telser (Roosevelt Univ., USA) drew attention to variation in oxidation states of nickel according to EPR and ENDOR studies. He concluded that Ni(I) is the formal oxidation state of red1, ox1 and ox2 forms of MCR. On the other hand, Prof. Mark Zimmer (Connecticut College, USA) presented his results on the normal-coordinate structural decomposition, cluster analysis, and molecular calculations on NiF₄₃₀. He explained how this cofactor has very little rotational and translational freedom within MCR.

Prof. Peter Ford (Univ. California at Santa Barbara, USA) presented a plenary lecture entitled "Probing Fundamental Mechanisms of Nitric Oxide Reactions with Metal Centers and Other Biologically Relevant Targets." Attention was also drawn to nitrosyl complexes by Prof. Roberto Cao (Univ. Havana, Cuba) in his invited lecture "Copper(II) Complexes as Inorganic Radical Scavengers." His coworker, Dr. Alicia Díaz gave more detailed information about this study, while Mayreli Ortiz described Ru(II) nitrosyl complexes. Finally, Dr. Alex Frago presented his results on Cu(II) cyclodextrin derivative complexes as SOD mimics. Prof. Wolfgang Kaim (Univ. Stuttgart, Germany) presented an interesting plenary lecture entitled "Cooperation of Metals with Electroactive Ligands of Biochemical Relevance: Beyond Metalloporphyrins."

The last presentation of the workshop was the invited lecture of Prof. Lena Ruiz (UNAM, Mexico) entitled "New Anticancer Mixed Chelate Copper(II) Complexes (Casiopeinas): Activity, QSAR, and Adenine Interaction." She presented information about the chemical and biological properties of copper(II) complexes of general formulae [Cu(N-N)(O-O)]NO₃, registered in Mexico under the name of "Casiopeinas."

On 9 July, a poster session was held featuring 15 posters from Cuban, Mexican, and Portuguese researchers. The closing dinner took place at "La Cabaña," a 17th century Spanish fortress in which the traditional "Cañonazo" (gunshot) activity takes place every day at 9 PM.



Conference Call

The next workshop, III SMWC, will take place 12–15 July 2004. The lecturers who have already confirmed are Angela Danil de Namor (U. Surrey), Javier de Mendoza (U. Auton. Madrid), A.P. de Silva (Queens U.), Luis Echegoyen (Clemson U.), Achim Müller (U. Bielefeld), Vincent Pecoraro (U. Michigan), Jozsef Szejtli (Cyclolab), and Fritz Voegtle (U. Bonn).

Stephen Lippard <lippard@lippard.mit.edu> is a professor in the Department of Chemistry at the Massachusetts Institute of Technology and is conference editor for the 2nd Santa Maria Workshop.

Macromolecules

by Jaroslav Kriz

An interesting international conference on the **Spectroscopy of Partially Ordered Macromolecular Systems** was held 21–24 July 2003 in Prague, Czech Republic. It was organized, under the auspices of IUPAC, by the Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic as the 22nd of its annual discussion conferences on macromolecules. The program reflected increasing scientific interest in ordered systems in the fields of synthetic and natural macromolecules. Although its main scope is local and targeted on details of structure and its dynamics, molecular spectroscopy can and must deal with order on the semi-local or even larger scale. Nuclear magnetic resonance and vibrational (infrared and Raman) spectroscopy offer effective, and in a certain sense complementary, research tools in this field. This was clearly demonstrated by a number of leading scientists from Europe, the USA, and Japan who mostly presented inventive modifications of these methods.

Lectures covered both liquid and solid-state magnetic resonance spectroscopy. Christian Griesinger (Germany) presented an ingenious study of protein dynamics using dipolar couplings and cross-relaxation in various alignment media. Jacob Shaefer (USA) showed quite new applications of his REDOR technique in the investigation of local order in polycarbonate glasses. Isao Ando (Japan) demonstrated how a pulsed field-gradient NMR could be used to study the quite slow diffusion of rod-like polypeptides in a liquid-crystalline phase. Horst Schneider (Germany) investigated another aspect of liquid crystals: inspect-

ing the main-chain orientation in siloxane polymers with liquid-crystalline side-chains by an original use of ^{29}Si solid-state NMR. Daniel Canet (France) presented an ingenious and original NMR imaging technique using electromagnetic field gradients, which has the potential for widespread application. Interesting shorter contributions were presented by G. Jeschke (study of polymer dynamics using EPR) and I. Schnell (merging liquid and solid state NMR methods in the study of supramolecular systems), both of whom are from Germany. J. Kriz (Czech Republic) used multi-nuclear, multi-quantum NMR to study order in poly-electrolytes. Yu. Gotlib and V. Toshchevnikov (both from Russia) devised theoretical methods to correlate dynamics with NMR relaxation in ordered systems.

In the field of vibrational spectra, Tim Keiderling (USA) elucidated deep connections between dichroism in electronic and infrared regions and infrared absorption or emission, usable for conformational and order studies of polypeptides. Liliane Bokobza (France) showed how FT infrared dichroism could be used in an effective study of molecular orientation in elastomeric networks. In a stimulating lecture, Heinz Siesler (Germany) presented a number of time-resolved mid-infrared and near-infrared techniques showing structural changes in solid polymers under external perturbations. Combining FT Raman spectroscopy with wide-angle X-ray diffraction, Yukihiko Ozaki (Japan) demonstrated relative order in some polymer blends. Michel Pezolet (Canada) demonstrated rather astonishing possibilities of polarization-modulated FT infrared spectroscopy in the study of polymer order, even in such subtle objects like spider silk. In shorter lectures, V. G. Gregoriou (Greece) tackled conformation changes in a polymer induced by stress or heating using both Raman and FT-IR. A study of polypeptide multi-layers by dichroic ATR-FTIR technique was presented by M. Mueller (Germany). H. Sato (Japan) presented a combined FTIR and WAXS study of a biodegradable polymer. An ingenious study of surface polymer layers by FTIR was presented by E. N. Vlasova (Russia).

The main and special lectures were further accompanied by a number of well-prepared and interesting posters. As a special feature, a panel discussion—moderated by C. Griesinger and T. Keiderling—was held on the complementary advantages of NMR and vibrational spectroscopy. In a lively discussion, the participants agreed that the time window of the respective methods gives the infrared spectroscopy

Conference Call

access to more immediate view of the objects, while NMR reflects a more time-averaged state. Also, more collective features of the system are naturally reflected by the infrared, while NMR has a typically local view. However, the participants rather disagreed when trying to decide if this difference leads to a serious limitation of any of the discussed methods. Apparently, both branches of spectroscopy keep developing various sophisticated modifications in striving to overcome their limitations. The discussion ended in a refreshing atmosphere of general optimism based on a number of rather astonishing examples of steadily improving sensitivity and performance of both types of spectroscopy.

The 23rd Discussion Conference, Current Trends in Polymeric Materials, will be held in Prague in July 2005.

Jaroslav Kriz <kriz@imc.cas.cz>, chairman of the 22nd Discussion Conference, is the head of the Department of Structure Analysis at the Institute of Macromolecular Chemistry of the Academy of Sciences of the Czech Republic, Prague.

Spectroscopy

by Carmen Cámara and Luis Fermín Capitán-Vallvey

The **Colloquium Spectroscopicum Internationale (CSI XXXIII)** took place in Granada (Spain), from 7–12 September 2003. The conference was co-chaired by Profs. Alfredo Sanz-Medel (Oviedo University) and Javier Laserna (Málaga University).

About 514 participants from 40 different countries attended the event. After Spain (with about 200 participants), the countries with the highest representation were Germany (39 participants), the United States (29 participants), and Japan (21 attendees). The contributions (504) were presented in 97 lectures and 407 posters. In addition to the above-mentioned countries, Turkey and Brazil contributed significantly to the CSI with posters.

More than 30 internationally recognized scientists from the different fields of spectroscopy delivered plenary and invited lectures in different simultaneous sessions devoted to most of the branches of molecular and atomic spectroscopy.

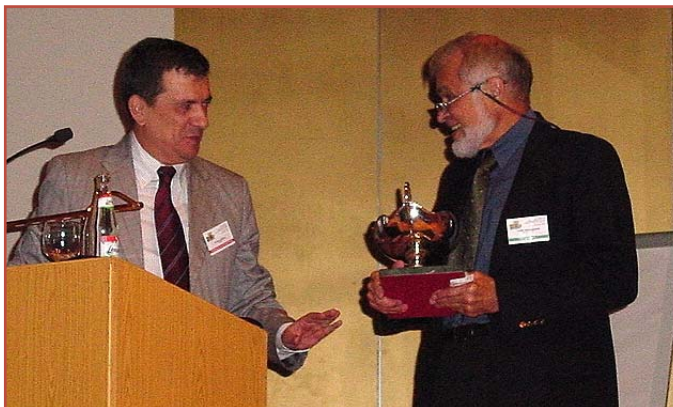
A special additional feature of the conference was the presentation of five “Hot Topics” sessions covering

some of the cutting-edge trends in applied spectroscopy. The sessions, which were organized by well-known experts in each Hot Topic, had a total length of about three and a half hours. The session titles, followed by the names of each organizer, are listed below:

- “Trace Analysis and Microanalysis with Lasers: Still the Ultimate Choice?”; Nicolo Omenetto (USA)
- “Modern Applications of NMR to the Study of the Structure, Dynamics, and Interactions of Biomolecules”; Jesús Jiménez Barbero (Spain)
- “Miniaturization, Chips, and Microfluidics for Chemical Analysis”; Andreas Manz (UK)
- “Mass Spectrometry in the Post-Genomic Era: Proteomics”; Ryszard Lobinski (France)
- “Chemical Imaging”; Renato Zenobi (Switzerland)

The CSI XXXIII award was given to Prof. Jim D. Winefordner (University of Florida, USA), “for pioneering work in developing analytical atomic and molecular optical spectroscopy from empirical approaches to fundamental physical approaches and for his contributions to the progress of spectrochemical analysis.” Prof. Winefordner received the award from Prof. J. Laserna in a special session, during which Ben Smith presented a history of Winefordner’s laboratory.

The conference also included an instrument exhibition featuring 14 instrument manufacturers and 3 spectroscopic publishers. The exhibition offered an opportunity for people from industry and academia to interact closely, exchanging ideas and experiences. Additionally a highly successful vendor session, chaired and organized by Dr. J. Brenner, was specially arranged for the conference. This workshop high-



Prof. J. Winefordner receiving the CSI XXXIII award from Prof. Javier Laserna

Conference Call

lighted technical-scientific presentations given by experts from different instrument manufacturers. The aim of the session was to demonstrate the current status of commercial instrumentation and accessories in spectroscopy and to provide conference participants with the opportunity to discuss current specifications and performance. The high number of attendees surpassed the organization's expectation.

Before the CSI Conference in Granada, a pre-symposium took place in Zaragoza on "Sample Introduction in Atomic Spectrometry: New Strategies," chaired by Prof. J. R. Castillo (Zaragoza University). In addition, a post-symposium was held in Almuñécar (Granada), on "Speciation of Elements in Biological, Environmental and Toxicological Sciences," chaired by J. I. García-Alonso (Oviedo University).

During the CSI Conference in Granada, the CSI Continuation Committee organized a National Delegates' Meeting. One of the most important items on the agenda was the decision regarding the venue for CSI XXXV in 2007. Two bids were received (China and Hungary), and after voting (attendees from 30 countries participated in the meeting), it was decided that China would host the CSI XXXV in 2007.

The local organizing committee did an outstanding job of carefully designing an attractive and successful social program. A night visit to the wonderful Alhambra, the premier season concert of the Symphonic Orchestra of Granada, and a friendly



The CSI XXXIII poster session featured 407 posters.

reception at the rector's office of the university were the most notable events. The gala dinner served as an excellent end to this outstanding conference.

Finally, four poster awards sponsored by the *Journal of Analytical and Bioanalytical Spectrometry*, the *Journal of Analytical and Atomic Spectrometry*, and the Thermo Electron Corporation (Spain) were given to presentations of significant, innovative analytical research in analytical spectrometry.

The CSI XXXIV will be held in Antwerp, Belgium, 4–9 September 2005, at the University of Antwerp <www.csixxiv.ua.ac.be>.

Dr. Carmen Cámara <ccamara@eucmax.sim.ucm.es>, a full professor of analytical chemistry at the University of Madrid, was a member of the organizing committee of the CSI colloquium. Dr. Luis Fermín Capitán-Vallvey <lcapitan@ugr.es>, full professor of analytical chemistry at the University of Granada, was a member of the organizing committee of the CSI colloquium.

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Where 2B&Y

Sample Handling

18–21 April 2004, Baiona-Vigo, Spain

The **11th Symposium on Sample Handling for Environmental and Biological Analysis** will be held 18–21 April 2004 in Baiona-Vigo (Northwest Spain). The symposium will cover all qualitative and quantitative areas of this field, including technical developments, theoretical considerations, and applications of the techniques in environmental, biological, pharmaceutical analysis, and other related areas.

This successful series, sponsored by the International Association of Environmental Analytical Chemistry (IAEAC), started in November 1983, in Lausanne, Switzerland. It was subsequently held in Freiburg, Germany (1985); Mallorca, Spain (1986); Basel, Switzerland (1988); Baden-Baden, Germany (1991); Guilford, Great Britain (1993); Lund, Sweden (1995); Almeria, Spain (1997); Porto, Portugal (1999); and in Mainz, Germany (2001).

All topics will be introduced in plenary lectures and invited research lectures, which will then be followed by brief research presentations and posters. A special session will be devoted to analytical approaches to

evaluating the impact of the “Prestige” oil spill through environmental and marine biological samples from the Galician Coast. Sampling of future oil spills will also be discussed. Topics of the special session will include marine and coastal pollution, wastewater analysis, micro and nanotechnology in sample handling, and new analytical developments, including biochemical, immunochemical approaches, and Proteomics.

Baiona is a fishing town considered a Gem of Galician Tourism, located 20 km from Vigo, the biggest and most populous city of Galicia (also the most active fishing port in Europe). Baiona is about 100 km from Porto, Portugal, and a similar distance from Santiago de Compostela. The symposium will be held at the “Parador Conde de Gondomar,” an enchanting Middle Age’s fortress that has been recently restored.

Registration is available at a reduced rate until 15 February. The appropriate forms may be downloaded via the conference Web site.

 www.iaec.ch

Bio-interfaces

23–26 May 2004, Barossa Valley, South Australia

The **Physical Chemistry of Bio-interfaces Workshop** will be held immediately following the 7th World Biomaterials Congress (17–21 May 2004, Sydney, Australia). This satellite workshop will focus on providing fundamental mechanistic insights into bio-interfaces using physico-chemical methods. The workshop format will allow for in-depth discussions on topics such as interfacial forces and properties involved in protein/surface interactions, non-fouling surfaces, molecular kinetics of drug delivery, and more.

This meeting will also provide an interdisciplinary forum for the presentation and discussion of experimental and theoretical studies of bio-interfaces and biomolecule-surface interactions. Increased understanding of interactions between biomolecules and

surfaces, the behavior of complex macromolecular systems at materials interfaces, and biomolecule-biomolecule interactions will contribute to the rapid growth in biomedical research, biotechnology, diagnostics, proteomics, genomics, dentistry, and medicine. Advances in materials science, molecular biology, surface and interface analysis methods, and theoretical and modeling approaches to biological systems will be featured in this workshop, as well as experimental tools and theoretical models to describe bio-interface phenomena with physical concepts and rules that allow predictive, model-driven research.

Invited and contributed talks will be selected for their ability to advance fundamental understanding of the topic, relevant to biomaterials, bio-diagnostics, and drug delivery applications.

See Calendar on page 36 for contact information

 www.iwri.unisa.edu.au/conferences.htm

Where 2B & Y

Latin American Congress

30 May–2 June 2004, Salvador, Bahia

The **26th Latin American Chemistry Congress** and the **27th Annual Meeting of the Brazilian Chemical Society (XXVICIAQ/27thRASBQ)**, organized by the Latin American Federation of Chemical Societies and the Brazilian Chemical Society, will be held 30 May to 2 June 2004 in Salvador, Bahia. The Latin American Chemistry Congress has been held in Brazil twice, in 1937 and 1984, since its inaugural meeting in 1924. The program for this joint 2004 Congress will include 26 plenary lectures, 18 symposiums, 3 workshops, and 13 short courses.

The Brazilian Chemistry Society (SBQ) has consolidated and become an important force within the country. There are now 41 graduate programs distributed throughout the country, with approximately 400 masters' dissertations and 300 doctorate theses defended each year (as of 2001). Scientific production also has increased. In 1984 approximately 800 articles

were published; in 2001, this number increased to more than 1900. Annual meetings of the SBQ involve approximately 2500 participants who present, on average, 1800 posters based on new research results. The SBQ co-edits a series of text books and publishes three scientific journals: *The Journal of the Brazilian Chemical Society* (in English), *Química Nova*, and *Química Nova na Escola* (both in Portuguese).

It is estimated that more than 2000 abstracts will be submitted for refereeing for this meeting; all accepted abstracts will be presented as posters. Symposia will have the format of coordinated sessions devoted to specific topics; some abstracts will be selected for presentation at symposia. The SBQ will continue to support the participation of undergraduate students who are members of SBQ through grants, which will be distributed according to the scientific merit of the work as evaluated by the Scientific Commission. Registration and submission of abstracts will be carried out online through the conference Web site.

 www.sbcqclaq.s bq.org.br

π -Electron Systems

14–18 June 2004, Ithaca, NY, USA

The **Sixth International Symposium on Functional π -Electron Systems** will bring together chemists, physicists, biologists, and engineers to discuss recent developments in the field of π -conjugated materials.

This symposium series began in 1989 in Osaka, Japan, as the "International Symposium on Functional Dyes." Past symposia were held in Kobe (Japan, 1992), Santa Cruz (California, 1995), Osaka (Japan, 1999) and Ulm (Germany, 2002). The name of the symposium changed several years ago to reflect its broadened scope and align it with recent developments in academic, industrial and government research institutions.

The π series is a unique forum for the discussion of structure-properties relationships in π -conjugated materials. Over 600 scientists from 29 nations attended the previous symposium in Ulm. The technical program will include 5 keynote lectures, 35 plenary lectures, 60 invited and contributed oral presentations and 3 extensive poster sessions. Papers are solicited on the following topics:

- synthesis of functional π -electron materials (molecular, polymeric, other)
- processing techniques
- structure (bulk, surface/interface)

- properties (electrical, optical, biological, mechanical, other)
- applications (electroluminescent devices, photovoltaic cells, transistors, non-linear optics, sensors, other)

Located in the Finger Lakes region, Ithaca will provide an ideal setting for this meeting. The region features a multitude of scenic gorges, state parks, and award-winning wineries. Combining the best of rural and urban life, Ithaca was voted one of the top 10 best places for families to live in the USA. The state-of-the-art lecture halls of the Cornell campus, the availability of dormitory rooms (in addition to regular hotel rooms) within walking distance of the conference, and easy access to Internet and exercise facilities will add to the quality of the meeting. The proximity to companies such as Xerox, Kodak, IBM, GE, and Corning will ensure a strong interaction with industry. An extensive social program will be organized for persons accompanying conference attendees.

For further information, including registration and abstract submission information please see the conference Web site.

See Calendar on page 36 for contact information

 www.fpi6.cornell.edu

Where 2B & Y

Biomolecular Chemistry

27 June–1 July 2004, Sheffield, UK

The **7th International Symposium on Biomolecular Chemistry** will continue the tradition of a successful biennial symposium on bioorganic chemistry. Most recently, conferences within the series were held in Toronto, Canada (2002, ISBOC 6), and in Pune, India (2000, ISBOC 5). The symposia focus on the advancement of international collaboration and communication at the interface of organic chemistry and biological and medicinal science.

ISBOC 7 will be held in the Octagon Centre at Sheffield University, a venue seating up to 1000 individuals. There will be six afternoon symposia, arranged in parallel sessions: bio-organic chemistry, proteins and peptides, structure and mechanism, bio-inorganic chemistry, biospectroscopy, and biothermodynamics. Contributed lectures (of 15 minutes) are invited, and abstracts should be submitted as soon as possible. There will be full poster sessions, with a closing date for all abstracts of 31 March 2004.

Plenary speakers include Stephen Benkovic (Penn State), Steven Lippard (MIT), Manfred Reetz (MPI

Mülheim), Carol Robinson (Cambridge), Dieter Seebach (ETH Zürich), Kazunari Taira (Tokyo), and George Whitesides (Harvard). There also will be a number of invited lecturers.

Accommodations, including breakfast and dinner, will be provided in the Halls of Residence, in close proximity to the conference center. *En suite* accommodation is available at a small premium, while hotel accommodations can be privately reserved at nearby locations (The Post House—Sheffield West, The Rutland Hotel, and The Westbourne Hotel are particularly convenient). The social program will consist of a mixer reception on Sunday evening, 26 June, a piano recital on Monday evening, and a banquet in the Culter's Hall on Wednesday evening. There will be an optional pre-conference tour to Chatsworth House, the seat of the Duke of Devonshire, on Sunday, 27 June. A daily social program (optional) will be organized for accompanying persons; registration is through the Royal Society of Chemistry.

See Calendar on page 36 for contact information

 www.rsc.org/lap/confs/isboc7.htm

Macromolecules

4–9 July 2004, Paris, France

The **40th International Symposium on Macromolecules, World Polymer Congress (MACRO 2004)** is organized by Centre National de la Recherche Scientifique with the participation of Université Pierre et Marie Curie, Paris, and Ecole Supérieure de Physique et de Chimie Industrielles de la Ville de Paris.

This biennial Conference of the Macromolecular Division of IUPAC will bring together scientists from the forefront of all sectors of the world polymer community: chemists, physicists, rheologists, mechanical and process engineers, educators and students, coming either from academia, governmental institutions, or industrial companies. The program will be structured around three half-day plenary sessions devoted to contemporary topics of interest to the whole poly-

mer community, and around a series of symposia related to more specialized areas. It will involve 10 plenary and 280 invited lectures together with some 300 short lectures and more than 1000 poster presentations.

The deadline for abstracts of papers is 25 March, and the registration deadline is 15 May. The procedures for both the abstract submission and the final registration will be exclusively electronic via the conference Web site.

See Calendar on page 37 for contact information

 www.upmc.fr/macro2004



Reactive Intermediates and Unusual Molecules

17–23 July 2004, Queensland, Australia

The **Heron Island Conference on Reactive Intermediates and Unusual Molecules (Heron3)** will take place 17–23 July 2004 on Heron Island (off Gladstone), Great Barrier Reef, Queensland, Australia.

This conference is part of the “ISRIUM” (International Symposium on Reactive Intermediates and Unusual Molecules) series started in 1978 in Geneva (EUCHEM conference on electron deficient

reactive intermediates). The most recent conferences in the series were held in Vienna in 2000, Nara in 2001, and Ascona in 2002, and Reykjavik in 2003. There have been two previous Heron Island Conferences in this series, in 1991 and 1994.

Attendance will be limited to 100, and participants should plan to arrive in Gladstone in time for the catamaran or helicopter transfer in the morning of July 17. Because of stringent room limitations, early registration and booking of accommodations and transfers are necessary.

 heron3.chemistry.uq.edu.au

Chemical Sciences in Changing Times

18–21 July 2004, Belgrade, Serbia and Montenegro

The **4th International Conference of the Chemical Societies of the South-Eastern European Countries (ICOSECS 4)** will be held 18–21 July 2004, in Belgrade, Serbia and Montenegro. The conference—the theme of which is “Chemical Sciences in Changing Times: Visions, Challenges, and Solutions”—will cover all aspects of pure and applied chemistry, although its focus will be on the three accompanying symposia:

- **Advanced Materials: From Fundamentals to Application**—Nanostructured materials, biomaterials, ceramics, macromolecules, metals and alloys, composites, coatings and thin films, carbon-based materials, methods for synthesis, and processing of materials.
- **The Greening of Chemistry: Pursuit of a Healthy Environment and Safe Food**—Renewable or recycled feedstocks, alternative synthetic pathways by catalysis and biocatalysis, photochemistry and biomimetic materials, reduction of energy consumption and release of pollutants, minimization of release of pollutants, reduction of energy consumption,

organically grown crops, and agrochemicals.

- **Teaching and Understanding Chemistry: New Concepts and Strategies for Changing Times** (Dedicated to 150 years of teaching chemistry in Serbia)—Chemical education at the elementary level, high school chemistry, university courses in chemistry, active learning in chemistry, permanent education, the public image of chemistry, and the chemical industry.

Plenary lecturers will include John Fenn (Virginia Commonwealth University, USA), Jean-Marie Lehn, (ISIS-Universite Louis Pasteur, Strasbourg, France), C.N.R. Rao (Centre of Excellence in Chemistry, Bangalore, India), Peter Atkins (University of Oxford, UK), Ronald Breslow, (Columbia University, USA), Egon Matijevic (Clarkson University, USA), K.C. Nikolau (The Scripps Research Institute, USA), Maurizio Prato (Universita degli Studi di Trieste, Italy), and Ivano Bertini (Universita di Firenze, Italy).

The conference is an event sponsored by both IUPAC and the Federation of European Chemical Societies.

See Calendar on page 37 for contact information

 www.shd.org.yu/icossecs4

Coordination Chemistry

18–23 July 2004, Mérida, Yucatán, México

The **36th International Conference on Coordination Chemistry** will be held in Mérida, Yucatán, México, 18–23 July 2004. This conference is a joint meeting organized by México and the USA, through the Mexican Academy of Science and the American Chemical Society Division of Inorganic Chemistry.

The conference program has been divided into seven sessions that cover all areas of coordination chemistry, in fundamental and applied research, including theoretical and green chemistry issues. The seven sessions are as follows: bioinorganic chemistry, nano- and supramolecular chemistry, catalysis, main group element coordination chemistry, d and f element coordination chemistry, functional materials, and reaction mechanisms.

The conference will include 10 plenary lectures and 70 session lectures. Large sections of the lecture program are being reserved for submitted contributions.

Posters, which will be highlighted in three evening sessions, will be a major focal point of the conference.

Plenary lectures will be given by Jean Claude G. Bünzli, Switzerland; Jinwoo Cheon, Korea; Marcetta Y. Darensbourg, USA; Bart Hessen, The Netherlands; Claudio Luchinat, Italy; Ian Manners, Canada; Daniel G. Nocera, USA; Angeles Paz Sandoval, México; and Martin Schröder, United Kingdom. The deadlines for oral presentations and poster presentations are 16 January and 20 February 2004, respectively.

The City of Merida is the capital of Yucatan and the economic and cultural center of Southeastern México. Merida, known also as “the White City,” is considered the cultural and tourist capital of the Mayan World and is near to the beautiful beaches of the Gulf of Mexico, small towns with colonial flavor, and the most important archeological sites of the Mayan culture: Chichén Itzá, Uxmal, Mayapán, and Kabah.

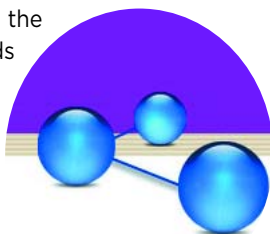
See Calendar on page 37 for contact information

 www.iccc36.org

Polymer Networks

15–19 August 2004, National Institutes of Health, Bethesda, Maryland, USA

The **Polymer Networks 2004 Conference (17th Polymer Networks Meeting)**, jointly organized by the National Institutes of Health (specifically NICHD and NIBIB), and the National Institute of Standards and Technology, is part of a series of biannual international meetings that began in Strasbourg, France, in 1975. The programs of these meetings include contributions from all areas relevant to the formation, structure, properties, and application of synthetic and natural polymer networks and gels, but at each meeting particular emphasis is put on a specific topic. The theme for the Polymer Networks 2004 meeting will be “Research of Gelation Phenomena, and Properties of Synthetic and Biopolymer Gels.” The purpose of the conference is to encourage polymer physicists, polymer chemists,



materials scientists, and engineers to apply their models and methods to address targeted biological problems, such as developing models of cell and tissue-level processes, and new methods for measuring and controlling biomolecular interactions.

Conference Topics:

- Phase Transition in Synthetic and Biopolymer Gels
- Associating/Self-Assembly Systems
- Polyelectrolytes and Intelligent Gels
- Nano-particles in Diagnostics and Therapeutics
- Gene and Drug Delivery
- Tissue Engineering and Hydrogel Scaffolds
- Controlled Synthesis of Networks
- Simulation and Modeling of Polymer Networks

Abstracts will be accepted until 1 April, and advance registration at a discounted fee is available until 15 June.

See Calendar on page 38 for contact information

 www.polymer.nichd.nih.gov

Mark Your Calendar

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

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6–9 January 2004 • Polymer Characterization • Guimaraes, Portugal

12th Annual Polychar World Forum on Advanced Materials (POLYCHAR 12)

Prof. Antonio M. Cunha, Department of Polymer Engineering, University of Minho, P-4800-058 Guimaraes, Portugal, Fax: +351 253510339, E-mail: amcunha@dep.uminho.pt

26–31 January 2004 • Biodiversity and Natural Products • Delhi, India

International Conference on Biodiversity and Natural Products: Chemistry and Medical Applications
(combining ICOB-4 and ISCNP-24)

Prof. V. S. Parmar, Department of Chemistry, University of Delhi, Delhi 110 007, India, Tel.: +91 11 2766 6555, Fax: +91 11 2766 7206, E-mail: virparmar@yahoo.co.in

9–10 March 2004 • Heterocyclic Chemistry • Gainesville, Florida, USA

5th Florida Heterocyclic Conference

Prof. Alan R. Katritzky, University of Florida, Dept. of Chemistry, PO Box 117200, Gainesville, FL, 32611, USA, Tel.: +1 352 392 0554, Fax: +1 352 392 9199, E-mail: katritzky@chem.ufl.edu

3–8 April 2004 • Macromolecules • Stellenbosch, South Africa

UNESCO Introductory Course (3–4 April) and 7th Annual UNESCO/IUPAC Conference on Macromolecules with Special Sessions on Polymers in Medicine, Nanotechnology and Degradation (5–8 April)

Prof. R. D. Sanderson, UNESCO Associated Centre for Macromolecules & 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@sun.ac.za

17–21 May 2004 • Mycotoxins and Phycotoxins • Bethesda, Maryland, USA

11th International Symposium on Mycotoxins and Phycotoxins (ISMP-11)

Dr. Douglas L. Park (HFS-345), CFSAN, 5100 Paint Branch Parkway, College Park, MD, 20740, USA, Tel: +1 301 436 2401, Fax: +1 301 436 2644, E-mail: dpark@cfsan.fda.gov

23–26 May 2004 • Bio-interfaces • Barossa Valley, South Australia, Australia

The Ian Wark Research Institute International Conference & Workshop on Physical Chemistry of Bio-Interfaces

Prof. Hans Griesser, Ian Wark Research Institute, University of South Australia, Mawson Lakes Campus, Mawson Lakes, South Australia, Australia 5095, Tel.: +61 8 8302 3703, Fax: +61 8 8302 3683, E-mail: hans.griesser@unisa.edu.au

1–4 June 2004 • Biodegradable Polymers and Plastics • Seoul, Korea

8th World Conference on Biodegradable Polymers and Plastics

Prof. S. S. Im, Department of Polymer and Textile Engineering, Hanyang University, 17 Haengdang-dong, Seongdong-gu, Seoul 133-791, Korea, Tel.: +82-2-2290-0495, Fax: +82-2-2297-5859, E-mail: imss007@hanyang.ac.kr

14–18 June 2004 • π -Electron Systems • Ithaca, New York, USA

6th International Symposium on Functional π -Electron Systems

Prof. George Malliaras, Materials Science and Engineering, 327 Bard Hall, Cornell University, Ithaca, NY, 14853-1501, USA, Tel.: +1 607 255-1956, Fax: +1 607 255-2365, E-mail: george@ccmr.cornell.edu

27 June–1 July 2004 • Biomolecular Chemistry • Sheffield, United Kingdom

7th International Symposium on Biomolecular Chemistry (ISBOC-7)

Prof. George M. Blackburn, University of Sheffield, Department of Chemistry, Sheffield, S3 7HF, UK, Tel.: +44 114 222 9462, Fax: +[44] 114 273 8673, E-mail: g.m.blackburn@sheffield.ac.uk

27 June–2 July 2004 • Germanium, Tin, and Lead • Santa Fe, New Mexico, USA

XIth International Conference on the Coordination and Organometallic Chemistry of Germanium, Tin, and Lead

Prof. Keith Pannell, Department of Chemistry, University of Texas at El Paso, El Paso, TX, 79968-0513, USA, Tel.: +1 915-747-5796, Fax: +1 915-747-5748, E-mail: kpannell@utep.edu

4–9 July 2004 • Phosphorus Chemistry • Birmingham, United Kingdom

16th International Conference on Phosphorus Chemistry (ICPC 16)

Prof. Pascal Metivier, Rhodia, R&D for Phosphorous and Performance Derivatives, Oak House, reeds Crescent, Watford, WD24 4QP, UK, Tel.: +44 1923 485609, E-mail: pascal.metivier@eu.rhodia.com

4–9 July 2004 • Macromolecules • Paris, France

40th International Symposium on Macromolecules—IUPAC World Polymer Congress (MACRO 2004)

Prof. Jean-Pierre Vairon, Université Pierre et Marie Curie, Laboratoire de Chimie des Polymères, Case 185, 4 Place Jussieu, F-75252 Paris Cédex 05, France, Tel: +33 1 44 27 50 45, Fax: +33 1 44 27 70 89, E-mail: macro04@ccr.jussieu.fr

11–15 July 2004 • Polymer Biomaterials • Prague, Czech Republic

43rd PMM Microsymposium: Polymer Biomaterials: Biomimetic and Bioanalogous Systems

Drahomir Vyprachticky, Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic, Heyrovskeho nam. 2, CZ-162 06 Praha 6, Czech Republic, Tel.: +420 296 809 332, Fax: +420 296 809 410, E-mail: sympo@imc.cas.cz

17–22 July 2004 • Photochemistry • Granada, Spain

20th IUPAC Symposium on Photochemistry

Prof. Dr. Miguel A. Miranda, Departamento de Química/Instituto de Tecnología Química UPV-CSIC, Universidad Politecnica de Valencia, Avenida de los Naranjos, s/n, E-46022 Valencia, Spain, Tel: + 34 963877807, Fax: + 34 963877809, E-mail: mmiranda@qim.upv.es

18–21 July 2004 • Chemical Sciences in Changing Times • Belgrade, Serbia and Montenegro

4th International Conference of the Chemical Societies of the South-Eastern European Countries

Prof. Ivanka Popovic, Belgrade University, Faculty of Technology and Metallurgy, Karnegijeva 4, 11000 Belgrade, Serbia and Montenegro, Tel.: +381 11 337 0478, Fax: +381 11 337 0473, E-mail: icosecs@elab.tmf.bg.ac.yu

18–23 July 2004 • Coordination Chemistry • Merida, Yucatan, Mexico

36th International Conference on Coordination Chemistry

Prof. Norah Barba-Behrens, Departamento de Química Inorgánica, Facultad de Química, Universidad Nacional Autónoma de México, Ciudad Universitaria, Coyoacán, México, D. F., 04510, México, Tel./Fax: +52(55)5622-3810, E-mail: norah@servidor.unam.mx

18–23 July 2004 • Polymers and Organic Chemistry • Prague, Czech Republic

11th International Conference on Polymers and Organic Chemistry 2004 (POC '04)

Dr. Karel Jerabek, Institute of Chemical Process Fundamentals, Rozvojova 135, 165 02 Prague 6, Czech Republic, Tel.: +420 220 390 332, Fax: + 420 220 920 661, E-mail: kjer@icpf.cas.cz

23–27 July 2004 • Carbohydrates • Glasgow, United Kingdom

22nd International Carbohydrate Symposium

Prof. E. Hounsell, School of Biological and Chemical Sciences, Birkbeck University of London, Malet St., London WC1E7HX, UK, Tel.: + 44 207 631 6238, E-mail: e.hounsell@bbk.ac.uk

25–29 July 2004 • Solubility Phenomena • Aveiro, Portugal

11th International Symposium on Solubility Phenomena, Including Related Equilibrium Processes (11th ISSP)

Prof. Clara Magalhaes, Department of Chemistry, University of Aveiro, P-3810-193 Aveiro, Portugal, Tel.: +351 234 401518, Fax: +351 234 370084, E-mail: issp@dq.ua.pt

25–30 July 2004 • Organometallic Chemistry • Vancouver, Canada

21st International Conference on Organometallic Chemistry (ICOMC)

21st ICOMC Secretariat, Conferences & Accomodation at UBC, 5961 Student Union Boulevard, Vancouver, BC, Canada V6T 2C9, Tel.: +1 604 822-1050, Fax: +1 604 822-1069, E-mail: registration@housing.ubc.ca

Mark Your Calendar

1–6 August 2004 • Organic Synthesis • Nagoya, Japan

15th International Conference on Organic Synthesis (ICOS-15)

Prof. Minoru Isobe, ICOS15 Secretariat, c/o International Communications Specialists, Inc., Sabo Kaikan-bekkan, 2-7-4 Hirakawa-cho, Chiyoda-ku, Tokyo 102-8646 Japan, Tel: +81-3-3263-6474, Fax: +81-3-3263-7537, E-mail: icos@ics-inc.co.jp

2–7 August 2004 • Chemistry in Africa • Arusha, Tanzania

9th International Chemistry Conference in Africa—Chemistry Towards Disease and Poverty Eradication

Dr. G. S. Mhinzi, University of Dar es Salaam, Chemistry Department, PO Box 35061, Dar es Salaam, Tanzania, Tel./Fax: +255 22 2410038, E-mail: mhinzi@chem.udsm.ac.tz

3–8 August 2004 • Chemical Education • Istanbul, Turkey

18th International Conference on Chemical Education (18th ICCE)

Prof. Dr. Mustafa L. Berkem, Chairman, Marmara University, Ataturk Faculty of Education, TR- 81040 Goztepe-Istanbul, Turkey, Tel: +90 2163459090/231, Fax: +90 2163388060, E-mail: icce2004@marmara.edu.tr

15–19 August 2004 • Polymers • Bethesda, Maryland, USA

Polymer Networks 2004

Dr. Ferenc Horkay, Section on Tissue Biophysics and Biomimetics, National Institutes of Health, Bldg. 13, Room 3W16E, 13 South Drive, Bethesda, MD 20892, USA, Tel: +1 301 435 7229, Fax: +1 301 435 5035, E-mail: horkay@helix.nih.gov

15–20 August 2004 • Physical Organic Chemistry • Shanghai, China

17th IUPAC Conference on Physical Organic Chemistry (ICPOC-17)

Prof. Guo-Zhen Ji, Shanghai Institute of Organic Chemistry, Chinese Academy of Sciences, 354 Fenglin Road, Shanghai 200032, China, Tel: +86 21-64163300, Fax: +86 21-64166128, E-mail: jigz@pub.sioc.ac.cn

17–21 August 2004 • Chemical Thermodynamics • Beijing, China

18th IUPAC Conference on Chemical Thermodynamics

Prof. Haike Yan, Chairman, 18th ICCT c/o Chinese Chemical Society, PO Box 2709, Beijing, 100080, China, Tel.: +86 10 62568157, 86 10 62564020, Fax: +86 10 62568157, E-mail: qiuxb@infoc3.icas.ac.cn

20–25 August 2004 • Heteroatom Chemistry • Shanghai, China

7th International Conference on Heteroatom Chemistry (ICHAC-7)

Prof. Lin-xin Dai, ICHAC-7, c/o Shanghai Institute of Organic Chemistry, Chinese Academy of Sciences, 354 Fenglin Road, Shanghai 200032, China, Tel: +86-21-64163300- 3405, Fax: +86-21-64166128, E-mail: ICHAC@pub.sioc.ac.cn

3–5 September 2004 • Chemistry of Vanadium • Szeged, Hungary

4th International Symposium on Chemistry and Biological Chemistry of Vanadium

Prof. Tamas Kiss, University of Szeged, Department of Inorganic and Analytical Chemistry, PO Box 440, H-6701 Szeged, Hungary, Tel.: +36 62 544337, Fax: +36 62 420505, E-mail: tkiss@chem.u-szeged.hu

5–10 September 2004 • Analytical Chemistry • Salamanca, Spain

European Conference on Analytical Chemistry—Euroanalysis XIII,

Prof. J. Hernández Méndez, Departamento de Química Analítica Nutrición y Bromatología, Universidad de Salamanca, E-37008 Salamanca, Spain, Tel./Fax: +34-923-294483, E-mail: jhm@usal.es

12–15 September 2004 • Heterocyclic Chemistry • Sopron, Hungary

XXI European Colloquium on Heterocyclic Chemistry

Prof. György Hajos, Chemical Research Center, Institute of Chemistry, H-1025 Budapest Pusztaszeri ut, Hungary, Tel.: +36 1 3257550, Fax: +36 1 3257863, E-mail: ghajos@chemres.hu

Mark Your Calendar

7–8 October 2004 • Trace Elements in Food • Brussels, Belgium

2nd International Symposium on Trace Elements in Food (TEF 2)

Dr. Michael Bickel, European Commission—Joint Research Centre, Institute for Reference Materials and Measurements, B-2440 Geel, Belgium, Tel.: +32 14 57 17 34, Fax: +32 14 57 17 87, E-mail: michael.bickel@cec.eu.int

17–22 October 2004 • Biotechnology • Santiago, Chile

12th International Biotechnology Symposium

Prof. Juan A. Asenjo, Centre for Biochemical Engineering and Biotechnology, University of Chile, Beauchef 861, Santiago, Chile, Tel.: +56 2 6784288, Fax: +56 2 6991084, E-mail: IBS2004@conicyt.cl

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17–22 July 2005 • Carotenoids • Edinburgh, Scotland

14th International Symposium on Carotenoids

Prof. Andrew J. Young, School of Biological and Earth Sciences, John Moores University, Byrom St. Liverpool L3 3AF, UK, Tel.: +44 151 231 2173 / 3575, Fax: + 44 151 207 3224, E-mail: a.j.young@livjm.ac.uk

13–21 August 2005 • IUPAC 43rd General Assembly • Beijing, China

IUPAC Secretariat, Tel.: +1 919 485 8700, Fax: +1 919 485 8706, E-mail: secretariat@iupac.org

14–19 August 2005 • IUPAC 40th Congress • Beijing, China

Innovation in Chemistry

Prof. Xibai Qiu, IUPAC-2005 Secretariat, c/o Chinese Chemical Society, PO Box 2709, Beijing 100080, China, Tel.: +86 (10) 62568157, Fax: +86 (10) 62568157, E-mail: qiuxb@iccas.ac.cn

11–15 September 2005 • Boron Chemistry • Sendai, Japan

12th International Meeting on Boron Chemistry

Prof. Yoshinori Yamamoto, Department of Chemistry, Graduate School of Science, Tohoku University, Sendai, Japan 980-8578, Tel.: +81 22 217 6581, Fax: +81 22 217 6784, E-mail: yoshi@yamamoto1.chem.tohoku.ac.jp

Visas

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

How to Apply for IUPAC Sponsorship

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