Bioinformatics and the Internet

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Introduction

At the turn of the millennium, two young technologies can be singled out which have a major impact on science, industry, and society: recombinant DNA and information technology. As they combine in the field of bioinformatics, they are transforming the pharmaceutical, agrochemical, and food industries and, as a consequence, university education. Much of today's information in the life sciences is generated by collaborative efforts at different locations worldwide, and effective communication is essential for success. Thus, the huge amount of data generated by large-scale genome sequencing activities, e.g., the human genome project, depends heavily on computing and telecommunications and stimulates further efforts in this area.

Explosive Growth of the World Wide Web

In information technology, the World Wide Web (WWW) has become the dominant global communication network. It is based on the Internet, which has served already for more than 20 years as a communication resource among scientists. But only when the hypertext transfer protocol (HTTP) was introduced in 1990 did communication via the Internet became sufficiently easy and inexpensive to allow its general use. Moreover, HTTP is hardware-independent and thus accessible even through inexpensive personal computers which are connected directly to the Internet or via a modem to an Internet provider. This development has stimulated all kinds of commercial activities, and the number of Internet hosts and Internet web sites has reached nearly 40 and 4 million (Fig. 1), respectively[1]. At present, the number of web sites doubles every year, 100 million people worldwide are estimated to be active Internet users, and business on the order of USD 8 billion is done via the Internet. It is expected that within two more years the number of active users might increase tenfold to reach 1 billion, a dramatic increase driven mainly by the populous Asian nations, and that Internet-based sales will account for USD 300 billion or 1% of all global sales within only four years.

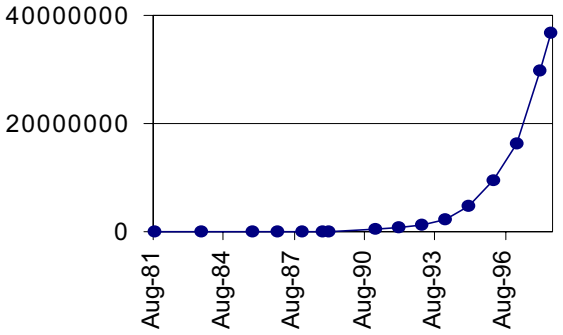

Fig. 1 Number of Internet hosts advertised in the DNS (Internet Domain Survey, July 1998, http://www.nw.com/zone/WWW/report.html).

Life Sciences and the World Wide Web

Though by now a majority of the 4 million web sites have a commercial background, the scientific use of the WWW will increase as well. Among the initiatives to enhance its quality and speed up transfer of large volumes of data, the Internet2 project is the most ambitious. It will start by mid-1999 with 141 participating universities and 14 companies across the United States. The Internet2 will serve exclusively scientific purposes and "facilitate and coordinate the development, deployment, operation, and technology transfer of advanced, network-based applications and network services to further U.S. leadership in research and higher education and accelerate the availability of new services and applications on the Internet"[2].

Even now in the era of Internet commerce, many thousands of WWW sites are devoted to the global science network. In fact, many recent discoveries and developments, particularly in the life sciences, would be unthinkable without the Internet. The modern era of life sciences started in the 1950s and accelerated in the early 1970s, when the modern tools of genetic engineering were developed, i.e., how to isolate, sequence, and clone DNA and express it in a host organism of one's choice. In those early days, DNA sequencing was cumbersome and restricted to single genes, minor gene clusters, or small virus genomes. In order to store the resulting DNA sequences, the National Biomedical Research Foundation, Washington, DC, USA, created the first sequence databank in 1965.

Table 1. Examples of Useful Web Sites in Bioinformatics

Database Type	Description	URL
DNA and Protein Sequence Databases		
SRS	Browser for 38 databanks in molecular biology	http://www.embl-heidelberg.de/srs5/
SWISS-PROT and TrEMBL	Annotated protein sequence database (78,082 and 178,957 sequences, respectively)	http://expasy.hcuge.ch/sprot/sprot-top.html
PIR	Protein Information Resource (116,372 sequences)	http://www.nbrf.georgetown.edu/pir/searchdb.html
EMBL Nucleotide Sequence Database	DNA sequence database (3,046,471 sequences)	http://www.ebi.ac.uk/ebi_docs/embl_db/ebi/topembl.html
GenBank	DNA sequence database (3,044,000 sequences)	http://www.ncbi.nlm.nih.gov/Entrez/nucleotide.html
DDBJ	DNA Data Bank of Japan (3,073,166 sequences)	http://www.ddbj.nig.ac.jp/
Genomics		
Pedant at MIPS	Software system for completely automatic and exhaustive analysis of protein sequence sets (21 complete, 21 unfinished genomes)	http://pedant.mips.biochem.mpg.de/
TIGR Database	Microbial database (20 published genomes, 60 genomes in progress)	http://www.tigr.org/tdb/tdb.html
Sanger Center	Human genome and 24 more genomes	http://www.sanger.ac.uk/
Protein Structure		
PDB	Archive of experimentally determined three-dimensional structures (9,179 entries)	http://www.pdb.bnl.gov/
Literature Searches		
Medline	Search for citations	http://www4.ncbi.nlm.nih.gov/PubMed/
SWISS-PROT journals list	List of online journals	http://www.expasy.ch/cgi-bin/jourlist?jourlist.txt
Homology Searches		
BLAST	Sequence similarity search in 22 sequence databases and 42 genomes	http://www.ncbi.nlm.nih.gov/BLAST/
FASTA	Sequence similarity search in 25 sequence databases	http://www2.ebi.ac.uk/fasta3/
Structure Prediction		
Swiss-Model	Homology modeling	http://expasy.hcuge.ch/swissmod/SWISS-MODEL.html
Biotech Validation Suite for Protein Structures	Quality checks of protein structures	http://biotech.embl-heidelberg.de:8400/
PredictProtein	Prediction of aspects of protein structure	http://www.embl-heidelberg.de/predictprotein/predictprotein.html
Protein Architecture		
SCOP	Protein structure classification	http://scop.mrc-lmb.cam.ac.uk/scop/

Table 1. Examples of Useful Web Sites in Bioinformatics (continued)

Database Type	Description	URL
CATH	Protein structure classification	http://www.biochem.ucl.ac.uk/bsm/cath/
International Organizations		
FAO	Partnership programs of FAO	http://www.fao.org/GENINFO/partner/default.htm
UNESCO	Biotechnology fellowship programs of UNESCO	http://www.unesco.org/general/eng/programmes/science/life/index.htm

Protein Sequencing Databanks

When DNA sequence information started to grow exponentially during the 1980s, three DNA sequence databanks were established as GenBank (National Center for Biotechnology Information) in Bethesda, MD, USA; the European Molecular Biology Laboratory (EMBL/EBI) Nucleotide Sequence Database, now at the European Bioinformatics Institute (EBI) in Hinxton, UK; and the DNA Data Bank of Japan (DDBJ), Mishima, Japan, serving as mirror sites to each other. As shown in Fig. 2, the DNA databases contained 40,000 DNA sequences with a total of 50 million base pairs in 1990, but within only a decade this number has increased 40-fold, now reaching 2 billion base pairs. This increase is due largely to advances in DNA technology and robot-assisted sequencing, allowing a shift from genetics to genomics; by now, the complete genomes of 14 bacteria, baker's yeast, 12 viruses and organelles, and the nematode *Caenorhabditis elegans* have been published on the Internet, and many others are approaching completion, among them the human genome with a total of about 3 billion base pairs alone. This enormous increase in numbers made new types of databases possible and necessary, e.g., web sites devoted to particular organisms such as the chromosome maps of the mouse. As the number of sequenced genomes increases and can be compared to individual geno- and phenotypes ("polymorphisms"), more and more important conclusions about the structure and regulation of single genes and proteins and their interrelation in health and disease can be drawn.

On the level of individual proteins, the first sequence databanks were set up in the mid 1980s, including SwissProt at the Swiss Institute of Bioinformatics, Geneva, Switzerland, and the Protein Information Resource established by the National Biomedical Research Foundation, Washington, DC, USA. When protein structure analysis by X-ray crystallography and later by NMR spectroscopy began to grow rapidly in the 1970s, the Protein Data Bank (PDB) was established at the Brookhaven National Laboratory, Upton, Long Island, NY, USA. It contains at present over 9000 entries on protein structures. Protein science, for a long time focused on protein structure and architecture, is now in a vigorous development in its own right; comparison of protein sequences based on DNA analysis and prediction of their tertiary structure ("from sequence to structure") is an active area of research, fueled by the quest for the so-called proteome, the sum of proteins expressed by a genome under different conditions of regulation and metabolism.

Bioinformatics Databanks and Web Sites

Table 1 lists a few important examples of the many extremely useful web sites related to the life sciences. Much of the experimental work required to arrive at such findings includes the use of complex algorithms which can, in turn, often be found on appropriate Internet pages. Finally, owing to its widespread accessibility, the Internet has also become a huge blackboard for scientific information, including online versions of scientific journals, free science information (such as the public database PubMed offered over the Internet by the National Library of Medicine at Bethesda, MD, USA, which allows free access to over 9 million scientific publications), tutorials, conference announcements, and information on grants and job offers. As a particular consequence of the Internet, the access to information of scientists working in less developed countries has dramatically increased. Thus, as just four among dozens of examples, there now exist the following web sites:

- an Asia-Pacific Network of Science and Technology Centers: http://www.sci-ctr.edu.sg/apnstc/
- an African Network for Essential National Health Research: http://www.healthnet.org/afronets/enhr.htm
- a West Africa Research Network (WARN): http://

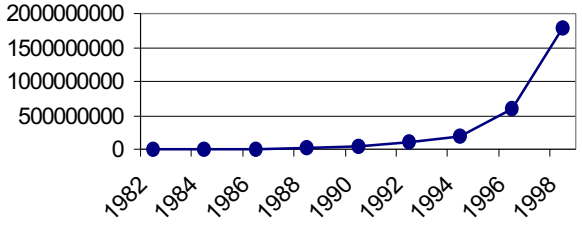

Fig. 2 Number of base pairs in the DNA sequence

www.yorku.ca/research/crs/prevent/warn.htm

- Uninet - The South African Academic and Research Network: http://www.idrc.ca/acacia/outputs/op-unin.htm

Challenges to Bioinformatics

The present shift from sequencing single genes to sequencing whole genomes is expected to expand widely our understanding of the regulation of expression, the interaction of proteins, and, finally, of the function of cells and multicellular organisms. Such progress implies new challenges to bioinformatics. There are at present two major problems:

1. Databases that deal with protein sequences and structures, on one hand, or with the function of whole cells, on the other, contain quite different, though interrelated, types of data. Research groups active in either area tend to chose data formats optimized for their particular purpose. As a result, consistency and coherence of databases can become a major problem.
2. The higher the complexity of the data, the more difficult is their analysis and their graphical presentation. Most future projects will be highly interdisciplinary, requiring the collaboration of experts from several or even many fields. In this situation, it will be inevitable to support the interaction with databases by expert systems, which integrate the knowledge of specialists and are user-friendly.

Future of Bioinformatics

As a probable consequence of all these developments, the biological and biochemical experiments of the future will, to some extent, be carried out not only *in vivo* and *in vitro*, but also *in silico*. Biology-related information will be the pertinent raw material, available from databases through the WWW, which can be profitable. As seen already in the case of the "gene hunt *in silico*", it becomes more and more feasible to transform this computer-based information into valuable research results or even products. Thus, it is becoming a reality that novel targets for drugs or new powerful biocatalysts can be identified in the huge and growing mass of computer-based genomic sequence information and that metabolic fluxes in living beings can be clustered, via a bioinformatics approach, to allow the genetic reengineering of metabolic pathways in microorganisms, plants, animals, or man.

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2. The Internet2 project, http://www.internet2.edu/

IUPAC–NIST Solubility Data Series

Dr. Mark Salomon, Editor-in-Chief of the IUPAC Solubility Data Series and Titular Member of the IUPAC Analytical Chemistry Division (V), contributed the following announcement, which originally appeared as an editorial by Malcolm Chase in the *Journal of Physical and Chemical Reference Data*.

A cooperative agreement between the IUPAC Solubility Data Commission (V.8) and the Standard Reference Data Program (SRDP) of the National Institute of Standards and Technology (NIST) has been signed. A result of this agreement is that the IUPAC Solubility Data Series volumes are now part of the *Journal of Physical and Chemical Reference Data* (JPCRD). These volumes will be published four times a years within the six yearly issues of JPCRD. The numbering of the volumes will continue the current sequence established by the Solubility Data Commission (V.8) of IUPAC.

The IUPAC Solubility Data Commission was established in 1979, with the duties and responsibilities within IUPAC to publish critically evaluated solubility and related thermodynamic data. To produce the comprehensive compilations and critical evaluations for the volumes in the Solubility Data Series, the Commission has enlisted the aid of over 100 scientists from more than 25 countries. Volumes 1 through 53 were published by Pergamon Press, and Volumes 54 through 65 were published by Oxford University Press.

The first article in this series appeared in 1998:

Jitka Eysseltovà and Thedford P. Dirkse, IUPAC–NIST Solubility Data Series, Vol. 66, Ammonium Phosphates, *J. Phys. Chem. Ref. Data 27*(6), (1998).

Upcoming articles in this Solubility Data Series to appear in *J. Phys. Chem. Ref. Data* include the following:

Ari L. Horvath and Forrest W. Getzen, IUPAC–NIST Solubility Data Series, Vol. 67, Halogenated Ethanes and Ethenes in Water, to be published in *J. Phys. Chem. Ref. Data*, Vol. 28.

Ari L. Horvath and Forrest W. Getzen, IUPAC–NIST Solubility Data Series, Vol. 68, Halogenated Compounds C_3 - C_{14} with Water, to be published in *J. Phys. Chem. Ref. Data*, Vol. 28.

Adam Skrzecz, Andrzeij Macynski, and David Shaw, IUPAC–NIST Solubility Data Series, Vol. 69, Ternary Alcohol-Hydrocarbon-Water System, to be published in *J. Phys. Chem. Ref. Data* Vol. 28.

Yuri P. Yampols'kii, Russell Paterson, and Peter G.

T. Fogg, IUPAC–NIST Solubility Data Series, Vol. 70, The Solubility of Gases in Polymers, to be published in *J. Phys. Chem. Ref. Data*, Vol. 28.

A complete list of previously published volumes is available on the IUPAC web site.

IUPAC, IUPHAR, and IUTOX Report on Natural and Anthropogenic Environmental Oestrogens: The Scientific Basis for Risk Assessment

The scientific underpinning for the controversial international concerns about endocrine disrupters has been addressed in detail in a recent issue of *Pure and Applied Chemistry* (Vol. 70, No. 9, 1998). This effort by three preeminent international scientific organizations covers a wide range of scientific aspects and subjects relevant to the issue and provides the background information necessary for informed debate.

The 19-chapter report, *Natural and Anthropogenic Environmental Oestrogens: The Scientific Basis for Risk Assessment*, was prepared by IUPAC in collaboration with the International Unions of Pharmacology (IUPHAR) and of Toxicology (IUTOX), and with the support of the International Council for Science (ICSU). The subject, commonly known as *endocrine* or *hormone disrupters*, is a complex, emotional, and controversial issue for which many scientific questions remain. Several aspects related to human and environmental health are presented, and the conclusions and recommendations drafted by the presidents of the three Unions review the policy issues and how they relate to the science.

This publication is the result of continuous efforts to address issues of societal and industrial concern objectively, involving the chemical sciences. A similar report on chlorine was published in September 1996.

For further information, visit http://www.iupac.org/publications/pac/special/0998/, or contact the IUPAC Secretariat.

A New NMR Data Standard for the Exchange and Archiving for Multidimensional Data Sets

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With multidimensional spectroscopic techniques playing an ever-increasing role in the life of an NMR spectroscopist, it didn't take long for the need for a new NMR data exchange standard for multidimensional data sets to arise. This requirement was formally established last year at the Experimental Nuclear Magnetic Resonance Conference (ENC) in Asilomar, CA, USA. An international task group was set up to develop this data exchange standard for multidimensional NMR experiments and is currently working under the auspices of the International Union of Pure and Applied Chemistry (IUPAC). This article describes how the process began, how the need for a new data exchange standard was established, and when we can expect to be able to make use of implementations in our software updates.

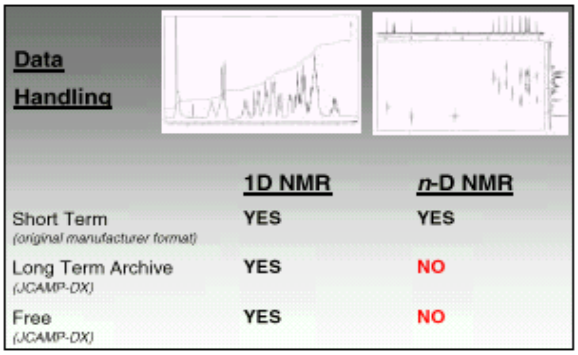

Figure 1. Although solutions are available for short- and long-term NMR data storage, and for exchange and long-term archiving of conventional NMR data, there is currently nothing available for n-D NMR data.

Introduction

In 1997, a discussion session at the Experimental Nuclear Magnetic Resonance Conference (ENC) in the USA raised the question of exchange and long-term storage of multidimensional data (see Fig. 1). The ensuing discussion revealed that there was a need but also a severe lack of information on the subject, so a discussion meeting was organized for the following ENC held last year at Asilomar entitled "A Standard Format for NMR Spectroscopy".

Following a presentation covering the current state-of-the-art, a lengthy discussion was held as to the desirability of a new standard and the best way forward. It was agreed that a new internationally recognized exchange standard was urgently required. A working group was established and many delegates volunteered to help design and build the new standard—including key people representing the major NMR manufacturers, industrial and academic NMR users, and representatives of independent software houses. In addition, following the ENC a number of experts active in this field who responded positively to the proposal have been contacted and have agreed to work on the Task Group.

Proposal to IUPAC

Following the discussion meeting, a formal proposal was made for IUPAC to organize a Limited Term Task Group to develop, document, and validate a new spec-

n-D NMR Registration

Name			
Organization Type	**Instrument Manufacturer** ❑	**Independent** ❑	**Academic** ❑
Organization			
Address Country			
Tel.:	Fax:	E-mail:	

Request for records in the new n-D NMR Protocol

Remember—the new protocol will be generic and not manufacturer-specific. Only fields that comply with this criterion will survive the review process.

All records require the following elements for the protocol:

NAME TYPE [OPTIONS] DESCRIPTION

Please enter the NAME of your requested record. This field should be short but descriptive, e.g., PULSSEQUENCE		**NAME** and	
Please select one of the following data types. Your field may be one of either.	**TEXT** for free formatted comments, etc. ❑	**AFFN** for free formatted numerical values ❑	**STRING** if only options from a pre-defined list are to be allowed ❑

If you have chosen **STRING**, you must now enter the list of possible options. Remember to include definitions for all options in the detailed description field below.
STRING OPTIONS:

Finally, please provide a detailed description of what purpose this field serves! How should these data be handled by software?

Should this field be optional or required? Why?	**REQUIRED**	❑
	OPTIONAL	❑

troscopic data standard for multidimensional NMR data sets. The proposal was presented to the IUPAC Standing Committee on Printed and Electronic Publications (CPEP)[1] in June and the project agreed.

This Task Group is limited to the lifetime of this project and function as proposed in the "Changes in Organization and Management of IUPAC Scientific Activities" from the IUPAC Strategy Development and Implementation Committee.[2] The Task Group would be coordinated through the current CPEP Working Party on Spectroscopic Data Standards (JCAMP-DX),[3] with the finished documentation being laid before the CPEP for approval before being published in *Pure and Applied Chemistry*.

Work Plan

The key to the success of this project is the production of a generic (manufacturer-independent) data dictionary describing a multidimensional NMR experiment. It is envisaged that most of the initial work developing the data dictionary will take place via the Internet within the first six months. However, experience has shown

that when developing these standards, at least one round-table discussion by the key participants is necessary to iron out difficulties of principle and to reach compromises between different points of view. The use of e-mail does not lend itself to arbitrating over difficult semantic differences!

During development, all documentation will be available freely over the Internet to registered participants, testers, and members of the task group. It will be made clear that these are draft documents only and are not to be cited until officially published.

A progress review will take place at the end of February 1999 before the ENC'99 in Orlando, FL, USA. An initial report including the draft data dictionary will be made available by, and presented to, the ENC'99 in March 1999, and the IUPAC CPEP meeting during the 37th IUPAC General Assembly in Berlin in August 1999.

With the finalization of the data dictionary, test files will be produced to aid development work by the manufacturers and independent software houses. Development work will be supported throughout 1999, including round-robin testing of the new files. It is planned to have the protocol ready for publication in *Pure and Applied Chemistry* and software implementations available in releases by the manufacturers the following year. Finalized implementation documentation should also be made available during this phase. A final report should be made to ENC'2000 in March 2000.

New Data Dictionary

The current stage—and probably by far the hardest—is to define the information content required/desired within the NMR data file. To do this, the data dictionary must be generic and not manufacturer-specific, but at the same time contain enough information to annotate the experimental data fully.

By the middle of July, a web site was set up to gather suggestions for the data dictionary[4]. It was pointed out to the Task Group that they should first make themselves acquainted with the structure of the protocols already agreed and published[5] to see how the records are built up. Only then would it be advisable to proceed to the data entry web pages where they should register before proceeding to the data dictionary entry pages.

We will gladly take suggestions from anyone with experience in this field, so if you wish to participate in this action, follow the instructions above. When registering, please allow the cookie to be set, as this will mean you only have to register once. All further attempts to access these pages will then go straight to the data entry pages. If you do not have access to the Internet, we would be grateful to receive your proposals by returning the form on page 38 either by post or fax (+49 231 1392 418).

Geography

Although the Task Group is geographically localized to North America, Europe, and Japan, this concentration seems to be unavoidable owing to the location of the manufacturers and independent software houses. IUPAC is, however, very keen to ensure global access to its activities, so the Internet will be used to advertise the presence of the draft documents for comment to obtain a geographical broad review of the proposals before they are presented to the CPEP for the ultimate stamp of approval.

Conclusion

I hope the activities reported here will quickly return results of benefit to the whole spectroscopic community. The work put into developing these standards is voluntary, and a tremendous vote of thanks must go out to those who have devoted so much time and energy to these projects in the last decade. Although such work will probably never win Nobel prizes, in our computer-dominated working environment, maintaining the availability and accessibility of data might well be the key to many of the more successful industrial and research efforts in the future. Nowadays, we cannot afford to let knowledge die either with the retirement of key workers or the phasing out of a particular computer technology.

Acknowledgments

I would like to thank the Joint Committee on Atomic and Molecular Physical Data and Bruker for financial support of the IUPAC CPEP Working Party on Spectroscopic Data Standards (JCAMP-DX) in 1998. I would also like to thank the Bundesministerium für Bildung Wissenschaft, Forschung, und Technologie; and the Ministerium für Schule und Weiterbildung, Wissenschaft, und Forschung des Landes Nordrhein-Westfalen, Germany for financial support. Finally, I have to give a big round of applause to the IUPAC Working Party members who have wrestled for so long with these problems: Peter Lampen, Robert Lancashire, Bob McDonald, Peter McIntyre, and Doug Rutledge, not forgetting Steve Heller at NIST for his unflagging support and encouragement.

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Present Status of Science in Cuba: Focus on Chemistry

Dr. Alberto J. Núñez Sellés, President of the Cuban Chemical Society (Ave 21 & 200, Atabey, Apdo. 16042, CP 11600 Havana, Cuba; e-mail: cqf@infomed.sld.cu, Fax: 537 336 471), furnished the following article (edited below for space considerations), based on his Opening Lecture at the Third International Congress in Chemistry, which was held in Havana from 1–4 December 1998.

Origins of Cuban Science

In Cuba, chemistry has played a key role since the nineteenth century. The beginning of Cuban science is linked to the appearance of Cuban creoles (*criollo*) from Spanish parents or people of mixed heritage from Spanish settlers and African slaves (*mulato*) in the eighteenth century. The present *Universidad de La Habana* (University of Havana) was founded in 1728, with strong Spanish, French, and Italian influences. The first Cuban scientific society, *Sociedad Económica de Amigos del País* (Economic Society of Country Friends), established in 1793, aimed to contribute to the social and economic development of the country through the application of scientific knowledge; it is the oldest Cuban scientific society still active today.

Nineteenth Century Scientific Development in Cuba

The nineteenth century was decisive for scientific development in Cuba. Reverend Felix Varela introduced experimental teaching of physics and chemistry in *Seminario San Carlos* (1812), and his work was continued by Professor José Antonio Saco and José de la Luz Caballero. Tomás Romay developed concepts of immunization and tested his smallpox vaccine on himself and his family with success at the beginning of the nineteenth century. Carlos J. Finlay discovered the *Aedes aegypti* mosquito as the yellow fever transmitter (1881), thereby introducing this new concept of disease transmission. The first institution for scientific research in Cuba, the *Instituto de Investigaciones Químicas* (Institute of Chemical Research), was founded on 18 November 1848 by a Spanish professor, José Luis Casaseca, who served as its director until 1858. The Institute's first efforts were devoted to the study of Cuban natural products and soils applied to hygiene, industry, agriculture, and medicine. Professor Alvaro Reynoso, Institute Director from 1859–1868, developed the most comprehensive study at that time about sugar cane cultivation (1862), *Ensayo sobre el cultivo de la caña de azúcar* (Essay about Sugar Cane Cultivation), from a chemical point of view considering soil composition and nutrients, fertilizer composition, and water intake. His book was translated into many foreign languages, and led to a true scientific revolution in the development of sugar cane crops. Professor Reynoso's work demonstrated how much chemistry was supporting Cuban agriculture and led to the creation of the Cuban Chemical Society in 1865.

The first national Academy of Sciences in America, *Real Academia de Ciencias Médicas, Físicas y Naturales de La Habana* (Royal Academy of Medical, Physics, and Natural Sciences), was founded in Cuba in 1861; thus, the present *Academia de Ciencias de Cuba* (Academy of Sciences of Cuba) has a history of 138 years. The development of Cuban science and chemistry in the nineteenth century is closely intertwined with the struggle against Spain, which began in 1868, seven years after creation of the Academy. Several Academy founders served in the Liberation Army, and some died on the battlefield. The highest exponent of Cuban social, literary, political, and scientific knowledge in the nineteenth century was José Martí, who died fighting against Spanish troops in 1895 and is considered Cuba's National Apostle.

Early Twentieth Century Obstacles for Cuban Science

The intervention of the U.S. Army in the war between Cuba and Spain (1898–1902) heralded the beginning of the twentieth century for Cuban society, including science. After 30 years of war, the Cuban population, comprising mostly farmers and people living in the countryside, was reconcentrated in the cities by the Spanish regime (1896–1898) to dilute Liberation Army support, but without proper housing or food. This oppression led to an extended famine within the whole population, more than 300,000 deaths, and the migration of most prominent university graduates to the United States or Europe. Cuban scientific activity also

declined severely at the beginning of the twentieth century as part of the whole social breakdown.

Weak official support from the Government for the development of science in Cuba in the first half of the twentieth century, after official proclamation of the Republic (1902), led to a stagnation of scientific activity at the lowest level since the eighteenth century. For example, in 1958, the Academy of Sciences of Cuba was attached to the Ministry of Justice as an association, the National Geographic Society belonged to the Ministry of State, and the National Weather Observatory was part of the Cuban navy; all had minimal budgets, and some were sponsored by individuals or foundations. Educational status, as a basis for scientific development, was polarized and dependent on the economic capacity of the Cuban family. In 1958, almost 40% of the Cuban population were illiterate, and more than half of Cuban children had neither classrooms nor teachers. It was almost impossible to think about development of science under those conditions. Despite these privations, Juan Tomás Roig thoroughly studied Cuban flora, Pedro Kourí pioneered discoveries on the origin and treatment of tropical diseases, and Fernando Ortiz published social research on the origin of Cuban nationality. New state Universities were founded, such as the *Universidad de Oriente* (1947) and the *Universidad Central de Las Villas* (1957), with low budgets devoted almost entirely to education and virtually nothing for research. On the other hand, private Universities, such as the *Universidad Católica de Santo Tomás de Villanueva* (1946), were organized with resources and style comparable to U.S. universities, but only accessible to the wealthiest Cuban families. The construction of a new building for the School of Chemistry (today, the Faculty of Chemistry) at the University of Havana was completed in the 1950s, and it was followed by the creation of the Center of Chemical Research at the *Universidad de Oriente* within the Faculty of Natural Sciences. These two facilities, together with laboratories and a small pilot plant for sugar cane production at the *Universidad Católica de Santo Tomás de Villanueva*, became centers for the development of Cuban chemical R&D and education before 1959 with several hundred chemists. The polarization between a poor official university and a rich private one was also present in primary and high schools until 1961, when schools and universities were nationalized, and substantial support was given to the whole educational system, including R&D at the universities. The first half of the twentieth century can be called "the dark time" for the development of Cuban chemistry as well as science.

Post-Revolutionary Development of Cuban Science

After the Cuban revolution in 1959, the new Government assigned science a high priority within the national development program. As early as January 15, 1960, at the celebration of the 30th Anniversary of the Cuban Speleological Society, Fidel Castro declared, "*El futuro de Cuba tiene que ser un futuro de hombres de Ciencia.*" (The future of Cuba has to be a future of men of science.) Since 1991, January 15 is commemorated as the National Day of Science, and the highest award for the most distinguished Cuban scientists, the Medal "Carlos J. Finlay", is given by the Council of State. Those laureate scientists have included several chemists.

Present Status of Chemistry in Cuba

The beginning of the present status of chemistry in Cuba must be placed in 1961, when a major campaign against illiteracy was undertaken and more than 1 million Cubans learned to read and write in one year. Today, chemistry lessons start in the 8th degree (high schools); 28 university faculties graduate B.Sc. chemists (*Licenciados en Química*), chemical engineers, or chemistry teachers for high schools and colleges; and 3 Polytechnic Institutes in Chemistry graduate chemical technicians to work in factories and laboratories. In the last 35 years, more than 160,000 students have been graduated from these educational facilities as chemists.

The first research institutions created in 1963, after 1959's revolution, were based on the development of chemistry for the exploitation of Cuban natural resources. These include the *Instituto Cubano de Investigaciones de Derivados de la Caña de Azúcar* (Cuban Research Institute of Sugar Cane Derivatives), founded to develop high value-added products from sugar cane by-products, and the *Laboratorios de Investigación de Minerales "Isaac del Corral"* (Research Laboratories of Minerals), with the purpose of exploring and chemically analyzing Cuban ores. Sugar cane crops and nickel ores were and are the most abundant natural resources in Cuba and were taken as the main basis for R&D efforts for a sustainable national development. Also in 1962, the Academy of Sciences of Cuba adopted a new organization and became a national body to support native scientific development.

In the 1960s and 1970s, emphasis was placed on the creation of new research and development facilities, where chemistry deserved a large investment. The modern era of chemical development in Cuba started with the inauguration of the National Scientific Research Center (1965) and the acquisition of the first mass and nuclear magnetic resonance spectrometers. Most of the

chemists and biotechnologists working in Cuba at present took their initial steps in chemical research at that institution, where the monthly *Revista de Ciencias Químicas* (Journal of Chemical Sciences) is edited today. The other present-day Cuban chemical journal is the *Revista Cubana de Química* (Cuban Journal of Chemistry), edited at the University of Oriente and sponsored by the Cuban Chemical Society.

The biotechnological revolution came upon the world scene in the 1980s, and it provided an opportunity for the Cuban scientific community to be present at the forefront of science. Chemists have been involved in the production of alpha interferon from leukocytes since 1981, and a contagious working fever started with the acquisition and structural elucidation of recombinant proteins (via new mass and nuclear magnetic resonance spectrometers from Japan), development of diagnostic and therapeutic monoclonal antibodies, production of restriction enzymes, etc. Several new research centers with well-equipped chemical laboratories were built, including the Center of Genetic Engineering and Biotechnology (1986), Center of Immunoassay (1987), Institute Finlay (research, development, and production of vaccines, 1989), Center of Pharmaceutical Chemistry (1989), and Center of Molecular Immunology (1994).

The support given to biotechnology led to the improvement of R&D in chemistry and a larger presence of chemists in national programs of decisive importance for the social and economic development of the country. Chemical R&D is present in 12 of the 14 National Programs in Science and Technology managed by the Ministry of Science, Technology, and Environment, as independent or related projects in basic and applied research. At present, there are more than 220 scientific institutions in Cuba, without considering university faculties, and 40 of them (18%) are devoted, entirely or partially, to R&D in different fields of chemistry, including medicine, agriculture, oil, mining, textiles, heavy and light industries, sugar, food, cosmetics, etc. Today, Cuba spends 1.2% of its GDP on the development of science and has 1.7 scientists and engineers per 1000 inhabitants, figures that are very close to those of Canada and several times above those of most nondeveloped countries.

Success of the Third International Congress in Chemistry

The Cuban Chemical Society, CCS (an IUPAC Observer), was reorganized in 1978 after several decades of inactivity. CCS is one of the most active scientific societies in Cuba today, with more than 1000 affiliates, a number that significantly increased after the Third International Congress in Chemistry (1–4 December 1998), organized by CCS and sponsored by IUPAC, the Latin American Network in Chemical Science (RELAQ), and several foreign companies and Cuban scientific and industrial institutions. The Congress hosted around 700 participants from 19 countries, and 645 papers were presented as lectures, oral communications, or posters. The Congress demonstrated how chemistry is present today in all strategic plans for national development and showcased the high creativity of Cuban chemists in solving complex problems. Sessions devoted to chemistry education and the history of chemistry also attracted a large audience.

The aim of the Congress was to present and discuss, in a broad cultural and social atmosphere, recent scientific, industrial, and educational advances in all fields of chemistry. The significance and contribution of the Congress to international chemistry was underscored by the opportunities it provided for participants to have discourse with chemists from all parts of the world, taking into account the "transfer of knowledge" from developed to nondeveloped countries, mainly those from Latin America.

Plenary lectures included talks by Dr. Herbert Hauptman (Buffalo, NY, USA), Nobel Laureate in Chemistry (1985), who presented his work on direct methods for determining crystal structures from X-ray diffraction data; Professor Rene Roy (Ottawa, Canada), who discussed his work on the design and synthesis of multivalent neoglycoconjugates for the study of nanoscale carbohydrate–lectin interactions; Professor Lester Mitscher (Lawrence, KS, USA), who discussed his experience with the use of combinatorial chemistry to develop new therapeutic agents; Professor Adamo Fini (Bologna, Italy), who discussed fundamentals and applications of microwave energy in several fields of chemistry, mainly organic synthesis; Dr. Julio San Roman (Madrid, Spain), who talked about his contributions to the development of natural and synthetic polymers for therapeutics; Professor Ernest Eliel (Chapel Hill, NC, USA), also IUPAC Representative at the Congress, who provided insights about chemistry teaching in high schools and colleges in the USA; Professor Jose Fernández (Havana, Cuba), who focused on his recent experience in mechanochemistry; and Dr. Rolando Pellón (Havana, Cuba), who presented his work about innovations on the Ullman-Goldberg reaction using water as a solvent. These last two lecturers were awarded

the National Award in Chemistry, given for the first time in Cuba by the Cuban Chemical Society. The Opening Lecture about the present situation of science and chemistry in Cuba was delivered by the author, and has been summarized above in this article. CCS is working now to have worldwide participation in its International Congresses (programmed every three years). The Fourth International Congress in Chemistry is scheduled for 17–21 April 2001, at the Conventions Palace, Havana.

Future of Chemistry in Cuba

Cuban chemists are focused now on a more competitive chemistry and R&D to obtain products of social and economic importance for national development, such as new vaccines against AIDS, cancer, cholera, and dengue hemorrhagic fever; new therapeutic monoclonal antibodies for the treatment of cancer and immune diseases; development of low-energy consumption technologies; studies of Cuban biodiversity for the exploitation of natural resources in terms of candidates to become new drugs; development of new materials for both medical and building applications; diversification of nickel production for high value-added products, and continuous evaluation of environmental impact for new investments, especially in the tourism area, as the main priorities. Chemistry, biochemistry, and chemical engineering are among those disciplines, according to the Ministry of Science, Technology, and Environment, in which Cuba has to maintain or reach a level of excellence in R&D in order to apply scientific results to industrial technologies. This work is severely hampered by the restrictions of the U.S. trade and financial blockade, which imposes upon Cuban chemists austere limitations in terms of chemicals, equipment, and spare parts supplies, which have to be bought from Europe or Asia, whenever possible, at even fivefold times the current prices in the United States. Cuban chemists are meeting such challenges as the dawn of the Third Millennium approaches.

Scientific Committee on Problems of the Environment (SCOPE) of the International Council for Science (ICSU)

SCOPE represents

- *synthesis, assessment, and evaluation of information* available on natural and human-made environmental changes and the effects of these changes on people;
- *30 years at the cutting edge* of interdisciplinary review of existing and potential environmental problems, and a seminal role in the development of major international research programs;
- *a recognized authority* at the interface between the science and decision-making spheres, providing advisers, policy planners, and decision makers with analytical tools to promote sound management and policy practices; and
- *a worldwide network* of 40 national science academies and research councils, and 22 international scientific unions, committees, and societies to guide and develop its scientific program.

SCOPE is an international, nongovernmental, nonprofit, and interdisciplinary body of natural science expertise. Its scientific program is designed to cover environmental issues—either global or shared by several nations—in urgent need of interdisciplinary syntheses. SCOPE was established by the International Council for Science (ICSU) in 1969. Throughout the world, SCOPE brings together scientists from a wide range of disciplines to identify emerging or potential issues likely to influence the world environment.

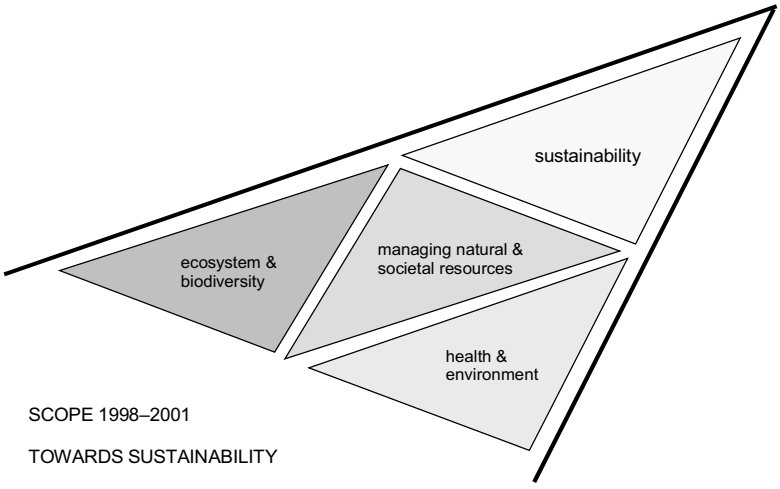
SCOPE acts at the interface between the science and decision-making spheres, providing advisers, policy planners, and decision makers with the analytical tools to promote sound management and policy practices. SCOPE takes pride in its track record, bringing attention to bear on emerging issues and foreshadowing a number of the important environmental research programs that are operative today. By providing syntheses and assessments of scientific information on global environmental problems, and pointing out gaps in knowledge, it indicates new directions for research and innovative approaches.

SCOPE undertakes joint projects with international and intergovernmental organizations. The United Nations Environmental Program (UNEP) and SCOPE have established a firm and mutually beneficial working relationship as they confront environmental issues worldwide. UNESCO, the UN program covering education, science, and culture; the European Commission; and the World Health Organization (WHO) are also partners with shared concerns.

Through cutting-edge evaluations and assessments, SCOPE focuses attention on major issues such as 1) human alterations of the life-sustaining cycles of carbon, nitrogen, sulfur, and phosphorus; and 2) biodiversity, including biological invasions and the functional significance of biodiversity. SCOPE took on the ambitious and demanding role of coordinator of a critically important project on indicators for sustainable development. It actively supported the input of project results into political debate and, in particular, the UN's Commission for Sustainable Development

(CSD) process to reach a reasoned consensus on the use of indicators in the decision-making and policy-planning process.

Project results are usually published as monographs, state-of-the-science analyses, and evaluations of environmental issues, widely referenced in scientific literature. In recent years, SCOPE has also sought to reach out to a wider public through publications which speak to the needs and requirements of practitioners in the policy, planning, and decision-making processes.



The General Assembly, which meets every three years, establishes the scientific program. An elected Executive Committee directs SCOPE's activities between Assemblies. Scientists involved in the conduct of the program voluntarily contribute their expertise and time.

The 1998–2001 scientific program focuses on the concepts and practices of sustainability. Projects are organized under three clusters of closely related and interactive studies:

Cluster 1: Managing Societal and Natural Resources (MSNR)

The first cluster projects are founded on scientific research, but emphasize the application of this scientific knowledge in developing options for practices and policies leading to a more sustainable biosphere. Projects include the following:

- Sustainable Biosphere Project
- Economy and environment
- Ecological engineering and ecosystem restoration
- Global Invasive Species Program (GISP)
- Earth system services and human population
- Environment in a Global Information Society (EGIS)
- The role of environmental sciences in agricultural practice
- Urban waste management
- Material flow analysis
- Implications of aquaculture and mariculture on biodiversity and ecosystem processes

Cluster 2: Ecosystem Processes and Biodiversity (EP&B)

The second cluster of projects focuses on ecosystem processes, how these processes operate and interact with human activities, and the significance of biological diversity in relation to ecosytem functioning. Projects include the following:

- Groundwater contamination
- Nitrogen transport and transformation
- Earth surface processes, material use, and urban development (ESPROMUD)
- Soils and sediments: biodiversity and ecosystem functioning
- Dynamics of mixed tree/grass systems
- Behavior of large-scale ecosystems
- Use of stable isotopes to study biogeochemical cycles in relation to global change
- Land–ocean nutrient fluxes: silica cycle
- Interactions of the major biogeochemical cycles
- Use of molecular biology in the study of environmental issues

Cluster 3: Health and Environment (H&E)

The third cluster projects develop methodologies for assessing chemical risk to human and nonhuman targets, and use case studies of environmental contamination to assess the health and environmental risks of specific chemicals. Projects include the following:

- Methodologies of assessing exposure to combustion products: particles and their semivolatile constituents (SGOMSEC 14)
- Radioactivity from nuclear tests (RADTEST)
- Mercury transport and transformation
- Cadmium in the environment
- Radioactivity at nuclear sites (RADSITE)
- Vector-borne diseases and environmental change
- Endocrine disrupters/modulators

Water Pollution Management in India (VI.3)

Introduction

The rapid pace of industrialization and the greater emphasis on agricultural growth for overall development have brought in a host of environmental problems in recent years in India. Financial and technological constraints have led to inefficient conversion processes, thereby leading to generation of larger quantities of waste and resulting pollution. The concentration of industries in certain pockets and the skewed distribution of rainfall have further compounded the scenario. Thus, India encounters water quality problems both on account of water pollution and overexploitation of groundwater.

Government Measures on Water Pollution Control

Major industries in India responsible for water pollution are fertilizers, sugar, textiles and chemicals, mines and minerals, pulp and paper, leather tanneries, and process industries. Pollution problems in India are addressed by a combination of legislative, punitive, and motivational measures. The government of India has enacted a number of pieces of legislation, such as the Water (Prevention and Control of Pollution) Act, 1974 and amended in 1988; the Water (Prevention and Control of Pollution) Cess Act, 1977 and amended in 1991; and the Environment Protection Act, 1986, etc. The problem is compounded by the presence of a large number of small-scale industries. A system of environmental audit has therefore been introduced to enable the production units to evaluate the raw materials, utilities, and operational efficiencies to effect any possible midcourse corrections and minimize environmental pollution. Imposition of cess for water required and wastewater produced represent the punitive measures that would force the industries to reduce the pollution load. At the same time, the government has come out with a number of schemes to encourage setting up of treatment plants to mitigate the pollution load through subsidies and soft loans.

Water Pollution Mitigation by Industries

Initially, the affected industries directed their efforts to treat their effluents so as to meet the discharge norms such as MINAS (minimum allowable standards), usually defined in terms of temperature, pH, BOD, COD, suspended loads, and toxic constituents such as mercury, chromium, cadmium, etc. The norms are different for inland and coastal discharges. Large- and medium-scale industries have their own infrastructure and resources, and they have adopted their own effluent treatment schemes so as to render their discharge streams environmentally safe.

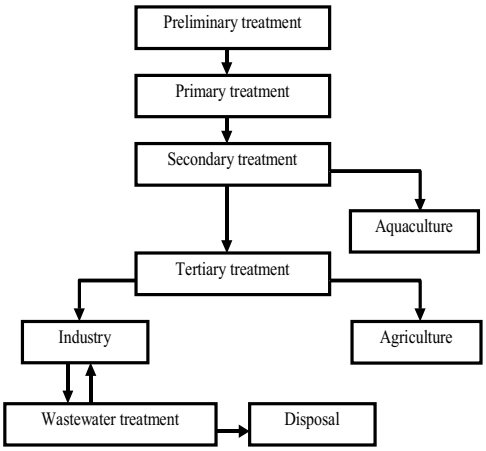
Small-scale industries, because of their limited resources in terms of finance, space, and technology, cannot afford to treat their wastes. The concept of Common Effluent Treatment Plant (CETP) was evolved to provide necessary assistance to this sector, wherein the wastes generated by a number of industries are brought together to a central place and treated. A number of plants are in operation in different parts of India. Significant variations in the composition of the wastewater arising from a cluster of industries has created difficulties in ensuring the efficiency and effectiveness of the CETP. Insisting on a pretreatment system by the individual industries to ensure consistency of the composition of effluents would defeat the very purpose of CETP. With the knowledge that the addition of domestic sewage improves the treatability of industrial wastewater, a new approach, referred to as a Combined Effluent Treatment Plant, has evolved, wherein the domestic sewage of the surrounding community is jointly treated with the industrial wastewater[1].

Water Management in Indian Industries

The migration of population and the clustering of industries around urban centers have escalated the demand for good-quality water, both for industrial and domestic use. Inadequate natural resources and increased generation of sewage have created problems, both in the supply of water and disposal of sewage, forcing the government to increase the water charges and effluent cess. In urban centers, a dual pricing system for water is being adopted, whereby water for domestic consumption is charged less. Furthermore, industries are encouraged to set up water recovery or desalination plants to meet their demands. Consequently, industry has not only started adopting measures to minimize waste, but also has been looking for various means by which they can recover and recycle their wastewater. Some industries, such as Rashtriya Chemicals and Fertilizers Ltd., have successfully experimented to recover and reuse water from their regenerant waste streams using reverse osmosis and are in the process of setting up large-capacity plants.

Role of Membranes in Water Recovery and Reuse

Membrane processes, with their variety and flexibility, are characterized by ambient temperature operation, low energy consumption, and modular nature. The physico-



Schematics of Municipal Wastewater Reuse

chemical mechanism of separation requires only limited use of chemicals, making the process eco-friendly. In some cases, the processes allow the recovery of valuable chemicals for reuse. Membranes are available in the market covering a wide range of characteristics.

Water recycling and reuse, in this context, has assumed greater significance. Thus, industries have resorted to methods whereby they can recover and reuse water. The general scheme[2] followed, as shown below, consists of preliminary, primary, and secondary treatments for the reduction of suspended matter and biocontaminants.

A scheme consisting of reverse osmosis at the tertiary treatment stage has been adopted on a trial basis by Madras Fertilizers Ltd. (MFL) and Madras Refineries Ltd. (MRL) to recover good-quality water from sewage. The water thus recovered is being used as a boiler feed after polishing through demineralizers. This process has encouraged the state government to adopt the scheme for Chennai, traditionally a water-starved city in India, for recycling about 30 MGD of water for industrial use.

Management of Drinking Water

The overexploitation of groundwater has particularly affected the availability of good-quality drinking water in remote villages of India. A significant number of villages have problems related to brackishness and contamination by iron, fluoride, arsenic, etc. Rain harvesting and groundwater recharge techniques are being encouraged to make the villages self-sufficient, but they have limited potential. Membrane processes, such as reverse osmosis and electrodialysis, have been widely adopted for the provision of drinking water for salinity-affected villages, but a number of improvements are required in order to simplify the operating features so as to absorb the technology under the rural infrastructural constraints.

Future Scenario

It is expected that in the future all process industries will have water recycling plants and coastal industries may adopt seawater desalination plants either using process waste heat or reverse osmosis membranes. Domestic water requirements would be met with natural resources, while industrial requirements may have to be supplemented by desalination.

Assessment of the Current Technology

Membrane technology, though originally developed for desalination, has made a major impact in a number of industrial separations. With reference to desalination and effluent water treatment for reuse, the technology is considered mature enough for large-scale exploitation. Whether for domestic use or industrial process water requirements, the cost of desalted water, however, continues to be an area of attention. Cost-reduction strategies include reduction in process energy requirements by adopting/integrating energy-recovery systems and enhancing permeate recovery through better feed water pretreatment practices and employing high-salt rejecting membranes. These measures are partially adopted for seawater desalination in India.

Seawater desalination on a large scale is generally considered for industrial process water needs in India rather than for domestic use. For small-capacity brackish water desalination in rural inland areas, membrane technology is at present facing a setback owing to the higher cost of water produced and operational problems such as nonavailability of skilled manpower needed for plant operation and frequent electric power breakdowns. Regarding effluent water treatment for reuse in industries, membrane technology is most suited for Indian conditions and is being rapidly adopted.

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B. M. Misra

Final Report on the Design and Field Testing of a Teaching Package for Environmental Chemistry (CTC) (An IUPAC/ICSU Project)

The design of a package for teaching selected aspects of environmental chemistry has been completed. The package has also been field-tested through a series of hands-on workshops. The details of the work, which was carried out in Bangalore and Delhi under the aus-

pices of the Jawaharlal Nehru Center for Advanced Scientific Research, are as follows:

Design of the Package

1. Four instruments for measurement of pH conductance, absorbance, and temperature have been designed in two versions: (a) a desktop model, and (b) a handheld model. The desktop model can be interfaced to a personal computer and has provisions for mains as well as battery operation. The handheld model is battery-operated only and is designed for field work.
2. A microprocessor-based four-channel data logger has been designed for use in field-based monitoring, as it can be interfaced to sensors. The data logger can also be interfaced to a personal computer for downloading data.
3. A three-in-one instrument called an Aqualyzer, consisting of a meter, conductometer, and colorimeter, has been designed. The unit has maximum application for water analysis, but it can also be used for other applications. The unit can be easily expanded to include an electronic thermometer.
4. An electronic kit has been designed for teaching/learning of basic electronics (including integrated circuits or ICs).
5. A micro-scale chemistry kit has been designed in two versions. In one version, the comboplate designed at the Radmaste Centre, University of Witwatersrand, is used, while in the other version, the plate is of Indian origin.
6. The usability of a camcorder has been investigated for making video clips to supplement the print material and for use in multimedia modules.
7. A multimedia presentation has been developed describing the microchemistry kit. Similar presentations, on selected aspects of environmental science, have also been investigated.
8. Over 100 activities/experiments have been standardized using (a) the electronic kit, (b) the electronic instruments, and (c) the small-scale chemistry kit.

Field Testing

About 20 hands-on teacher–student workshops were conducted at Bangalore, Delhi, Bombay, Jaipur, and Madras to validate the instruments, the kits, and the activities. In addition, the ICSU/IUPAC package was used/demonstrated and/or exhibited at the following international meetings/workshops:

1. International Symposium on Cost-Effective Science Education, University of Wisconsin, Madison, WI, USA (14–26 July 1996)
2. Workshop on Low-Cost Instrumentation, University of Lusaka, Zambia (22–29 Nov. 1996)
3. Workshop on Low-Cost Instrumentation, University of Mutare, Zimbabwe (4–9 June 1997)
4. Exhibition of Low–Cost Instrumentation., IUPAC General Assembly, Geneva (22–29 August 1997)
5. Low-Cost Instrumentation for Environmental Monitoring, Bangalore, India (9–14 March 1998)
6. Workshop on Low-Cost Instrumentation, Male, Maldives (17–20 March 1998)
7. Demonstration of Low-Cost Instrumentation at the Science Education Sector, World Bank, Washington DC, USA (5 May 1998)
8. 7th International Conference on Chemistry in Africa, Durban, South Africa (6–10 July 1998)

K. V. Sane

New Books and Publications

New Books from the Royal Society of Chemistry

Fatty Acids

The Royal Society of Chemistry published *Fatty Acids*, the latest supplement to McCance & Widdowson's *The Composition of Foods*, in December 1998. The book, compiled by the Ministry of Agriculture, Fisheries and Food, forms a major update to the official UK food tables. It provides new, authoritative fat and fatty acid composition data for an extensive range of foods consumed in the United Kingdom that are significant sources of fat.

Fatty Acids presents data on up to 37 individual fatty acids for over 520 foods, of which 130 are new to the UK food composition tables. The composition data, detailed in easy-to-read tables and expressed per 100 g of food, cover total fat, total saturates**,** total *cis* and total *trans* mono- and polyunsaturates, 13 individual saturated fatty acids, 14 individual monounsaturated fatty acids, and 10 individual *cis*-polyunsaturated fatty acids.

Supplementary tables provide cholesterol and phytosterol content for foods that are new to this supplement to *The Composition of Foods.*

With a comprehensive introduction, an appendix describing fatty acid nomenclature, and a food index,

Fatty Acids is an essential reference source for professionals and researchers in food science and nutrition, dietitians, students, and the food industry.

Fatty Acids, Supplement to McCance & Widdowson's *The Composition of Foods*. ISBN: 0854048197; softcover; Approx. 200 pages; Price: GBP 32.50.

The book may be ordered from: Turpin Distribution Services Ltd, Blackhorse Road, Letchworth SG6 1 HN, UK

Tel: +44 (0)1462 672555; Fax: +44 (0)1462 480947; E-mail: turpin@rsc-org.

For further details contact: Mike Corkill, The Royal Society of Chemistry, Thomas Graham House, Science Park, Milton Road, Cambridge CB0 4WF UK

Tel: +44 1223 432381; Fax: +44 1223 423429; E-mail: marketing@rsc.org.

Metabolic Pathways of Agrochemicals

This major new reference source was launched at the 9th IUPAC Congress on Pesticide Chemistry held in London, 2–7 August 1998. The two-volume publication provides comprehensive coverage of the chemical degradation and metabolism of agrochemicals in soils, plants, and animals. Organized by compound class for ease of use, and covering 40 years of literature, it comprises:

- Separate entries for each pesticide
- Overviews of the metabolism of specific classes of agrochemicals
- Key similarities and significant differences between individual chemicals in the class
- Extensive bibliography
- Comprehensive, high-quality indexes

Editor-in-Chief Terry Roberts, of JSC International Ltd, and his team of international experts have extensive experience in the field. Part 1, available now, covers Herbicides and Plant Growth Regulators, while Part 2 will feature Insecticides and Fungicides. For further details, contact: The Sales & Promotion Department, The Royal Society of Chemistry, Thomas Graham House, Science Park, Milton Road, Cambridge CB4 4WF; Tel.: +44 1223 420066; Fax: +44 1223 423429; E-Mail: Sales@rsc.org; Web Site: http://www.rsc.org.

New Publications from the World Health Organization

***Benefit–Risk Balance for Marketed Drugs: Evaluating Safety Signals,* Report of CIOMS Working Group IV**

CIOMS 1998, 160 pages (English), ISBN 92 9036 068 2, CHF 15.-/USD 13.50; In developing countries: CHF. 10.50, Order no. 1840020. WHO distribution and sales, CH-1211 Geneva 27, Switzerland.

This report presents and explains a standardized methodology for reassessing the established benefit–risk relationship of a marketed drug when a new safety problem arises. Addressed to drug manufacturers and regulatory authorities, the book responds to the absence of any standard, systematic procedure for assessing newly detected hazards, balancing risks against benefits, and reporting the results. The recommended approach, which reflects the consensus reached by 24 representatives of industry and government regulatory authorities, includes detailed advice on concepts and procedures for determining the magnitude of the safety problem and deciding on the appropriate action, whether involving a routine change in product information or immediate withdrawal of the drug from the market. The use of a standard reporting form, presented here for the first time, forms a central part of the recommended procedure.

The report adopts a public health approach aimed at encouraging consistent practices, on the part of both regulators and companies, when a major safety problem is signaled. Throughout, examples from case studies are used to illustrate pragmatic responses to the many difficult problems involved. Information ranges from a checklist of questions to consider when evaluating benefits, through an agreed-upon method for scoring the relative seriousness of different adverse reactions, to recommendations for the standard visual presentation of data. Particular attention is given to procedures that can help minimize bias when risk profiles are prepared for competing products from the same therapeutic class.

The report has five chapters. The first provides an overview of recommended principles, the factors influencing benefit–risk assessments, and the types of data and analytical approaches that should be used. Chapter 2, which forms the core of the report, presents a standard five-part reporting form and provides detailed guidelines for its completion. Examples from case histories are used to illustrate basic principles and methodologies for collecting and analyzing the data needed for benefit estimation, risk estimation, benefit–risk evaluation, and the analysis of options for action. The chapter also suggests standardized ways of displaying data when profiling and quantifying risks or comparing the risk profiles of competing drugs.

Chapter 3 covers the decision-making process, including advice on how to select the best options for action and how to determine the responsibilities of regulators and companies. The remaining chapters discuss issues unaddressed or unresolved by the working group, and summarize key recommendations and proposals.

The report concludes with a series of appendices, which include in-depth case histories for seven drugs, a model for the quantification of risks (accompanied

by a detailed example of how the model works in practice), and a summary of results from a survey of actions taken by manufacturers and regulatory authorities when postmarketing safety issues arise.

Guidelines for Drinking-Water Quality, Second Edition, Addendum to Volume 1: Recommendations

1998, viii + 36 pages (available in English; French and Spanish in preparation) ISBN 92 4 154514 3 CHF 14.-/ USD 12.60; In developing countries: CHF 9.80 Order no. 1154404.

This addendum to Volume 1 of *Guidelines for Drinking-Water Quality* summarizes new findings that have become available since the second edition was published in 1993, and that call for a reconsideration of selected guideline values issued at that time. In addition, guideline values for four substances are presented here for the first time. The addendum is part of WHO's ongoing effort to ensure that recommendations about the safety of chemical substances found in drinking water are in line with the latest scientific data.

For some of the substances under review, previously established guideline values have been revised in the light of new evidence. For others, new findings confirm the continuing validity of previous recommendations. In addition, guideline values for four substances are presented here for the first time.

Updated or new evaluations are provided for seven inorganic substances (aluminium, boron, copper, nickel, nitrate, nitrite, and uranium), four organic substances (edetic acid, microcystin-LR, benzo[a]pyrene, and fluoranthene), ten pesticides (bentazone, carbofuran, cyanazine, 1,2-dibromoethane, 2,4-dichlorophenoxyacetic acid, 1,2 dichloropropane, diquat, glyphosate, pentachlorophenol, and terbuthylazine), and a disinfectant by-product (chloroform).

Evaluations of chemical substances published in this addendum supersede evaluations of the same substances previously published in Volume 1 of the *Guidelines.*

The guideline values recommended by WHO are not mandatory limits. Such limits should be set by national or regional authorities, using a risk–benefit approach and taking into consideration local environmental, social, economic, and cultural conditions.

Toxicological Evaluation of Certain Veterinary Drug Residues in Food

Prepared by the Fiftieth Meeting of the Joint FAO/WHO Expert Committee on Food Additives; WHO Food Additives Series, No. 41, 1998, vi + 173 pages (English), ISBN 92 4 166041 4, CHF 50.-/USD 45.00; In developing countries: CHF 35.- no. 1270041.

This book evaluates the design and findings of studies relevant to the safety assessment of selected veterinary drug residues in food. The book, which is part of a long-running series prepared by the Joint FAO/WHO Expert Committee on Food Additives (JECFA), gives toxicologists, the food industry, and regulatory agencies a record of the scientific evidence considered when the Committee allocates or revises acceptable daily intakes and other endpoints.

Emphasis is placed on studies that relate specific exposure levels to specific toxic effects or guide the meaningful extrapolation of animal data to the human condition. Through its careful attention to questions of study design, methodology, and the validity of reported data, the book also demonstrates the strict safety standards used by JECFA in its efforts to protect consumers from any possible toxicological or pharmacological hazard linked to the consumption of veterinary drug residues.

Separate toxicological monographs are presented for four anthelminthic agents (eprinomectin, febantel fenbendazole, and oxfendazole), three antimicrobial agents (gentamicin, sarafloxacin, and tetracyclines), three antiprotozoal agents (diclazuril, imidocarb, and nicarbazin), one production aid (recombinant bovine somatotropins), and one tranquilizing agent (azaperone).

Pesticide Residues in Food 1997, Part I: Toxicological and Environmental Evaluations

Prepared by the joint FAO/WHO Meeting on Pesticide Residues 1998, ix + 359 pages (English) ISBN 92 4 166513 0, CHF 80.-/USD 72.00; In developing countries: CHF 56.- Order no. 1280013.

This book presents detailed evaluations of the available toxicological and other safety data for thirteen pesticides and one metabolite that have the potential to leave residues in food commodities. Data on risks posed to the environment by an additional two pesticides are also included.

The evaluation is part of an ongoing series of activities coordinated by FAO and WHO since 1963 and used to advise governments and the Codex Alimentarius Commission of possible hazards to consumers arising from the presence of pesticide residues in food. To this end, panels of experts, jointly appointed by the two agencies, scrutinize data submitted by pesticide manufacturers and regulatory authorities. Conclusions, which are based on a rigorous assessment of all relevant toxicological studies, form the basis for the acceptable daily intakes for humans established by the Joint FAO/WHO Meeting on Pesticide Residues.

Toxicological evaluations cover the following pesticides: abamectin, amitrole, chlormequat, fenamiphos, fenbuconazole, fenthion, fipronil, guazatine, lindane, malathion, methidathion, phosalone, triforine, and a metabolite of glyphosate, aminomethylphosphoric acid

(AMPA). Also included are evaluations of the environmental effects of 2,4-dichlorophenoxyacetic acid (2,4-D) and mevinphos.

Boron

Environmental Health Criteria, No. 204 1998, xviii + 201 pages (English with summaries in French and Spanish), ISBN 92 4 157204 3, CHF 42.-/USD 37.80; In developing countries: CHF 29.40, Order no. 1160204

This book evaluates the risks to human health and the environment posed by boron, a naturally occurring element widely distributed, in the form of various inorganic borates, in the oceans, sedimentary rocks, coal, shale, and some soils. Boron is also used in laundry bleach and in the manufacture of glass, glass products, fertilizers and herbicides, antiseptics, and pharmaceuticals. Because boron is widely detected in drinking water and occurs naturally in fruits, nuts, and vegetables, the report gives particular attention to health risks associated with exposure of the general population through diet and drinking water.

A section on sources of human and environmental exposure cites evidence that boron enters the environment mainly through volatilization from seawater, volcanoes, geothermal steam, and natural weathering of clay-rich sedimentary rock. Although industrial uses account for much smaller releases, the report notes that all of the boron from the sodium perborate contained in detergents ultimately enters the wastewater system, and is not removed by standard water treatment procedures.

The environmental behavior of boron is covered in the next section, which concludes that boron does not persist in the atmosphere to a significant degree, adsorbs onto soil particles, accumulates in aquatic and terrestrial plants, but does not magnify through the food chain. Numerous findings indicate that boron is an essential micronutrient for higher plants. A section on environmental levels and human exposure cites diet and drinking water as the principal sources of exposure for the general population. Occupational exposure to boron compounds is judged to be potentially significant, with inhalation of dusts singled out as the most significant route of exposure. Concerning kinetics and metabolism in laboratory animals and humans, numerous studies demonstrate that boric acid and borax are readily absorbed from the gastrointestinal and respiratory tracts, widely distributed, and rapidly excreted in urine.

The most extensive section reviews findings from toxicity studies in laboratory mammals and test systems. General clinical signs of exposure are described as depression, ataxia, occasional convulsions, decreased body temperature, and violet red color of skin and mucous membranes. The review found unequivocal evidence that the male reproductive tract is the principal target of toxicity. The review also cites several recent reports indicating that boron in physiological amounts is beneficial to, if not essential for, higher animals.

An evaluation of the few human studies of toxicity concludes that exposure is associated with short-term and reversible irritant effects on the upper respiratory tract, nasopharynx, and eye. The most frequently observed symptoms involve the gastrointestinal tract and include vomiting, abdominal pain, diarrhea, and nausea. Less frequently observed symptoms include lethargy, rash, headache, light-headedness, fever, irritability, and muscle cramps. Data on carcinogenicity were judged inadequate for evaluation. In line with findings from animal studies, the review found several recent studies demonstrating that boron is a dynamic trace element that can affect the metabolism or utilization of numerous substances essential to life processes.

On the basis of all evidence considered, the report established a tolerable intake for boron of 0.4 mg/ kg body weight per day.

Guide to Drug Financing Mechanisms

J. Dumoulin, M. Kaddar, and G. Velasquez, 1998, vii + 55 pages (available in English; French in preparation) ISBN 92 9036 068 2 CHF 19.-/USD 17.10; In developing countries: CHF 13.30, order no. 1150461.

This book provides a practical guide to the use of economic criteria to analyze a country's pharmaceutical sector and identify ways to improve the drug supply. Addressed to decision makers responsible for formulating drug policies, the book aims to facilitate the analysis of expenditure on drugs within the context of a government's overall economic policies and priorities. With this goal in mind, the book explains the many complex economic factors that influence the drug supply and identifies the corresponding policy options available for introducing changes in different situations.

Information ranges from a discussion of strategies for avoiding surpluses or shortages of drugs, through a comparison of the advantages and disadvantages of four methods of delivering drugs to pharmacies, to the simple reminder that cost alone should never be the sole criterion for drug selection in national procurement schemes. Throughout the book, recommended policies and strategies are presented in line with the overall objective of ensuring that safe, effective, good-quality drugs are available to those who need them at the least possible cost.

The book opens with a brief analysis of three interrelated systems that shape the pharmaceutical sector: the pharmaceutical supply system, the financing system by which the manufacturers and distributors of drugs are paid, and the information system which influences consumer demand and prescribing practices.

Against this background, subsequent chapters explain how these three systems affect the performance of the pharmaceutical sector during the distinct steps of drug selection, procurement, distribution, and prescribing. Each step is discussed in terms of the objectives of a national drug policy, the processes that allow these objectives to be attained, and the structures and organizational arrangements needed to carry out these processes and attain these objectives.

The chapter on selection considers strategies for avoiding drugs of no therapeutic interest, reducing the number of drugs, and increasing the efficiency of available drugs. Methods for measuring drug costs and efficacy are also presented and illustrated with examples taken from different countries. Chapter 2 explains the advantages and disadvantages of three common strategies for drug procurement: blind confidence, systematic distrust, and cooperation. Examples from various countries are used to demonstrate the effects that specific procurement strategies can have on both immediate and future drug costs.

Distribution is covered in Chapter 3, which considers factors that influence geographical, physical, and economic access to drugs. Particular attention is given to the advantages and disadvantages of different options for financing drug consumption and preventing stock shortages, surpluses, and losses of drugs. The final chapter considers lines of action for improving prescribing practice and thus reducing the economic costs of irrational prescribing.

New Publications from ILSI Europe

Recycling of Plastics for Food Contact Use

As more packaging options are proposed for food and beverage products, the opportunities to reuse materials, especially plastics, for these purposes are growing as well. The quality and safety aspects of recycling technologies thus need to be carefully examined for the major polymer types. Plastics recycling technology for food purposes clearly must remove potential chemical contaminants to an acceptable level of safety that addresses public health concerns. With this in mind, the ILSI Europe Packaging Material Task Force convened a workshop in London (UK) in March 1997 to examine the scientific database on the safe recycling of plastics for food contact use. The discussions of the experts participating in the workshop and subsequent meetings to produce guidelines and recommendations on the subject appear in a new publication in the ILSI Europe Report Series. It covers recycling operations, feedstock for recycling, challenge tests and surrogates, as well as migration test conditions and limits.

Functional Food Science in Europe

In response to concerns from the scientific community worldwide about recent developments in the understanding of the functional food concept, ILSI Europe elaborated, in 1995, a project proposal for a European Commission Concerted Action aimed at establishing a science-based approach for the concept. The goal of this concerted action was to establish a multidisciplinary European network to (1) critically assess the science base required to provide evidence that specific nutrients positively affect physiological functions, (2) examine the available science from a function-driven rather than a nutrient-driven point of view, and (3) reach a consensus on targeted modifications of food and food constituents and options for their application.

To attain these objectives, a First Plenary Meeting was organized in 1996 in Nice (France) to assess the state of the science. Based on the results of this meeting, six areas in human physiology were identified: development, growth, and differentiation; substrate metabolism (including metabolic aspects of physical activity); defense against reactive oxidative species; cardiovascular system; gastrointestinal physiology and functions; and behavioral and psychological functions. Individual Theme Groups (ITGs) composed of industry and nonindustry scientists were established to produce theme papers that would critically review the science base of the functional food concept in each area. The exercise focused on characterizing specific body systems, assessing methodologies, identifying nutritional options to modulate functions, evaluating potential safety implications, examining the role of technology, critically assessing the required science base, and suggesting areas where further research is needed. The resulting documents were scrutinized in a Second Plenary Meeting in 1997, in Helsinki (Finland), and have now been published as a supplement to the *British Journal of Nutrition*.

Food Safety Management Tools

Throughout the world, food manufacturing, distribution, and retailing is becoming a highly complex business. Raw materials are traded on a global scale, an ever-increasing number of processing technologies are used, and a vast array of products are available to the consumer.

Such a complexity necessitates the development of comprehensive control procedures to ensure the production of safe, high-quality food.

Despite progress in medicine, food science, and the technology of food production, illness caused by foodborne pathogens continues to present a major problem of both health and economic significance. A new report describes several tools to use in an integrated

approach to the management of food safety, such as elements of Good Manufacturing Practice (GMP), the importance of applying HACCP (Hazard Analysis Critical Control Point) within a GMP framework, and a quality management system as a means of effectively managing total product quality. Although the primary focus of this report is microbiological issues, the general principles addressed are applicable to the management of chemical and physical contaminants as well.

This publication, in the ILSI Europe Report Series, was undertaken under the auspices of the ILSI Europe Risk Analysis in Microbiology Task Force.

All ILSI Europe publications are available upon written request (E-mail: marc@ilsieurope.be).

Other Books and Publications

Chemicals from Plants: Perspectives on Plant Secondary Products

Edited by N. J. Walton, Institute of Food Research, Norwich Lab., UK.

This book is principally concerned with the relatively complex small molecules produced by plants, which are important as drugs, fine chemicals, fragrances, flavors, and biologically active dietary constituents. In a wide-ranging series of thematic essays, it covers key aspects of their role in plant ecology; their metabolism in the plant; their discovery, characterization, and use; and their significance in the diet. Biotechnology, including prospects for the genetic engineering of metabolic pathways, for biotransformations and also for the production of biologically active proteins, is the focus of the final section of the book. The overall aim of the volume is to provide, in each of the selected subject areas, a personal critique which is readily accessible to the advanced undergraduate student and to the nonspecialist research worker alike.

Contents

Classes and Functions of Secondary Products from Plants (J. B. Harborne); Characterization and Control of Secondary Metabolism (A. J. Parr et al.); Agricultural Production and Extraction (S. G. Deans & K. P. Svoboda); Modern Methods of Secondary Product Separation and Analysis (T. A. von Beek); Structure Elucidation of Plant Secondary Products (G. Massiot et al.); Plant Drug Discovery and Development (M, Simmonds et al.); Conservation of Plant Resources (M. Simmonds & W. Blaney); Disease Prevention and Plant Dietary Substances (G. R. Williamson et al.); Manipulation of Plant Chemical Production by Genetic Engineering (C. R. Martin & A.. J. Michael); Production of Biologically Active Proteins in Plants (G. Lomonossoff); Biotransformations (M. C. R. Franssen et al.); Biotechnology and Plant Secondary Products—The Future (V. De Luca).

UN/ECE Comprehensive Chemical Legislation Database (CHEMLEX) on CD-ROM

The United Nations Economic Commission for Europe (UN/ECE) launched a database on chemical legislation (CHEMLEX) from 25 countries on CD-ROM. The database covers 15 sectors of the chemical industry, including asbestos, fertilizers, materials in contact with foodstuffs, transport of dangerous chemicals, and labeling. Over 600 text summaries are given, with complete reference to the original acts. The database is searchable by country, keyword, act reference, and date. Acts are chained as well (so amendments to an act can be found with the act itself). Summaries and titles are generally provided in the original language, as well as in English.

The database, which also includes European Community directives, is intended to provide useful information and guidelines for countries worldwide that still have little or no chemical legislation. It will also give manufacturing companies, trading companies, legislators, and lawyers instant access to information that is normally difficult to obtain. It should also appeal to institutes studying industrial development, trade, and investment possibilities. The research was undertaken with assistance from the European Commission.

A major nontariff barrier to trade in chemical products is the lack of harmonized legislation in the chemical industry in various countries. With many countries having very little or no chemical legislation, numerous problems arise in trade, as well as in the domestic arena. Examples of chemical legislation already in force in the major industrialized countries can be models for those countries needing to create effective legislation, preferably in harmony with existing legislation in other countries. Such legislation is necessary for improved working conditions, transportation regulations, labeling of products, environmental parameters, and other factors in the worldwide chemical industry.

Priced at USD 250, the CD-ROM may be ordered through the normal United Nations publications sales agencies or direct from the United Nations sales offices in New York or Geneva. Please quote ISBN number 92-1-100776-3 or sales number GV.E.98.0.1 7.

Further information can be obtained from: Howard Hornfeld, UN/ECE Trade Division, Enterprise Development Program, Palais des Nations, 429-3, CH-1211 Geneva 10, Switzerland

Tel: +41 22 917 32 54; Fax: +41 22 917 01 78; E-mail: chem@unece.org

Web site: http://www.unece.org/indust/chem.htm

Pesticide Leaching in Polders: Field and Model Studies on Cracked Clays and Loamy Sand

Klaas R Groen. Ministerie van Verkeer en Waterstaat. Directoraat-Generaal Rijkswaterstaat. Directie IJsselmeergebied. Lelystad 1997. ISBN 90-369-1209-1. This book deals with the topic of the role of models in the evaluation of the environmental fate of pesticides as well as the management and assessment of the risk related to their use, taking into account a very specific condition: pesticide leaching in polder areas. The study is divided in two parts: 1) data collection, and 2) development and application of a model for simulation of pesticide transport. The field study was carried out in three experimental areas, situated in the IJsselmeerpolders, differing in soil characteristics (loamy sands and cracked clay soils). The research program took into account four pesticides, 1,3-dichloropropene, metamitron, aldicarb, and simazine.

The scenario analysis showed that pesticide and soil characteristics, time of application, lateral boundary conditions, and weather conditions are all factors affecting the amount concentrating in the drain pipes and, thereby, the fraction available for leaching. Moreover, it gave fundamental information on the measures to be taken in order to reduce leaching, as follows: 1) allowing pesticide application only during a certain period; 2) increasing drain depth; and 3) decreasing preferential flow by increasing the ploughing depth.

Even though it concerns a very specific subject, this study offers a lot of general information to the reader. It is recommended not only to field experts but also to all those dealing with environmental problems related to pesticide use.

National Profile to Assess the Chemicals Management in Slovenia

Toward the Implementation of the Recommendations of Chapter 19 of Agenda 21 on the Environmentally Sound Management of Chemicals, December 1997.

Chemicals are present in all segments of human life, in all parts of their life cycle—from production, treatment processing, distribution, storing, transport and use, to chemical waste management and disposal. This book mainly concerns industrial chemicals, agricultural pesticides, biocides, and consumer chemical products. These chemicals make life possible or at least easier but, nevertheless, their impact can be harmful because the more that large quantities of chemicals are in use, their potential misuse can represent a risk to human health and the environment. Slovenia is especially sensitive to certain kinds of environmental damage because it is geographically and hydrogeologically very diverse. Furthermore, a great part of the territory is karstic with interconnected underground drinking-water resources, which means that the pollution at one part of the country could endanger many other parts.

It has been recognized that an appropriate level of chemical safety can only be reached by a joint action of all governmental and nongovernmental stakeholders involved. Thus, measures for appropriate management of chemical risks and for ensuring sustainable development must be taken with a concerted stepwise approach at all levels, including individual. In line with international recommendations and according to our own need, the Intersectoral Committee on the Management of Dangerous Chemicals (ICMDC) was established by the Government of the Republic of Slovenia in the summer of 1996. To facilitate information exchange and to avoid duplication of work, which can cause a loss of very limited financial and manpower resources, ICMDC began to work as a central coordinating, advisory, and facilitating body with the function of a catalyst. The work accomplished in these months has shown that in Slovenia in this field many things still have to be put in order, while some of them we only have to give a final touch to. To begin with rebuilding and upgrading of the system, first an assessment of the situation (a national profile) had to be prepared. Like a living organism, the chemical safety field is constantly developing in every country; therefore, the document should be revised and updated periodically and additional pieces added to the mosaic. In the countries in transition to the market economy, such as Slovenia, the situation changes quickly. The present version of the national profile was drafted before IFCS 11 in Ottawa in February 1997.

The National Profile served as a basis for the identification of potential priorities which were then set at the National Priority Setting Workshop in November 1997. According to the Resolution of the Government of the Republic of Slovenia, within the framework of a two-year pilot project, the Intersectoral Committee is to prepare a national program for integrated chemicals management. Although Slovenia has rich experience with the preparation of a national program for environment protection, the approach in this field will be different—more detailed and integrated—and instead of unisectoral, a multisectoral approach will be taken.
1000 Ljubljana, Stefanova 5, Slovenia; Tel.: (386) 61-178-605 1; Fax: (386) 61-123-1781.

Commission on High-Temperature Materials and Solid State Chemistry—II.3

Minutes of Commission Meeting in Ljubljana, Slovenia, 12–13 June 1998

Chairman's Remarks and Reports from IUPAC
Corish and Rosenblatt reported on the recent events concerning the future role and organization of IUPAC activities. The IUPAC Executive Committee (EC) on 4 April 1998 discussed the report of the Strategy Development and Implementation Committee (SDIC). The ad hoc SDIC was appointed in 1997 to develop a strategic plan for the Union and to suggest the procedure to redirect IUPAC's major scientific activities toward a project-based system, to replace the existing Division/Commission structure. The EC accepted the SDIC report and decided unanimously to recommend that the Bureau approve the SDIC proposals at their meeting in September 1998. These proposals will provide new policy for IUPAC's future development. IUPAC President Jortner sent a letter to commission officers on 21 April 1998 asking for a wide-ranging discussion of the details and ramifications of the SDIC proposals.

The summary of recommendations on the organization and management of scientific activities and the summary of formal actions required were distributed to members of Commission II.3. Under the SDIC proposals, the IUPAC Council will be asked in 1999 to terminate all existing commissions at the end of 2001. Instead of commissions, the division committees are to become the focus of scientific work in the Division, and to have overall responsibility for initiating, developing, and managing the work of the Division. The committees would solicit ideas for projects from National Adhering Organizations (NAO), National Chemical Societies, Regional Federations, IUPAC Fellows, and participants at relevant IUPAC symposia. Future projects would be carried out by Task Groups appointed for the (usually short-term) duration of the project and funded adequately to permit completion of the project in the planned time frame. A committee on Project Evaluation Criteria was recently established to advise the EC and the Bureau on criteria for the evaluation of project proposals, on the mechanism for approval of such proposals and allocation of resources, and on criteria for the assessment of the outcome of the projects. Corish is a member of this committee.

Corish asked for responses to the proposals in the SDIC Report by 31 July. In particular, opinions and proposals were sought relevant to the following items: (i) Division Committee—nomination and election of the Committee and Officers, size and responsibilities of the Committee; (ii) future of the Commissions of Division II—the need for long-term Commissions after 2001; and (iii) Project-Driven System—how will it work within the Division, how should the proposed Task Groups be organized and managed? Members of Commission II.3 were asked to communicate their comments to Chairman Spear.

Project Reports

230/23/89 Terminology for Diffusion in the Solid State
Kizilyalli reported on a previously refereed draft manuscript, "Definition of Terms for Diffusion in the Solid State", by M. Kizilyalli, J. Corish, and R. Metselaar. Corish and Chadwick volunteered to perform a final review of the manuscript, with special care taken to ensure that the symbols used are in agreement with IUPAC recommendations. They will FTP the finalized manuscript to Rosenblatt by 12 July. Rosenblatt will maintain it on a server for FTP downloading (LORENZO.WINS.LBL.Gov). The referees will be informed by e-mail that a revised manuscript is now available for their viewing. Each reviewer is being individually contacted to preserve the confidentiality of their identities.

230/24/93 Chemical Research Needed to Improve High-Temperature Processing of Advanced Ceramics
Kolar distributed a short progress report. Several suggestions for improvement and additions to the draft manuscript distributed at the Geneva meeting were received. Kolar will prepare an amended version of the report and send it by e-mail to Spear by 15 August. Spear will review and edit it before the 10 September meeting of the Inorganic Division executive committee of Corish, Rosenblatt, and Busch at Berkeley. Corish may use this draft to illustrate Commission II.3 activity in the materials field at the Bureau Meeting in Frankfurt on 26–27 September. In parallel, Kolar and coworkers will work further on the document. The revised document will be sent to commission members at the beginning of 1999 for comments and suggestions. An amended manuscript will be reviewed at the Commission II.3 meeting in Berlin in August 1999. The title of the report should be amended to read "Chemical Research Needed to Improve High Temperature Processing of Advanced Ceramic Materials".

230/27/95 Terminology of Vapor Deposition
Spear reported that Carlsson will share responsibility for managing the efforts of several experts to provide more breadth to the project. Leskala will oversee atomic layer epitaxy (ALE) terminology; Hastie will handle laser ablation terminology, and Teer will collect terminology for PVD processes. Chatillon volunteered to provide names of experts for help with the MBE terminology area. A draft report for review by the Commission is planned for the Berlin IUPAC meeting.

SC-2 (232/1/91) Characterization of Carbonaceous Materials and New Carbons
Boehm reported that the compilation of various national standards for the characterization of carbon materials is close to completion. Professor E. Heintz (U. of Buffalo, NY, USA) will send the finalized manuscript in the near future, and Boehm will forward it to the other members of SC-2 for comment without delay.

PST-18 Calculation of Equilibrium Thermodynamic Properties of High-Temperature Superconductors
Voronin submitted an extensive report entitled "Thermodynamics of High-Temperature Superconductors in Yttrium-Barium-Copper-Oxygen System, Part 1: Y-123 Solid Solution", which includes an analysis of results of experimental and theoretical investigations. About 3000 experimental results obtained in 220 miscellaneous experiments published in 57 papers have been processed simultaneously to obtain the most reliable Gibbs energy of the Y-123 solid solution in the temperature region from 250 ^{o}K to 1300 ^{o}K. A linear error model was employed for the simultaneous assessment and compared with results of the conventional weighted least squares method. The benefit of the new approach is emphasized. Voronin estimates that the project may be finished within 1.5 years.

In the discussion, the necessity was pointed out to distinguish between original scientific contributions and IUPAC commission reviews. Some of the results mentioned above have been previously published. It was concluded that the final IUPAC commission report should be edited and compared to the distributed document, by referencing previously published articles that describe experimental and calculated procedures and results. The commission report to be published in *Pure and Applied Chemistry* (PAC) should summarize conclusions developed from the review and analysis of the global body of work performed, and should explain the scientific and technological importance of the unique data analysis. The value of publication in PAC will be to inform interested readers about the existence of the collected data and a new tool for their interpretation.

Voronin will prepare a modified commission-sponsored article for PAC that summarizes conclusions and applications while referencing available journal articles that contain the original data and the full details of the analysis technique.

PST-16 Teaching of High-Temperature Materials Chemistry at Universities
Commission regrets that because of a recent accident, Balducci was neither able to attend the meeting nor to prepare an extensive report. However, Balducci informed the chairman that he would submit a report to commission members by the end of summer 1998.

WB-3 Structure and Properties of Ceramic Fibers
Lewis was not present to report, owing to the examination schedule at Warwick University. In a short written report, he informed the commission that there are new developments in the field but the progress is slow in relation to commercially available fibers. If the period as a watching brief (WB) is soon to expire, Lewis would be prepared to initiate a task force (TF); however, it is not clear that a survey, defining structure and properties, is within the meaning of an IUPAC TF. Commission members believe the project is timely and justified. It is necessary to find experts willing to help in the further definition and carrying out of the project. Lewis mentioned that he needs to reconsider his continued participation in IUPAC projects. Spear will contact Lewis to clarify this matter.

230/9/83 High-Temperature Mass Spectrometry Ionization Cross-Sections
Chatillon's report contains 3 sections (metals, ionization cross-sections, and thermodynamics), including 40 pages of text, 140 references, and a limited number of tables and figures. Data on the cross-sections proposed by Man are being considered for inclusion as an Appendix. Chatillon will convey the document to Drowart, who will complete the tables for this project during June/July. Chatillon will prepare a new draft report, which will be given to "mass spectrometry" experts before the Gordon Research Conference (GRC) on "High Temperature Materials: Processing and Diagnostics" in Plymouth, New Hampshire on 19–24 July 1998. Chatillon will not attend the conference, but Drowart and Hastie will coordinate discussions with experts at this GRC. Suggestions will be recorded and communicated to Chatillon. Chatillon and Drowart will complete the document in September. The final document, reviewed by Spear, Rosenblatt, and Corish, will be ready for review by the commission at the IUPAC meeting in Berlin in August 1999.

230/25/93 Surface Analysis of Ceramics
Lewis was not present to report. In a written report, he informed the commission that the two other contributors to this project (Dowsett and Watts) have made no further progress owing to pressure of teaching and research. Prospects for completion before the 1999 meet-

ing are poor. Spear will contact Lewis to clarify further prospects for this project.

230/29/95 Teaching Experiments in Solid State Chemistry

Kizilyalli's report includes a list of 21 experiments developed and edited by various authors. The initial two sets of experiments, edited by Kihlborg and presented at the Guildford meeting, were developed at Stockholm University and the Indian Institute of Technology at Madras, respectively. Those sets of experiments were tested by Kizilyalli in Ankara, and most were found suitable. In 1997, several new experiments developed by Kizilyalli were added to the list.

As a next step, Kizilyalli will reorganize the format of each experiment to include (1) equipment needed, (2) chemicals needed, (3) time required, and (4) safety issues at the beginning of the write-up. The plan is to make the experiments available to interested persons on the IUPAC web site. Corish will contact John Jost to accomplish this. Spear will contact Jimmie Edwards for help in preparing the web site. Spear will also contact Kihlborg to see if the experiments he submitted for this project are available on a computer disk to save work in retyping. Spear will also inform the Gordon conference participants of this project, and will ask for interest and a willingness to contribute to the testing and editing of written documents. Kizilyalli will inform the IUPAC Committee on Teaching Chemistry (she is a member) and check their interest in publicizing the availability of experiments on the IUPAC web site. Spear is willing to serve as a contact between Kizilyalli and the IUPAC web site person. He will also determine the possibility of securing IUPAC funds for secretarial help, if needed.

TF 20 Terminology Used in Sol-Gel Processing of Advanced Ceramics and Inorganic/Organic Polymeric Substances (Pool Project)

Holland was not present to report. In a written report, she informed the commission that the contributor to the project from Commission IV.I is now Dick Jones of Kent University. Holland met with Jones and other experts (John Wright and Mark Smith). She included a listing of abbreviations and terms in her report as an example of the type of information and style of presentation for the Sol-Gel Nomenclature report. The list was discussed at the UK/Ireland Sol-Gel Workshop in London in April and will be shown at the meeting of IUPAC Commission IV.I in July in Sydney. Holland will also arrange a meeting with Jones, Livage, and Hess (and possibly others) over the summer of 1998. The aim is to have a complete draft document of terms at the commission meeting in Berlin in August of 1999.

Spear will contact Holland, commend her on the work completed to date, and strongly encourage her to meet with Livage and other experts. It seems possible to secure financial support, if needed, and to complete the project and prepare the final draft document for the IUPAC meeting in Berlin.

PST-19 Thermochemical and Thermophysical Properties of Refractory Metal Carbides

Balducci was not present to report. He and De Maria will present a report in July. Chatillon may join the project after completion of the mass spectrometry cross-section project.

230/28/95 Terminology of Silicon Nitride-Based Ceramics

Metselaar was not present to report. He informed the commission that, after receiving comments from a number of reviewers, a revised proposal was published in the *J. Eur. Ceram. Soc.* and *the Bull. Amer. Ceram. Soc.* Because no additional comments were received as a result of these efforts, the manuscript should be sent to 15–25 additional reviewers. Spear will inform Metselaar to proceed.

PST-20 Classification and Nomenclature of Phosphorous Compounds

Kizilyalli's report elaborated on the need for this project and informed the commission of several inconsistencies or ambiguities in the phosphate literature. Rosenblatt had previously contacted the chairman of nomenclature commission in the Inorganic Division; however, no definite opinion was received. In order to decide on justifying this project for Commission II.3, a listing of phosphate compounds with inconsistencies or ambiguities in their naming should be sent to the nomenclature commission for their inspection and proper naming. In an accompanying letter, it should be stated that the aim of Commission II.3 is not to introduce new rules for nomenclature but, rather, to assign names according to existing rules and to classify the compounds. Kizilyalli should prepare the list and send it to Corish, who will contact the chairman of the nomenclature commission.

Potential New Projects

New projects will be affected by future IUPAC policy to support short-term projects, not titular members. The Bureau meeting in September will shed more light on this matter. Commission II.3 may propose important projects, for example, concerning materials. New commission members should be engaged in projects within their area of expertise.

Other Topics

HTMC-X in 2000
Hilpert reported that the conference will be held at Jülich from 10–14 April 2000 (Monday–Thursday). Mail asking for IUPAC sponsorship was sent to Jost, and HTMC-X has been announced in *Chemistry International* as approved. An international advisory committee has been established. Plenary lectures are foreseen as covering general overviews of alloys, ceramics, thermodynamic modeling, and CVD (coatings). Keynote lectures will be delivered by younger scientists. A visit to Jülich KFA laboratories will be arranged for Friday, 15 April. Hands-on demonstrations of thermodynamic databases will be organized. A proceedings volume may be issued by the Jülich Institute. The first circular will be issued shortly, and the conference will be announced in materials-related journals.

HTMC-XI in 2003
Rosenblatt reported that he will contact prospective organizers within months. The actual deadline for determining the location of HTMC-XI is the HTMC-X meeting in April 2000 (see above).

Commission II.3 Meeting in 1999
The commission meeting will be during the General Assembly in Berlin, 7–14 August.

Report from CTC
Kizilyalli reported. CTC Chairman Bradley summarized the future actions and some dilemmas at the CTC meeting in Geneva. His observations were distributed to Commission II.3 members. CTC launched an international critical review of chemical education, with the important objective of providing the basis for transmitting chemical principles into associated disciplines, such as materials chemistry and chemical biology. The plan is to produce approximately 10 manuscripts on suitable subjects and publish them by June 1999. CTC will work out the details of a formal agreement with UNESCO to secure funding for this project. Comments concerning this action are solicited.

D. Kolar
Secretary of Commission II.3

Prizes and Awards

Maison de la Chimie Foundation Prize

This prestigious award, created in 1986, is intended to honor an original work in chemistry of benefit to mankind, society, or nature. The year 2000 prize, to be awarded to one or several recipients, irrespective of nationality, has a value of 150,000 FF.

All entries must be presented through a learned society or through a national or international scientific organization, such as IUPAC. Entry forms, a report on the work of candidates, and copies of the most significant publications related to this work must be registered by the Secretariat of the Maison de la Chimie Foundation before 15 May 1999. Entries will be judged by an international jury composed of a chairman and 10 prominent members recognized for their work in chemistry. The jury for the year 2000 prize includes three former laureates (Peter B. Dervan, Professor of Chemistry, California Institute of Technology, Pasadena, CA, USA, 1996; Claude Helene, Membre de l'Institut, Professeur au Museum National d'Histoire Naturelle, Directeur Scientifique du Groupe Rhone-Poulenc, 1996; and Professor Herbert W. Roesky, Institut fur Anorganische Chemie der Universitat Gottingen, 1998), and six scientists whose nationality is other than French. The jury will choose the prize winner by majority vote, and the laureate will be invited to present a lecture on his or her work at the award ceremony on 18 January 2000 at the Maison de la Chimie in Paris. Unsuccessful entries may be renewed for subsequent awards of the prize.

For entry forms or additional information, contact the Secretariat, Prix de la Fondation de la Maison de la Chimie, 28, rue Saint-Dominique, 75341 Paris Cedex 07, France, Tel: 01 40 62 27 00; Fax: 01 40 62 95 21.

King Faisal International Prize

The 1999 winners of the annual King Faisal International Prize (KFIP) for Science (Chemistry) and Medicine (Allergic Diseases) have been announced in Riyadh, Saudi Arabia.

Professors Ryoji Noyori (Chemistry Department, Nagoya University, Nagoya, Japan) and Dieter Seebach

(Laboratory of Organic Chemistry, Federal Polytechnic School ETH, Zurich, Switzerland) have been honored for their outstanding work in developing new methods for the preparation of organic chiral molecules and for the achievement of selective and efficient chemical synthesis. Their contributions enable the manufacture of new compounds with enormous benefits for mankind, ranging from agriculture to medicine. Professor Noyori's work has numerous applications ranging from the formation of many natural products, such as vitamins, nucleic acids, prostaglandins, and alkaloids, to industrial processes. Professor Seebach's work involves the development of new synthetic methods and the use of a wide range of procedures to investigate new organic compounds.

Professors Patrick G. Holt (Senior Principal Research Fellow, National Health and Medical Research Council of Australia, Perth, Australia) and Stephen T. Holgate (Medical Research Council Clinical Professor of Immunopharmacology, University of Southampton, UK) have been honored for their work on respiratory allergies. Professor Holt's pioneering studies on the respiratory immune responses to inhaled allergens have major implications on understanding asthma. His experimental and clinical studies on atopic sensitization and immune modulation very early in life have potential applications in the prevention of allergies in infants. This experimental work could well pave the way for the development of vaccines for the prevention of asthma. Professor Holgate's research has focused on asthma as an inflammatory disease and demonstrated the role of chemical signals from mast cells which play a key role in allergies and the role of specific immune cells in prolonging the inflammatory response. His research on asthma has also included the role of viral infections, fibrosis, and genetic predisposition to allergic diseases.

The KFIP Science and Medicine awards were introduced in 1982 and 1983, respectively, and three KFIP laureates have gone on to win Nobel Prizes. Nominations for each KFIP are accepted from relevant institutions and organizations from around the world, and independent experts examine the work of nominated candidates during two elimination rounds. Finalists are judged by autonomous specialist selection committees in Riyadh. Each award includes a gold medal and a cash endowment of SR 750,000 (USD 200,000).

Nominations for the year 2000 KFIP in Science (Biology) and Medicine (Aging) are due by May 31, 1999. Further information on nomination procedures can be obtained from the General Secretariat, King Faisal International Prize, P.O. Box 22476, Riyadh 11495, Saudi Arabia, Tel: +966-1-465-9030; Fax: +966-1-465-6524; E-mail: infokff@kff.com, *Web site: http://www.kff.com.*

James Economy Wins American Chemical Society Mark Award

Professor James Economy, chairman of the materials science and engineering department at the University of Illinois, Champaign-Urbana, IL, USA and President of the IUPAC Macromolecular Division Committee (IV) from 1994–1997, has won the 1998 Herman F. Mark Polymer Chemistry Award. This award, sponsored by Dow Chemical Company, consists of an honorarium and a plaque and is presented by the ACS Division of Polymer Chemistry in recognition of outstanding research and leadership in polymer science.

Professor Economy has played a key role in macromolecular research and development during his 45-year career in industry and academia. His work has included the design and development of new polymer systems, such as liquid crystalline materials for structural uses, recyclable thermosetting resins, flame-resistant textiles, new fibers for environmental control, microelectronic devices, and inorganic preceramics. He has published over 170 papers and his name appears on 60 U.S. patents.

Conference Announcements

12th International Symposium on Polymer Analysis and Characterization (ISPAC-12), 28–30 June 1999, La Rochelle, France

This three-day Symposium will consist of invited lectures, poster sessions, discussions, and information exchange on the latest developments involving polymer characterization approaches, techniques, and applications. Special sessions will focus on polymer separations, characterization of complex systems, polymer structural analysis, morphology, dynamics, and analytical aspects of polymer aging and degradation, as well as other areas of polymer analysis.

Preceding the Symposium, there will be a one-day course on "Techniques for Polymer Analysis and Characterization". Course content will include liquid chromatography of polymers, mass spectrometry, solution NMR, and scanning probe microscopy.

For further information, please contact Professor

Josef Janca, Universite de la Rochelle, Avenue Marillac – 17042 La Rochelle Cedex 01, E-mail: jjanca@cri.univ-lr.fr; *Tel: 33 546 458 218; Fax: 33 546 458 243; ISPAC web site: http://www.chem.cmu.edu/ispac/.*

13th Bratislava International Conference on Polymers: Separation and Characterization of Macromolecules, 4–9 July 1999, Bratislava, Slovakia

This Conference, sponsored by the Polymer Institute of the Slovak Academy of Sciences, the Slovak Chemical Society, and the Slovak Society of Industrial Chemistry, will include lectures and poster sessions on liquid chromatography of synthetic and biological macromolecules, development of size-exclusion chromatography including coupled procedures, liquid chromatography of oligomers, and unconventional and emerging techniques of separation and characterization of macromolecules.

For further information, please contact Dr. Dusan Berek, Polymer Institute, Slovak Academy of Sciences, Dubravska cesta 9, SK-842 36, Bratislava, Slovakia, E-mail: upoldber@savba.sk *or berek@savba.sk; Tel: +421-7-378 2306 or 378 2254; Fax: +421-7-375 923 or 377 414; Web site: http://www.savba.sk/polymer/CONFER.HTM or http://www.savba.sk/~upoldber/.*

17th ICHC International Congress of Heterocyclic Chemistry, 1–6 August 1999, Vienna, Austria

For information, contact Professor Dr. Fritz Sauter, Chairman of the ICHC 1999, Institute of Organic Chemistyr, 154, Vienna University of Technology, Getreidemarket 9, A-1060 Vienna, Austria, E-mail: jfoehli@pop.twien.ac.at; Fax: +43 1 5866931; Web site: http://www.sbq.org.br/DIV-SO/congres.htm.

58th Chemical Conference and Exhibition and 7th Caribbean Chemical Conference, 3–6 August 1999, Hato Rey, Puerto Rico

For information, contact Colegio de Quimicos de Puerto Rico, 658 Calle Peñuelas, Hato Rey, Puerto Rico 00918, Tel: (787) 763-8070 or (787) 753-2027; Fax: (787) 758-2615 or (787) 753-2022.

4th International Symposium on Philosophy, History, and Education in Analytical Chemistry, 3–4 September 1999, Vienna, Austria

The featured topic of this Symposium will be "Analytical Chemistry and the Law".

For further information, please contact Professor Wolfhard Wegscheider, Department of General and Analytical Chemistry, University of Leoben, Franz-Josef-Strasse 18, A-8700 Leoben, E-mail: wegschei@unileoben.ac.at; Tel: ++43-3842-402-340; Fax: ++43-3842-402-543; Web site: http://www.unileoben.ac.at/~chemie/wegschei.html.

Symposium on Common Themes in Transcription and RNA Processing, 6–8 September 1999, Buenos Aires, Argentina

This Symposium has been organized by the University of Buenos Aires, Argentina; MRC, Edinburgh, Scotland, UK; and ICGEB, Trieste, Italy. It will be limited to 20 participants, who will discuss their experience with transcriptional regulation of eukaryotic genes, mechanisms of mRNA alternative splicing, coupling between transcription and mRNA processing, and factors involved in RNA processing.

For more information, please contact Professor Alberto R. Kornblihtt, Lab. Fisiologia y Biologia Molecular (LFBM), Dpto. De Ciencias Biológicas, Fac. De Ciencias Exactas y Naturales, Univ. De Buenos Aires, Ciudad Universitaria, Pabellón II, 1428 Buenos Aires, Argentina, E-mail: ark@bg.fcen.uba.ar; Tel: (541) 576-3386/68; Fax: (541) 576-3321.

113th AOAC International Annual Meeting and Exposition, 26–30 September 1999, Houston, Texas, USA

This meeting focuses on analytical methodology and laboratory management for chemists, microbiologists, and other scientists working in analysis of foods, beverages, feeds, fertilizers, pesticides, soil, water, human and animal drugs, hazardous wastes, forensics, and other related areas.

Scheduled program topics include adulteration of foods; advances in nutrient analysis; analytical chemistry of phycotoxins in seafood and drinking water; detection of genetically modified organisms (GMO); feeds, seeds, and fertilizers; food safety initiative—seafood, produce, and beef; mega reg (pathogen reduction); proficiency testing; uncertainty of results; and the Wiley Award Symposium on Immunochemical Tech-

niques in Food Contaminant Analysis.

The meeting will also feature numerous poster sessions and Regulatory Roundtables on nutrient and dietary supplements and on Hazard Analysis Critical Control Points (HACCP) and accreditation, where representatives from regulatory agencies worldwide will talk about upcoming programs and meet in small groups to answer questions, learn about concerns, and discuss issues in depth.

A large Expo will display the latest in analytical laboratory equipment and services, and will provide the opportunity to discuss needs with vendors and learn about how to improve your laboratory.

Training courses held before and after the meeting will include sessions on implementing good laboratory practices (GLPs); intralaboratory (in-house) analytical method validation; ISO9000, ISO/IEC Guide 25, and the laboratory; practical SFE methodology for the AOAC methods program; quality assurance for analytical laboratories; quality assurance for microbiological laboratories; and statistics for method development.

For more information, contact the AOAC International Meetings and Education Department, E-mail: meetings@aoac.org; Tel: +1-800-379-2622 or +1-301-924-7077; Fax: +1-301-924-7089; Web site: http://www.aoac.org. The web site will have regularly updated information about the meeting.

8th International Conference on Multiphoton Processes, 3–8 October 1999, Monterey, California, USA

ICOMP Conference topics include above threshold ionization; high-order harmonics – XUV radiation processes; novel ultrashort pulse effects on atoms and molecules; multiphoton ionization, dissocation, and Coulomb explosion of molecules and clusters; coherent control of atomic and molecular processes (Rydberg wave packet creation, manipulation, and characterization; vibrational wave packet control); stabilization; and relativistic effects in strong fields.

For up-to-date information, see the conference web site at http://www.engr.ucdavis.edu/~icomp8/icomp.html. Also, e-mail or write Conference Co-Chairs Rick Freeman and Ken Kulander, College of Engineering, Department of Applied Science Davis-Livermore, University of California, Davis, Hertz Hall, P.O. Box 808, L-794, Livermore, CA 94550 at jekeene@ucdavis.edu with your name, address, telephone, and fax numbers to make sure you will get all subsequent announcements regarding the conference.

Conference Calendar

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

1999

Functional Dyes

31 May–4 June 1999
4th International Symposium on Functional Dyes, Osaka, Japan.
Prof. Yasuhiko Shirota, Faculty of Engineering, Osaka University, Yamadaoka, Suita, Osaka 565-0871, Japan.
Tel.: +81 6 879 7364
Fax: +81 6 877 7367
E-mail: isfd@chem.eng.osaka-u.ac.jp

Polymer Systems

7–10 June 1999
3rd International Symposium on Molecular Mobility and Order in Polymer Systems, St. Petersburg, Russia.
Prof. A. A. Darinskii, Chairman; Mrs. I. Kovalenko, Coordinator; Institute of Macromolecular Compounds, Bolshoy pr. 31, St. Petersburg, 199004 Russia.
Tel.: +7 812 213 2907
Fax: +7 812 218 6869
E-mail: IMC@macro.spb.su

Biodiversity and Bioresources

11–15 July 1999
2nd International Conference on Biodiversity and Bioresources—Conservation and Utilization, Belo Horizonte, Minas Gerais, Brazil.
Prof. Alaide Braga de Oliveira, Faculdade de Farmacia—UFMG, Av. Olegario Maciel 2360, 30.180-112 Belo Horizonte, Brazil.
Fax: +55 31 337 9076
E-mail: fernao@dedalus.lcc.ufmg.br

Polymerization Methods

12–15 July 1999
39th Microsymposium, Advances in Polymerization Methods: Controlled Synthesis of Functionalized Polymers, Prague, Czech Republic.
Dr. Jaromir Lukas, Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic, Heyovskeho na. 2, 162 06 Praha 6, Czech Republic.
Tel.: +420 2 360341
Fax: +420 2 367981
E-mail: sympo@imc.cas.cz

CHEMRAWN - Postponed

~~20–25 June 1999~~ To be rescheduled
CHEMRAWN XII—African Food Security and Natural Resource Management: The New Scientific Frontiers,
Nairobi, Kenya.
Dr. Pedro Sanchez, International Center for Research in Agroforestry, P.O. Box 30677, Nairobi, Kenya.
Tel.: +254 2 521003
Fax: +254 2 520023
E-mail: p.sanchez@cgnet.com

Memorial K. I. Zamaraev

28 June–2 July 1999
International Memorial K. I. Zamaraev Conference on Physical Methods for Catalytic Research at the Molecular Level, Novosibirsk, Russia.
Prof. V. N. Parmon, Boreskov Institute of Catalysis, 5, Prosp. Akad. Lavrentieva, Novosibirsk, 630090, Russia.
Tel.: +7 3832 343269
Fax: +7 3832 343056
E-mail: parmon@catalysis.nsk.su

Advanced Materials

14–18 July 1999
1st IUPAC Workshop on New Directions in Chemistry. Workshop on Advanced Materials: Nanostructured Systems (IUPAC-WAM-1), Hong Kong.
Prof. M. A. El-Sayed, School of Chemistry and Biochemistry, Georgia Institute of Technology Atlanta, GA 30332-0400, USA.
Tel.: +1 404 894 0292
Fax: +1 404 894 0294
E-mail: mostafa.el-sayed@chemistry.gatech.edu

Organo-Metallic Chemistry

18–22 July 1999
10th International Symposium on Organo-Metallic Chemistry Directed Towards Organic Synthesis (OMCOS 10), Versailles, France.
Prof. J. P. Genet, Laboratoire de Synthese Selective Organique et Produits Naturels, E.N.S.C.P.—UMR CNRS 7573, 11 rue Pierre et Marie Curie, 75231 Paris Cedex 05, France.
Tel.: +33 1 44 276743
Fax: +33 1 44 071062
E-mail: genet@ext.jussieu.fr

Carotenoids

18–23 July 1999
12th International Symposium on Carotenoids, Cairns, Australia.
Prof. George Britton, School of Biological Sciences, The University of Liverpool, Crown Street, Liverpool, L69 3BX, UK.
Fax: +44 (151) 794 4349.

Rheology of Polymer Systems

19–22 July 1999
19th Discussion Conference on the Rheology of Polymer Systems, Prague, Czech Republic.
Dr. Jaromir Lukas, Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic, Heyovskeho na. 2, 162 06 Praha 6, Czech Republic.
Tel.: +420 2 360341
Fax: +420 2 367981
E-mail: sympo@imc.cas.cz

Ionic Polymerization

19–23 July 1999
International Symposium on Ionic Polymerization, Kyoto, Japan.
Dr. Shiro Kobayashi, Department of Materials Chemistry, Graduate School of Engineering, Kyoto University, Kyoto 606-01, Japan.
Tel.: +81 75 753 5608
Fax: +81 75 753 4911
E-mail: kobayashi@mat.polym.kyoto-u.ac.jp

Visas

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

Analytical Science

25–30 July 1999
Analytical Science into the Next Millennium (SAC 99), Dublin, Ireland.
Prof. Malcolm R. Smyth, Faculty of Science, Dublin City University, Dublin 9, Ireland.
Tel.: +353 1 704 5308
Fax: +353 1 704 5032
E-mail: smythm@ccmail.dcu.ie

Solution Chemistry

26–31 July 1999
XXVI International Conference on Solution Chemistry, Fukuoka City, Kyushu, Japan.
Prof. Hitoshi Ohtaki, Department of Chemistry, Faculty of Science and Engineering, Ritsumeikan University, 1-1-1 Noji-Higashi, Kusatsu 525, Japan.
Tel.: +81 775 61 2777
Fax: +81 775 61 2659

E-mail:
ohtaki@bkc.ritsumei.ac.jp

Plasma Chemistry

2–6 August 1999
14th International Symposium on Plasma Chemistry, Prague, Czech Republic.
Prof. M. Hrabovský, Institute of Plasma Physics, Za Slovankou 3, P.O. Box 17, 182 21 Praha 8, Czech Republic.
Tel.: +420 2 824751
Fax: +420 2 8586389
E-mail: hrabov@ipp.cas.cz

IUPAC General Assembly

7–13 August 1999
IUPAC Secretariat.
Tel.: +1 919 485 8700
Fax: +1 919 485 8706
E-mail: secretariat@iupac.org

IUPAC Congress

14–19 August 1999
Frontiers in Chemistry: Molecular Basis of the Life Sciences, Berlin, Germany.
Gesellschaft Deutscher Chemiker– GDCh, PO Box 90 04 40, 60444 Frankfurt Am Main, Germany.
Tel.: +49 69 7917 358/360/366
Fax: +49 69 7917 475
E-mail: tg@gdch.de

Colloquium Spectroscopicum Internationale

5–10 September 1999
31th Colloquium Spectroscopicum Internationale 1999, Ankara, Turkey.
Prof. Dr. O. Yavuz Ataman, Department of Chemistry, Middle East Technical University, TR-06531 Ankara, Turkey.
Tel.: +90 312 210 3232
Fax: +90 312 210 1280
E-mail:
xxxicsi@rorqual.cc.metu.edu.tr

Macromolecule-Metal Complexes

6–10 September 1999
8th International Symposium on Macromolecule-Metal Complexes (MMC-VII), Tokyo, Japan.
Prof. Eishun Tsuchida, Department of Polymer Chemistry Waseda University Toyko 169-50, Japan.
Tel.: +81 3 5286 3120
Fax: +81 3 3209 5522
E-mail:
w169988@mn.waseda.ac.jp

Organic and Organoelement Chemistry

7–11 September 1999
Horizons of Organic and Organoelement Chemistry, to the memory of Prof. A. N. Nesmeyanov, on the 100th anniversary of his birth, Moscow, Russia.
Prof. Y. N. Bibnov, INEOS, Vavilov str. 28, Moscow.
Tel.: +7 (095) 135 6165
Fax: +7 (095) 135 5085
E-mail: dir@ineos.ac.ru

Toxicology

6–10 November 1999
4th Congress of Toxicology in Developing Countries, Antalya, Turkey.
Prof. Semra Sardas, Gazi University, Faculty of Pharmacy Toxicology Department, TR 06330 Ankara, Turkey.
Tel./fax: +90 312 212 30 09
E-mail: ek03-k@tr-net.net.tr

2000

Bio-organic Chemistry

30 January–4 February 2000
5th IUPAC Symposium on Bio-Organic Chemistry (ISBOC-V), New Delhi, India.
Prof. S. Ranganathan, Biomolecular Research Unit, Regional Research Laboratory, Trivandrum 695 019, India.
Tel.: +91 471 491 459
Fax: +91 471 490 186

High Temperature Materials Chemistry

4–10 April 2000
10th International Conference on High Temperature Materials Chemistry, Aachen, Germany.
Prof. K. Hilpert, Forschungszentrum Julich GmbH, Institut fur Werkstoffe der Energietechnik (IWE 1), 52425 Jülich, Germany.
Tel.: +49 2461 61 3280
Fax: +49 2461 61 3699
E-mail: k.hilpert@fz-juelich.de

Mycotoxins and Phycotoxins

21–25 May 2000
10th International IUPAC Symposium on Mycotoxins and Phycotoxins, Sao Paulo, Brazil.
Dr. Myrna Sabino, Instituto Adolfa Lutz, AV Dr. Arnaldo 355, Sao Paulo, Brazil, 01246-902.
Fax: +455 (11) 853 3505
E-mail: Myrna@Sti.COM.BR

Organic Synthesis

1–5 July 2000
13th International Conference on Organic Synthesis (ICOS-13), Warsaw, Poland.
Prof. M. Chmielewski, Institute of Organic Chemistry, Kasprzaka 44, 01-224 Warsaw 42, PO Box 58, Poland.
Tel.: +48 22 631 8788
Fax: +48 22 632 6681
E-mail: icho-s@ichf.edu.pl

Macromolecules

9–14 July 2000
38th International Symposium on Macromolecules (MACRO 2000), Warsaw, Poland.
Prof. Stanislaw Penczek, Polish Academy of Sciences, ul. Sienkiewicza 112, 90363 Lodz, Poland.
Tel.: +48 42 81 9815
Fax: +48 42 684 7126
E-mail:
spenczek@bilbo.cbmm.lodz.pl

Coordination Chemistry

9–14 July 2000
34th International Conference on

Coordination Chemistry (34-ICCC), Edinburgh, Scotland.
Prof. P. Tasker, Chairman, Dr. John F. Gibson, Secretary, The Royal Society of Chemistry, Burlington House, London W1V OBN, UK.
Tel.: +44 171 440 3321
Fax: +44 171 734 1227
E-mail: gibsonj@rsc.org

Polymers in Medicine

17–20 July 2000
40th Microsymposium Polymers in Medicine, Prague, Czech Republic.
Dr. Jaromir Lukas, Institute of Macromolecular Chemistry, Academy of Science of the Czech Republic, Heyovskeho na. 2, 162 06 Praha 6, Czech Republic.
Tel.: +420 2360341
Fax: +420 2367981
E-mail: sympo@imc.cas.cz

Photochemistry

22–27 July 2000
18th Symposium on Photochemistry. "Photochemistry into the New Century", Dresden, Germany.
Prof. Dr. Silvia E. Braslavsky, Max-Planck Institut fuer Strahlenchemie, Postfach 101365, D-45413 Muelheim an der Ruhr, Germany.
Tel: +49 (208) 306 3672
Fax: +49 (208) 306 3951
E-mail: braslavskys@mpi-muelheim.mpg.de

Chemical Thermodynamics
6–11 August 2000
16th IUPAC Conference on Chemical Thermodynamics, Halifax, Nova Scotia, Canada.
Prof. M. A. White, Department of Chemistry, Dalhousie University, Halifax, Nova Scotia B3H 4J3, Canada.
Tel./Fax: +1 902 494 3894
E-mail: Mary.Anne.White@DAL.CA

Thermal Analysis and Calorimetry

14–18 August 2000 12th International Congress on Thermal Analysis and Calorimetry, Copenhagen, Denmark.
Dr. O. Toft Sorensen, Materials Research Departmen,t Riso National Laboratory DK-4000, Roskilde, Denmark.
Tel: +45 4677 5800
Fax: +45 4677 5758
E-mail: o.toft.sorensen@risoe.dk

Natural Products

1 September 2000
22nd International Symposium on the Chemistry of Natural Products, Sao Paulo, Brazil.
Dr. M. Fátima das G.F. da Silva, Universidade Federal de Sao Carlos, Depto. de Quimica, Via Washington Luiz, km 235, CP676, Sao Carlos, Brazil.
Tel.: +55 16 274 8208
Fax: +55 16 274 8350
E-mail: dmfs@power.ufscar.br

How to Apply for IUPAC Sponsorship

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

Biotechnology

3–8 September 2000
11th International Biotechnology Symposium, Berlin, Germany.
Prof. G. Kreysa, DECHEMA eV—c/o 11th IBS, Theodor-Heuss-Allee 25, 60486 Frankfurt/Main, Germany.
Tel.: +49 69 7564 205
Fax: +49 69 7564 201
E-mail: info@dechema.de

Food Packaging

8–10 November 2000
2nd International Symposium on Food Packaging—Ensuring the Safety and Quality Food, Vienna, Austria.
Dr. L. Contor, ILSI Europe, 83, Avenue E. Mounier, Box 6, B-1200, Brussels, Belgium.
Tel.: +32 (2) 762 0044
Fax: +32 (2) 771 0014
E-mail: laura@ilsieurope.be

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