Research and Training in Medicinal Chemistry in South and Central America and Sub-Saharan Africa

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Introduction

Improving therapeutic and sanitary conditions in different countries is a noble objective that, at present, receives much attention from diverse organizations and governments throughout the world. However, it is well known that therapeutic needs differ from country to country. For example, in some countries, the principal health problems are linked to cardiovascular diseases, degenerative diseases, and cancer, while in others, infectious diseases are the principal causes of morbidity and mortality. In each of these cases, medicine, as a sanitary tool, is part of the universal heritage, with important implications for sanitary and economic interests. Medicinal chemists are the health professionals charged with the responsibility of synthesizing new compounds for testing as part of the discovery process for new medicines.

IUPAC's Medicinal Chemistry Section decided to gather statistical and anecdotal information about the collaboration and the barriers to progress in drug discovery among countries. We were particularly interested in those countries that are at present unable to contribute a significant part of their resources to research and education in the discovery of new medicinal agents. Our initial actions are intended to determine the current situation; subsequently we will seek channels to facilitate better communication between countries. Here we publish the results of our first study, with the aim of stimulating international contact and collaboration.

This first review considers South and Central America and sub-Saharan Africa. A subsequent study will include other geographic areas of interest, such as Asia.

Members of IUPAC Medicinal Chemistry Section

Work Rationale

A medicinal agent is part of the universal heritage of a nation, in spite of the difference between countries that carry out research on new medicinal agents and those countries that are only consumers of medicinal agents. There are countries that promote medicinal chemistry in their universities, research centers, and industrial companies, while in some others, it is common knowledge that this practice is nonexistent. In others still, it is unknown whether this practice is carried out. The world is constantly changing, and great civilizations have disappeared while new ones have emerged. In this context, is the present situation, in which there are countries that carry out research *versus* countries that only use the results, likely to continue in the future?

The process of discovering medicinal agents contains both old and new elements: the techniques are new, while imagination is old; the instrumentation is new, but careful and well-documented observation is old; and the reporting methods are new and yet communication, as the most characteristic concept for defining humanity, is old. While large research groups usually carry out discovery of medicinal agents, small groups can also be successful when they know their profession well and when their members are researchers of great talents. The discovery and invention of new medicinal agents calls for well-endowed libraries, but access to these installations no longer requires the immediate physical presence of the researcher; such access can be remote. The discovery and invention of new medicinal agents also requires information, but this tool is found not *only* in traditional libraries. Can we simply ignore old civilizations that have conserved a traditional medicine which has proved itself effective, despite its vicissitudes?

Events relating to this question date back many years, for example, to the discovery of America in 1492. This example can be applied to today's experience. A continent that was well developed in the arts, philosophy, and sciences, met up with another continent whose development, in general, was very different. These circumstances changed the history of all humanity. But it was in the field of medicine and the area of therapeutic remedies where the great revolution in therapeutics would take place. What has happened since then? The developed countries have considered the traditional medicines of the New World to be of great interest, but they have carried out their research *outside* the newly discovered territories. This generalization is applicable to Africa, Central America, and South America and has resulted in the development of both research and the derived clinical experience in countries other than those where the native medicinal plants had been found. Thus, many compounds within the scope of modern therapeutics have their origin in plants used in traditional cultures for therapeutic purposes. Current studies with *Taxus* and *Uncaria* are examples of this phenomenon.

As a result, the panorama is divided as in the 16th century; however, the situation is not the same. The 21st century will be important for many reasons. The countries of South and Central America and Africa are finding their way in social, political, and even scientific fields. In the near future, true collaboration among countries can be an important alternative, among others, for the global development of medicinal chemistry. Possibly, it is in *this* context that medicinal chemistry should be developed in the next century.

Cooperation already exists between equals, i.e., well-developed companies and well-developed research centers. The time has come for these organizations to cooperate with lesser-developed institutions. Contemplating our planet Earth from up on the Moon clarifies many things with regard to differences between races, countries, cultures, and levels of industrial development.

With the proposal to search for universal cooperation in the field of medicinal chemistry, the IUPAC group has formulated a work plan divided into two phases:

- Develop an awareness of the true situation of medicinal chemistry in the different geographic areas of the world.
- Recommend a proposed set of actions to achieve more effective cooperation.

This report presents and discusses the results of a written questionnaire and interviews carried out in Central and South America and in sub-Saharan Africa.

General Considerations

The survey was designed to cover four distinct areas:

- teaching of medicinal chemistry
- research in medicinal chemistry
- opportunities for development of research, teaching, and training in the field of medicinal chemistry
- cooperation in practical training, teaching, and research in medicinal chemistry

Survey Recipients

Addressees of the survey included South and Central American countries and sub-Saharan Africa. Ten surveys were distributed by mail to recipients in Chile (B. K. Cassels and S. Sepúlveda-Boza), Perú (E. Montoya), Nigeria (M. O. Fatope and S. A. Adesanya), Cameroon (N. Barthelemy and B. L. Sondengam), Zimbabwe (L. F. S. Chagonda), Ethiopia (D. Abate), and Madagascar (P. Rasoanaivo).

Surveys were carried out directly by way of interviews in 15 countries of South and Central America. Interviewees included Argentina (G. D. Ferraro), Bolivia (A. G. Turba), Brazil (A. Braga de Oliveira, A. J. Lapa, and E. Barreiro), Colombia (R. Pinzón), Costa Rica (G. A. Mora), Cuba (R. Pellón), Chile (B. Cassels, E. González, and P. Huenchuñir), Ecuador (X. Chiriboga), Guatemala (A. Cáceres), Panamá (M. P. Gupta), Paraguay (E. A. Ferro), Peru (E. Montoya and O. Lock), Dominican Republic (M. Vásquez), Uruguay (E. Manta and G. Seoane), and Venezuela (J. N. Domínguez).

Results and Analysis of the Answers Received

Results and analysis are grouped according to the four areas described under "General Considerations" above.

Teaching of Medicinal Chemistry

In this section of the questionnaire, a request was made for information concerning the type of institution where medicinal chemistry is taught, the strong points and deficiencies observed in the system, and the perceived needs and actual situation concerning collaboration with other countries.

The fundamental situation is that teaching of medicinal chemistry, as currently defined, is not present at all in the developing countries; however, complementary disciplines such as organic chemistry, pharmacognosy, and pharmacology are considered. In some cases, studies in medicinal chemistry are related to the identification and preparation of biologically active chemical entities, not new chemical entities.

Results of the surveys indicate that studies related to medicinal chemistry are dispersed throughout different institutions and reflect interest in considering medicinal chemistry as a new discipline to be included in the curriculum.

Interesting initiatives have been found in the promotion of medicinal chemistry education. One noteworthy example is that of a group of professors from

Brazil (56 Schools of Pharmacy) who are working on new study programs, both academic and training, incorporating internationally recognized tools. This type of initiative is not unique in South America, and a Peruvian group can be cited as one more example. Argentina is yet another interesting case where studies in medicinal chemistry are adapted to current parameters used by those countries with a long tradition in this specialty.

From a teaching standpoint, the needs are, in general, substantial and important. Three areas require scrutiny: (1) teaching staff, (2) reference literature, and (3) reagents and equipment. Teaching staff, in general, are well trained and quite interested in the subject. Very often, many of these professors have had long stays in prestigious universities and research centers as part of their training. Making adjustments within the field of education to allow professors from related disciplines to contribute to the task of teaching medicinal chemistry does not appear to present special difficulties. From a reference literature standpoint, important needs have been found. Lack of a research tradition, vital for consolidating libraries of reference materials, and economic problems in coping with the cost of these essential tools have contributed to important deficiencies in the bibliographic area. Lack of adequate reagents is equally important. Once again, the economic aspects conflict with the teaching practice.

Aid is needed in all three areas of teaching. Experts are needed to give courses in the various institutions surveyed. These experts need to be able to collaborate in drafting training programs and to be able to receive professors for training in their universities. Material aid for acquisition of reference literature and of supplies for practical training in laboratories is a foremost necessity. In addition, inadequate maintenance of laboratory equipment by supplier companies is a frequent problem.

Research in Medicinal Chemistry

This section of the questionnaire investigated the offerings and needs of research centers and personnel dedicated to the study of medicinal chemistry.

Research in medicinal chemistry in the countries surveyed is and has historically been centered almost exclusively on the field of natural products. This situation can be traced to considerable historical knowledge of plants with medicinal activity in cultures whose origins are very remote, and to the circumstance that little effort has been put into technology and scientific investigation in the search for and improvement of active compounds by molecular manipulation.

All those who answered the questionnaire showed great interest in not being mere suppliers of plants. In order to upgrade medicinal chemistry research in developing countries by taking natural products as a starting point, it is necessary to consider the following:

- Strengths: correct identification of plants (in general, good botanists exist in these countries), gathering of plant material, and preparation of extracts.
- Weaknesses: difficulties in determination of biological activities, validation of extracts, determination of structures responsible for specific biological activity, and industrialization and commercialization.

Independent of the degree of scientific development, there is considerable interest in entering the field of medicinal chemistry research. Scientific authorities in the countries surveyed are particularly interested in collaborating on research relevant to natural products with biological activity. Most importantly, authorities of the countries studied consider the active plants to be part of their heritage and a possible source of wealth. They are aware of the fact that they are obliged to attempt, by all means, to retain the greater part of the resulting capital gains. In some cases, bureaucratic requirements necessary for obtaining plants or extracts from their place of origin are overwhelming, and failure to satisfy these requirements can result in judicial action.

Opportunities for Development of Research, Teaching, and Training in Medicinal Chemistry

Although natural products are of greatest interest to the countries surveyed, possibilities for collaboration with countries that are leading the way in research and education in medicinal chemistry are so diverse that they could cover practically any area of interest in the therapeutic field.

In a true sense of collaboration, it is important to work on questions that are characteristic of the countries surveyed. A representative example is Chagas' disease, or malaria. There are also diseases, such as AIDS, that were once restricted to certain countries but are now a universal problem. An illness such as diarrhea, no longer considered to be a significant problem in developed countries, is of great concern in the countries surveyed. Ophthalmologic diseases are another example of interest to developing societies, where there is a different focus from that in developed countries. The approach to treating these diseases can be considered, at least partially, from a medicinal chemistry standpoint.

All of the aforementioned examples are of interest to countries that are developing medicinal chemistry programs. The point here is that working collaboratively on these issues is not only resulting in a great contribution to development of and interaction with other societies, but it is also leading to the discovery of new opportunities for those societies that have found their way into the field of medicinal chemistry.

Cooperation in Practical Training, Teaching, and Research in Medicinal Chemistry

The need for increased cooperation appears in all of the questionnaire responses. The impression created in this regard is that there are countries that circulate on a railway on board a train while others run alongside asking for help to get on. The countries on board the train must extend a hand to the countries that are not on board by responding to their requests.

Requests are very diverse. Countries such as Cameroon are considering aid, including in its initial stages, for commercializing plants in which active compounds appear. In general, cooperation is requested for correct preparation of extracts. In other cases, requests are related to the identification of active molecules and, in still others, to the determination of biological activities. Implicit in all the responses is a desire to be able to participate in the processes of research and development so as not to remain mere suppliers of plants.

Cooperation can be set up along three fundamental lines of action:

- courses, seminars, etc., that foster relationships between institutions and persons within the teaching field
- joint scientific investigations and research projects, emphasizing activities that allow for development of research centers
- greater presence of pharmaceutical companies in scientific collaboration with those countries that sell their products

Comments

Survey responses have not been numerous enough to allow us to propose a statistical study of much significance. Nevertheless, certain tendencies constantly appear, which allow us to come to conclusions that seem to be generally valid.

First of all, similar problems exist in all three areas studied. Activity in medicinal chemistry is linked directly to the degree of progressiveness and economic development of each country. In more than one case, medicinal chemistry has been considered a luxury permitted only in developed countries.

Medicaments have historically been studied by using plants and traditional medicine as a starting point even in the most sophisticated societies. From a pragmatic point of view, it would be interesting to take into account the realities in developing countries when setting up corresponding academic programs and when putting forth proposals for collaboration on scientific research. Scientific authorities in Latin American countries seem to agree that this approach is wise.

With regard to collaboration on aspects of teaching, no special difficulties seem to appear; most likely, this interaction should establish itself based on mutual knowledge and aid from various institutions and foundations. Necessary actions to be taken in this area are not especially difficult; they fundamentally require the generosity of professors and researchers in the dedication of their time. One aspect to take into consideration would be the sometimes difficult access to money for travel expenses for professors.

Special importance should be placed on circulation of reference literature and bibliographic material. Any collaboration in this area should take into account all aspects of intellectual property, including legal rights of publishers, editors, and authors. Finding formulas that allow access to reference information by countries of limited resources is a true challenge to the imagination of the scientific community. Likewise, obtaining the means for developing countries to purchase adequate materials and reagents can only be accomplished through economic collaboration.

Equipment maintenance is an interesting consideration deduced from the survey. Some research centers have had access to valuable equipment as a result of goverment support, aid from private foundations, etc. However, in most of these cases, upkeep of this equipment, which is usually quite costly in monetary terms, has not been taken into consideration. This point is especially important in those countries that cannot readily maintain instruments in working order because maintenance service is not justified on the part of companies that produce the equipment.

With regard to possibilities of collaboration on scientific research, it is necessary to start from a position that contemplates the true situation of the indigenous institutions, including their strengths as well as their weaknesses. At present, it is possible to obtain quality extracts from plants that have proved active in traditional medicine. This advantage is important to those countries that have the plants and know their scientific possibilities; however, the possibility of obtaining extracts from plants that have never been studied before should not be underestimated. Structural novelty now appears on the scene frequently, and with it there is potentially an enormous interest when considering the possibilities of patents. Determination of biological activities, their validation, and elucidation of structures responsible for these activities should all be part of any offer of collaboration from even the most advanced countries. Most importantly, discovery of new medicinal agents cannot be realized without active participation of pharmaceutical companies.

A Crucial Time for Collaboration in Medicinal Chemistry

We have reached an important juncture for both the developing and advanced countries regarding collabo-

ration in the field of medicinal chemistry. We need to question whether true cooperation is developing between the groups or if, on the other hand, differences are increasing. We must also question whether we are capable of recognizing the possibilities of collaboration, for mutual benefit, on areas in which the world of research is truly divided at this time.

Our survey shows that the developing countries are requesting collaboration with more advanced societies in which natural products should be considered as a starting point; this opportunity could very well be of interest to both societies.

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Agenda for 40th IUPAC Council Meeting, Berlin, Germany, 13–14 August 1999

1. Introductory Remarks and Finalization of Agenda
2. Approval of Minutes of 39th Council Meeting and Matters Arising
3. Ratification of Decisions Taken by Bureau and Executive Committee since 39th General Assembly
4. Announcement of Nominations for Union Officers and Bureau Members
5. Announcement of Time of Elections
6. Statutory Report of President on State of Union
7. Report of Secretary General
8. Biennial Report of Treasurer/Report of Finance Committee and Accounts for 1997–8/Appointment of Auditors for 1999–2000
9. Reports of Division Presidents (10 minutes each)
10. Report of Committee on Printed and Electronic Publications (10 minutes)
11. Report of CHEMRAWN Committee (10 minutes)
12. Report of Committee on Chemistry and Industry (10 minutes)
13. Report of Committee on Teaching of Chemistry (10 minutes)
14. Report on and Review of Affiliate Membership and Fellows Programs
15. Budget Proposal and National Subscriptions for 2000–2001
16. Proposed Changes to Statutes and Bylaws
17. Continuation/Dissolution of Existing IUPAC Bodies, Proposals for New and Reconstituted Bodies/Terms of Reference
18. Proposals Formally Received from National Adhering Organizations
19. Proposed Category of "Associated National Adhering Organizations"
20. Approval of Dates and Sites of 41st General Assembly and 38th Congress (2001)
21. Approval of Dates and Sites of 42nd General Assembly and 39th Congress (2003)
22. Election of Union Officers and Bureau Members and Approval of Elected Officers of Divisions
23. Applications for Membership in IUPAC
24. Applications for Associated Organization Status within IUPAC
25. Adoption of Recommendations on Nomenclature and Symbols
26. Important Matters Discussed by Bureau at 40th General Assembly not Covered by Items on Council Agenda
27. Any Other Business (discussion only)

Text of Proposed Bylaw Change, Agenda Item 16

Current

B4.307 Titular Members of Commissions have the right to receive contributions towards travel and subsistence expenses from funds of the Union as authorized by the Treasurer acting on behalf of the Union. Contributions may be made to Associate Members or members of subcommittees on recommendation of the Division or Section President and with the agreement of the Treasurer.

Proposed

B4.307 Members of IUPAC bodies may receive contributions towards travel and subsistence expenses from funds of the Union, as authorized by the Treasurer. The Bureau shall establish procedures and guidelines for the approval of such expenses.

IUPAC Delegate Report from 24th Scientific Committee on Oceanic Research (SCOR) Assembly, Amsterdam, Netherlands, 1–6 November 1998

Professor David Turner (Department of Analytical and Marine Chemistry, Goteborg University, SE-412 96 Goteborg, Sweden; E-mail: david@amc.chalmers.se), IUPAC delegate to the 24th SCOR Assembly held in Amsterdam 1–6 November 1998, has submitted the following report:

A written report briefly summarizing IUPAC's marine-related activities was submitted to SCOR in advance of the Assembly (see below). I presented the report to the SCOR Assembly, and reported that the planning group on sea salt solubilities (Commission V.9) was still considering whether and how to prepare a proposal for financial support from SCOR.

SCOR invited IUPAC to consider a future joint project on estuarine particles, which had been the subject of a SCOR Working Group in the late 1990s. This group had not been able to produce a final report, in part owing to lack of a conceptual framework in which to synthesize a diverse range of field observations. SCOR considered that a new initiative in this area would be timely, and invited IUPAC to consider establishing this initiative as a second joint project. I gave a personal view that estuarine particles would be an excellent subject for a volume in the IUPAC series on Analytical and Physical Chemistry of Environmental Systems, produced by Commission VI.1, and undertook to explore the matter further with this Commission with a view to being able to present an outline proposal to the IUPAC and SCOR meetings in summer/autumn 1999.

While in Amsterdam, I also acted as IUPAC co-chair of the joint IUPAC–SCOR Working Group on marine biogeochemistry of iron (SCOR WG109). The Working Group met over two days to review the seven draft chapters that had been submitted and circulated to all Working Group members in advance of the meeting. For each chapter, the discussion was led by a previously appointed lead reviewer, but the whole group was fully involved in the review process, leading to intensive and constructive working group sessions. The revised chapters, after further review and editing, will be published in the IUPAC series on Analytical and Physical Chemistry of Environmental Systems, with publication planned for late 1999. Although production of this book had been planned as the final activity of the Working Group, an ad hoc group met to discuss the need for standard materials for low iron concentrations in seawater, and for other intercalibration and validation activities related to iron measurements. SCOR agreed to support a small workshop meeting on this topic in early 1999 as a further activity of WG109. No direct IUPAC involvement in this activity is planned.

The Working Group's meeting was preceded by an international symposium on the marine biogeochemistry of iron. This symposium was sponsored by SCOR and attracted leading researchers from all around the world. The symposium provided a very stimulating introduction and complement to the Working Group meeting.

In conclusion, I consider that the collaboration between IUPAC and SCOR in the area of marine chemistry is proving to be very productive and a benefit to both organizations.

Report of IUPAC Activities Relevant to SCOR

Several IUPAC Commissions have current projects of interest to SCOR; these projects are briefly summarized below.

Commissions V.2 (Microchemical Techniques), VI.1 (Fundamental Environmental Chemistry), and VII.C.2 (Toxicology).
These three commissions are jointly developing guidelines for terms related to chemical speciation and fractionation of trace elements. A draft manuscript is now undergoing internal review within IUPAC.

Commission V.6 (Equilibrium Data)
A project entitled "Influence of pressure on chemical equilibria in aqueous solutions—with particular reference to sea water" has resulted in a paper which is now undergoing internal review within IUPAC prior to publication.

Commission V.8 (Solubility Data)
The project "Solubilities of oceanic salt systems and related systems" is still in the planning stage. A report from the latest project group meeting held in August 1998 is not available at the time of writing.

Commission VI.1 (Fundamental Environmental Chemistry)
This Commission is co-sponsor of SCOR WG109 and has one other project relevant to SCOR. Volume 6 in the IUPAC series on Analytical and Physical Chemistry of Environmental Systems is entitled *In situ Analytical Techniques for Water and Sediments*. This volume is currently in preparation; a workshop meeting to review draft chapters was held in July 1998. The book includes applications in both fresh and saline waters.

Project on Strengthening the Biological and Toxin Weapons Convention

As negotiations to agree upon a compliance and verification protocol for the 1972 Biological and Toxin Weapons Convention (BWTC) approach the endgame at the United Nations in Geneva, the Project on Strengthening the Biological and Toxin Weapons Convention, based at the University of Bradford, West Yorkshire, England, UK, aims to raise the profile of the negotiations among interested parties in academia, science, and industry, and among policymakers and opinion formers on a worldwide basis.

The BWTC bans development, production, acquisition, stockpiling, and retention of an entire class of weapons. Unlike existing arms-control regimes that relate to nuclear and chemical weapons of mass destruction, however, the BWTC, which came into force in 1975, lacks verification measures to ensure that States Parties are in compliance with the Convention.

Since 1994, an Ad Hoc Group, meeting at the United Nations in Geneva, has been mandated to: *"consider appropriate measures, including possible verification measures, and draft proposals to strengthen the Convention, to be included, as appropriate, in a legally binding instrument, to be submitted for the consideration of the States Parties"*.

Requirements for declarations, procedures for visits to facilities, and provisions for investigations together with safeguards for confidential information have emerged from the negotiations as central and essential elements of the Protocol. They are also the elements of the Protocol that are of greatest relevance to the scientific community.

There exists the real possibility that agreement on strengthening the BTWC will be reached over the next 12 to 18 months, although the final details have yet to be negotiated before the Protocol can be successfully completed.

For the past four years, the Bradford-based Project on Strengthening the Biological and Toxin Weapons Convention has been engaged in disseminating information relating to the negotiations to interested parties. To date, the Project has provided some 19 briefing papers on issues of key importance to the negotiations to strengthen the Convention. The briefing papers have been prepared to aid the negotiators of the Protocol in successfully meeting the objectives of their mandate. Electronic versions of the briefing papers and related information have been posted on the Project's web site at http://www.brad.ac.uk/acad/sbtwc. In the near future, in order to raise the profile of this issue among the scientific community on a worldwide basis, the Project will launch an expert-level online discussion forum on issues facing the Ad Hoc Group during the final stages of the negotiations.

It is in everyone's interest that the BWTC is strengthened through the successful implementation of a compliance protocol, and it is important that the scientific community is aware of and can monitor developments in Geneva during the final stages of the negotiations.

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News and Notices from Other Societies and Unions

Historical Overview of the South African Chemical Industry: 1896–1998

Mr. G. C. Gerrans of the South African Chemical and Allied Industries' Association (CAIA) furnished the following article at the invitation of Professor Pieter S. Steyn (SASOL Centre for Chemistry, Potchefstroom University, Private Bag X6001, Potchefstroom 2520, South Africa), Member of the IUPAC Bureau, IUPAC Committee on Printed and Electronic Publications, and IUPAC Executive Committee.

Introduction

In a limited sense, a chemical industry has been in existence in South Africa for many centuries. Dyes, fragrances, flavorings, and medicinals were extracted from plants, and animal fats were used in soap making and leather preserving. These activities were carried out on a limited scale; just enough was made to meet the immediate needs of small groups of people. As time passed, some substances, particularly fragrances, dyes, and medicinals, became articles of trade and, when in short supply, commanded high prices. However, it was not until the Industrial Revolution that chemicals were manufactured in sufficient quantities to talk about a chemical industry as we know it today.

Between 1780 and 1840, Great Britain was transformed from a predominantly agricultural to a predominantly industrial country. Rapid growth in population and urbanization was accompanied by increased literacy and the need for better housing, clothing, health, food, and transport. These changes led to an unprecedented demand for paper, glass, cotton textiles, soap, fertiliz-

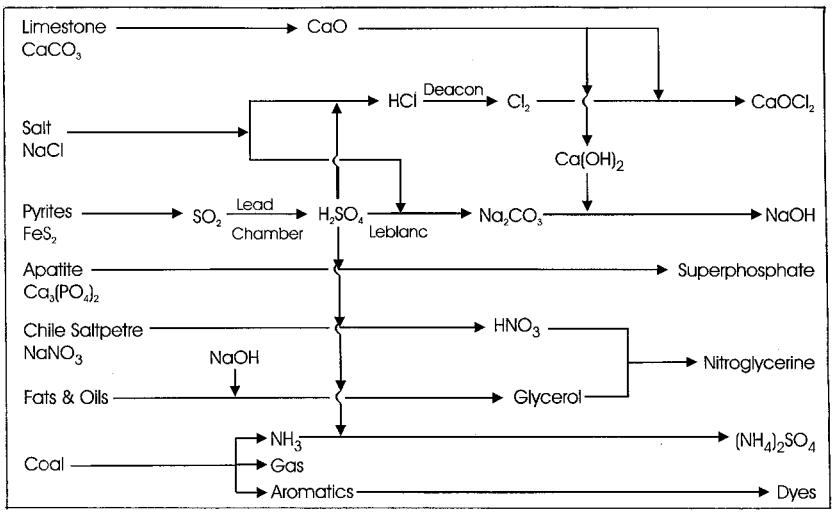


Figure 1 The Chemical Industry in the U.K. around 1875

ers, and explosives. Chemists and engineers responded imaginatively to meet these demands, and it was not long before a range of chemicals was being produced. So great, however, was the demand for sodium carbonate and sodium hydroxide that the fledgling chemical industry was often called the "alkali trade". The structure of the chemical industry around 1875 is shown in Figure 1.

The chemical industry in South Africa came into being in 1896, about 100 years after the first lead chamber and Leblanc plants were built in Great Britain. The discovery of diamonds near Kimberley in 1868, gold on the Witwatersrand in 1886, and coalfields around Witbank and Vryheid, led to a burgeoning mining industry and a rapidly growing demand for explosives. For the first 40 years of its existence, the South African chemical industry could well have been called the "explosives trade".

In this article, the development of the chemical industry is discussed around three major companies, African Explosives and Chemical Industries (AECI), South African Coal, Oil, and Gas Corporation Ltd., (SASOL), and Sentrachem.

AECI's Predecessors

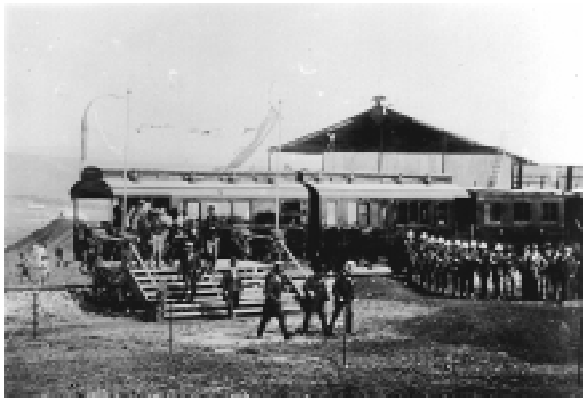
Alfred Nobel's discovery of dynamite had made the transportation of nitroglycerine a reality, and increasingly large quantities of the explosive were imported into South Africa in the early 1890s. To ensure a regular supply and to improve blasting efficiency, required for mining the hard quartzitic gold-bearing rock of the Witwatersrand, the Nobel Dynamite Trust decided to produce the required explosives locally.

On 22 October 1896, President Paul Kruger traveled from Pretoria to the farm Modderfontein, east of Johannesburg, to open De Zuid Africaansche Fabrieken voor Ontplofbare Stoffen. With a name like this, it is not surprising that the factory was called simply "The Dynamite Company". After the Anglo Boer War of 1899–1902, management of the company passed into the hands of the British South Africa Explosives Company, with the Nobel Dynamite Trust retaining a controlling interest.

For some years, Cecil John Rhodes, founder of De Beers Consolidated Mines, was concerned about the monopoly on explosives manufacture held by the Dynamite Company. In 1903, one year after his death, the Cape Explosives Works, at Somerset West near Cape Town, started producing dynamite, principally for the De Beers diamond mines around Kimberley. By 1907, this company's annual production of 340 000 cases (each of 50 lb) had exceeded that of Modderfontein (230 000 cases).

In the United Kingdom, Kynoch and Company, Nobel's chief competitor, had its eye on the rapidly growing explosives market in South Africa. Arthur Chamberlain, who had taken over from the founder, George Kynoch, started negotiations with the Natal government in 1907. In an amazingly short period of time, Kynoch established a third dynamite factory at Umbogintwini, south of Durban, in 1909.

By 1911, the explosives industry was by far the largest manufacturing industry in the country, with an investment of over £2 million and more than 3000 employees. But three companies—all importing the same raw materials, all making the same product, and all using the same process—were finding it difficult to make



Paul Kruger opens "The Dynamite Company" in 1896.

a profit. Their problems were compounded by the rising price of glycerine; only exports during World War I saved the three companies from bankruptcy.

After the war, both Somerset West and Umbogintwini diversified into fertilizer manufacture using locally manufactured sulfuric acid and phosphatic rock, most of which was imported from Morocco. The benefits of this development were short-lived; overproduction of superphosphate in Holland led to dumping in South Africa. The postwar slump only added to the woes of the industry. Rationalization was the only answer.

African Explosives and Industries

In 1923, Sir Harry McGowan, chairman of Nobel Industries, arranged a merger of their Modderfontein company with that of Kynoch's at Umbogintwini. Getting De Beers to come on board required more protracted negotiations, but success was finally achieved in December 1923 when a new company, African Explosives and Industries, was registered. Mr. Ross Frames of De Beers was appointed chairman and Sir Harry McGowan, deputy chairman. A young Ernest Oppenheimer, chairman of Anglo American Corporation, joined the board to represent the mining industry and retained a close association with the company for the rest of his life.

Two successful mergers in South Africa apparently whetted McGowan's appetite for more in the UK. By 1926, he had formed Imperial Chemical Industries (ICI) from the merger of Nobel Industries; the British Dyestuffs Company; the United Alkali Company; and Brunner, Mond Limited. ICI acquired Nobel Industries' 50% holding in African Explosives and Industries, establishing a partnership that lasted until 1998. This partnership resulted in a steady flow of technical expertise, information, and personnel that was to be of incalculable benefit in the development of the local chemical industry.

The great depression of the early 1930s adversely affected the chemical industry, but the board of African Explosives and Industries was looking adventurously to the future. A technical mission from ICI was sent to investigate erecting a synthetic ammonia plant at Modderfontein. In 1932, less than two years later and at a cost of £300 000, the ammonia plant went into full production—5000 tons per annum! With an associated oxidation plant, it was possible to produce nitric acid, and research started into the substitution of ammonium nitrate for nitroglycerine, ultimately with considerable cost savings to the mines.

The boom in gold mining meant that expansion of the ammonia plant was inevitable. By 1936, annual capacity had been increased to 25 000 tons. In 1938, Modderfontein and Somerset West together produced 2 348 987 cases of explosives, bringing the total production since 1896 to over 30 000 000 cases.

African Explosives and Chemical Industries (AECI)

Diversification from explosives followed. Fertilizers, paints, veterinary preparations, and insecticides were all produced to meet a growing demand. To reflect this diversity, the name of the company was changed from African Explosives and Industries to African Explosives and Chemical Industries in 1944. Two years later, as if to celebrate the 50th anniversary of the explosives industry, a calcium cyanide plant was erected, again to meet the growing demand from the gold mines.

The next 35 years were characterized by an almost continuous increase in production and diversification. A second ammonia plant was commissioned at Modderfontein in 1955 and, when urea was first produced in 1960, annual capacity for ammonia was increased to 145 000 tons. In 1955, surplus acetylene from a carbide plant at Ballengeich in Natal was transported to Umbogintwini for the production of polyvinyl chloride, the first commodity plastic to be made in South Africa. The associated chlor-alkali plant also supplied chlorine and caustic soda to the South African Industrial Cellulose Corporation (SAICCOR) at Umkomaas. Methanol, formaldehyde, and urea-formaldehyde resins were produced at Modderfontein, and in 1963, interests in SA Titan Products (now Tioxide SA) and SA Nylon Spinners were acquired.

In 1964, the company opened a fourth manufacturing site, the Midland Factory at Sasolburg. Using feedstocks from SASOL, the new factory produced initially calcium cyanide and then polyethylene (1966). PVC, CFCs, and chlorinated solvents followed. Adherence to the Montreal Protocol resulted in the phasing out of CFCs manufacture in 1995.

The company name was abbreviated to AE & CI in 1972, and, in 1974, a 300 000 ton per annum coal-based ammonia plant was commissioned at Modderfontein. A further name change to AECI followed in 1976, and the company's dependence on coal as a raw material was emphasized with the commissioning of the Coalplex project at Sasolburg in 1978. A joint venture with Sentrachem, Coalplex consisted of five linked plants: carbide, acetylene, chlorine, VCM, and PVC. Coalplex also produced caustic soda and lime hydrate.

During the early 1980s, AECI consolidated its position as the major chemical company in South Africa, expanding and diversifying its product range. Acquisition of Chemical Services in 1980 was significant, reflecting an increased emphasis on speciality chemicals. In 1985, after 82 years, explosives manufacture at Somerset West was phased out. A joint-venture soda ash plant was commissioned in Botswana in 1991, and two years later the formation of AECI Bioproducts and AECI Aroma and Fine Chemicals was announced, with plants at Umbogintwini and Richards Bay.

In 1993, AECI and SASOL agreed to the formation of a new company, later to be called Polifin. This joint venture produces monomers, polymers, chlor-alkali products, cyanide, and peroxides. Restructuring involved closing the costly carbide-acetylene route to VCM and using, instead, ethylene from SASOL. Major restructuring also occurred within the group during the 1990s. Manufacture of nitroglycerine gave way to new-generation explosives in 1994, and the Modderfontein complex celebrated its centenary in 1996.

In 1998, SASOL put in a bid to take over AECI, but the deal was aborted owing to stringent restrictions imposed by the Competitions Board. Further restructuring is currently in progress involving a move out of ammonia and urea production, and the likely sale of interests in Polifin, Dulux (paints), Tioxide SA, and Fedmis (fertilizers). Proceeds from these sales will go to reducing debt and reinvestment in five core clusters: explosives, speciality chemicals, fibers, biotechnology, and agricultural products.

SASOL's Predecessors

Although SASOL started producing oil from coal in 1955, its origins can be traced back to 1895 when coal was first mined on both sides of the Vaal River near Vereeniging. The mining house, Anglovaal, was interested in the large deposits of low-grade coal in this area and further south in the Free State. There was considerable interest in coal chemistry during the 1920s, and, in 1927, a government White Paper was published recommending the development of gasification and carbonization processes.

In the early 1930s, Anglovaal and the British Burmah Company established the South African Torbanite Mining and Refining Company (SATMAR) to mine oil shales near Ermelo and to distill off and refine the oil, mainly for petrol. Anglovaal's interests in oil-from-coal were extended when rights to the German Fischer-Tropsch process were acquired. In 1938, Hendrik van Eck, Anglovaal's consulting chemical engineer, appointed Etienne Rousseau as research engineer at SATMAR to pursue this initiative. Franz Fischer visited South Africa in 1938 to assist in getting the venture off the ground; however, World War II intervened.

During the war, Anglovaal maintained its interest in oil-from-coal and entered into negotiations with the M. W. Kellogg Corporation. There was considerable interest in the United States at that time, with the U.S. government considering an oil-from-coal plant on the west coast. In 1945, Anglovaal applied to the South African government for assistance to establish a plant based on the American Hydrocol process. After protracted negotiations, a license was finally issued in 1949. Owing to devaluation and involvement with gold mining developments, Anglovaal needed assistance to raise the required £20 million. The World Bank expressed polite interest in the project, but no money was forthcoming.

In the meantime, negotiations were proceeding with the Kellogg Corporation for licensing of its patents and assistance in the design and erection of a plant. However, Rousseau believed that a closer look needed to be taken at what the Germans had been doing with the Fischer-Tropsch process since the war. He obtained an offer from the Lurgi Gesellschaft, Oberhausen-Hollen, and Ruhrchemie Aktiengesellschaft, through an Arbeitsgemeinschaft (ARGE), of the designs for and the right to operate plants for the production of synthetic gas from coal and the Fischer-Tropsch process.

SASOL One

The upshot was the establishment, on 26 September 1950, of the government-sponsored South African Coal, Oil, and Gas Corporation Ltd., commonly called SASOL. This acronym arose from Rousseau's initial suggestion that the company be called South African Synthetic Oil Limited. Rousseau, SASOL's first employee, was appointed managing director, a position he held for 18 years. Both Kellogg and ARGE processes were used; the former produced high proportions of medium octane petrol, LPG, and a range of chemicals; the latter produced mainly higher-boiling waxes and oils, including diesel.

The plant, SASOL One, and its associated town, Sasolburg, were established in the Free State, just south of the Vaal River. All did not run smoothly as Rousseau recalled, "I must tell you honestly that there were times in SASOL's early years, times when we had trouble, big trouble, when I felt that my main charge was to keep up the courage of our men. I certainly could not allow myself a moment's despair". Despite these setbacks, SASOL chemists and engineers managed not only to get the plant working satisfactorily, but also to devote time to improving efficiency and to widening the product range. Feedstocks for the manufacture of synthetic rubber, fertilizers, and secondary chemicals followed. Together with Total SA and the National Iranian Oil Company, a refinery (NATREF) was established in Sasolburg in 1960. Imported petroleum was refined and cracked to produce ethylene for plastics, and pipeline gas was supplied in increasing quantities to industry.

SASOL Two and Three

Before World War II, coal provided more than two-thirds of the world's energy needs. By 1973, oil provided more than half of these needs, consumption was increasing, and the first oil crisis threatened supplies from the Middle East. SASOL's response to these developments was to commission a feasibility study on

SASOL Plant

the establishment of a second oil-from-coal plant. At the end of 1974, plans for the erection of SASOL Two were announced at a cost of R 2458 million. A site about 100 km to the east of Sasolburg, to be called Secunda, was chosen. Construction began in 1976 and was completed in 1980. At that time, South Africa imported much of its oil from Iran, and the overthrow of the Shah precipitated a further oil crisis. The result was SASOL Three, constructed in 1982 adjacent to SASOL Two.

Since its inception, SASOL has always placed a high priority on research and development. The SASOL One plant no longer produces fuels but instead a wide range of chemicals. The Fischer-Tropsch process has undergone continuous improvement, first through the Synthol process and more recently via the SASOL Advanced Synthol process. As a result, at SASOL Two and Three, fuels are being produced with greater efficiency and increasing numbers of petrochemical feedstocks, and speciality chemicals are being extracted from the product stream. SASOL's Slurry Phase Distillate process for the production of high-quality diesel from natural gas has aroused keen interest in Europe, Africa, and the Middle East.

SASOL functions through six main operating companies and has interests in several specialized chemical and petrochemical companies. Foreign sales amount to nearly 26% of group turnover, and there are major oil and gas exploration activities underway in southern and west Africa. By the mid 1990s, SASOL had become, by far, South Africa's largest chemical company.

Sentrachem's Predecessors

In 1967, National Chemical Products (NCP), the Industrial Development Corporation (IDC), and Federale Volksbeleggings (FVB) pooled their chemical interests into a single entity, Sentrachem. The origins of some of these chemical interests, which go back to the 1930s, are outlined below.

National Chemical Products (NCP)

For many years after the formation of Sentrachem, NCP was the biggest profit earner of the various divisions and, equally importantly, was the nursery of many of the parent company's management team. NCP was established in 1935 by George Irvin, cofounder of the fishing company Irvin and Johnson, now known as I & J. The original company, called National Maize Products, built a plant in Germiston to manufacture alcohol from maize. Rapid increases in the price of maize soon forced a change to molasses as the raw material, and, in 1940, the name of the company was changed to National Chemical Products.

The scope of the young company's activities soon widened. Besides alcohol, much of which was sold to SATMAR as a fuel additive, other products included methylated and rectified spirits, absolute alcohol, vinegar, and dry ice. One unsuccessful venture was the manufacture of glycerine for the government's war effort. In 1943, after two years of development, the plant was closed down; demand, price, and output were all lower than anticipated.

In 1940, a synthetic acetone/butyl alcohol plant was built to provide raw materials for cordite manufacture, also a war-related effort. The plant design and process were provided by the UK-based Distillers Company. The latter took a large, but not majority, interest in NCP and made available a wealth of expertise and know-how for the manufacture of organic chemicals.

Development away from the original site in Germiston took place in 1944 when NCP acquired the entire shareholding of Umgeni Distilleries in Durban. This company traced its origins back to the 1860s when a Mauritian engineer, known only as Phillippe, built a distillery on the north bank of the Umgeni river. Some of Phillipe's original buildings are still in use. The acquisition of Umgeni led to the manufacture of better grades of alcohol and placed NCP in a favorable geographic position to export some of its production.

More takeovers were to follow; most important of these were Poly-Resin Products (East London, 1956) and two yeast companies, Natal Organic Industries (Durban, 1959) and Free State Yeast (Welkom, 1959). Meanwhile, the Germiston factory had steadily expanded its range of products to include, by 1960, alcohols, ketones, acids, esters, CO_2 gas, mining froth-flotation reagents, phthalate plasticizers, synthetic resins, and animal feed supplements.

In 1959, NCP entered into a joint venture with SASOL, called Kolchem, to manufacture diacetone alcohol, hexylene glycol, pentaeryrithritol, and detergent alkylate, using feedstocks from SASOL. The latter eventually sold its interest, and Kolchem joined with Shell Chemical to form Styrochem, for the manufacture of polystyrene.

Umgeni Distillery

Industrial Development Corporation (IDC)/ Federale Volksbeleggings (FVB)

During World War II, the South African government established a chlor-alkali facility at Chloorkop, between Johannesburg and Pretoria. Known as Klipfontein Organic Products (KOP), the plant was to produce phosgene and mustard gas. Thankfully, these gases were never used, and, after the war, production was focused on DDT and other insecticides. In 1965, KOP was taken over by a consortium of companies led by the IDC and FVB.

In 1960, the IDC promoted the Synthetic Rubber Development Company to investigate the possibility of manufacturing general purpose synthetic rubbers. A major study resulted in the establishment of the Synthetic Rubber Company (SRC) for the manufacture of a range of styrene-butadiene rubbers. Also involved were FVB, three tire companies (Dunlop, Firestone, and General), and the Polymer Corporation of Canada. Production started in 1964 with the Polymer Corporation as the licensor of the process.

Sentrachem Group

When Sentrachem was launched in 1967, its four constituents were NCP, Kolchem, KOP, and SRC. The new board, which was chaired by Etienne Rousseau of SASOL and had as one of its members Jack Irvin, son of NCP's founder George Irvin, initiated an ambitious expansion program.

The first new project was a joint venture with Uniroyal to produce rubber chemicals. This company, called Karbochem, was soon to absorb the SRC and by 1992 was a producer of synthetic rubber and rubber lattices; industrial mining and rubber chemicals; water-based lubricants; and carbide, acetylene, and carbon black.

This endeavor was followed in 1969 by Safripol, a joint project with Hoechst SA, designed to produce high-density polyethylene and polypropylene. A separate company, Plastomark, was set up to handle the marketing of Safripol's products.

In 1974, another joint venture, this time with the Olin Corporation, led to the formation of Aquachlor, which produced chlorine-based water sanitizers. The acquisition of Agricura, a formulator of insecticides and herbicides, provided an entry into agricultural chemicals. Subsequently called Agrihold, this company manufactured crop-protection products, animal feeds, and a range of veterinary products.

Besides being a primary manufacturer, Sentrachem became involved with downstream converting through a group of companies operating under the control of Mega Plastics. In 1993, Delta G Scientific was acquired, signaling a new emphasis on research and development. This strategy was designed to assist Sentrachem in moving out of commodity chemicals into high value-added products.

International diversification came in 1995 when Sentrachem announced the purchase of the entire issued share capital of Hampshire Chemicals Corporation in the United States. Hampshire was selected for takeover because its size, products, technologies, and markets complemented those of companies within the Sentrachem Group.

During the 1990s, a number of factors, ranging from prolonged droughts through high interest rates to increased international competition, adversely affected Sentrachem's profitability. These problems, together with the decline in the value of the rand, left the company in a vulnerable position. Before rationalization within the Group could be fully implemented, the Dow Chemical Company, in 1997, successfully acquired control of Sentrachem. Dow subsequently purchased Hoechst SA's interest in Safripol, restructured Agrihold into Dow Agrosciences, and is currently developing plans to establish a regional hub in Johannesburg for its African and Middle East interests.

Conclusion

Development of the chemical industry during its 100 years of existence has been dominated by three factors: the demand for explosives by the mining industry, the abundance of relatively cheap coal, and the political and regulatory environment in which it operated between 1948 and 1994.

Because South Africa is a country with no proven oil reserves, little natural gas, and abundant coal resources, it is not surprising that the gasification of coal became a major factor in the development of the chemical industry. This scenario was aided and abetted by a political system that increasingly forced the industry to look inward and to focus on import replacement. It led also to the construction of small-scale plants with

production geared to local demand. As a consequence, locally produced commodity chemicals and processed goods have generally been less than competitive in export markets.

For a developing country, South Africa has an unusually large chemical industry of substantial economic significance. In 1996, the industry comprised 5.3% of the GDP and 22% of manufacturing sales. Almost 12.5 million tons of primary and secondary products were manufactured during 1996. The "big three" chemical companies, whose development has been outlined in this article, were joined in 1993 by a fourth major company, Polifin, the joint venture between AECI and SASOL. A large number of smaller companies are involved with manufacturing a wide range of specialities and in formulating and converting products. Many multinational companies operate in South Africa as manufacturers and/or distributors, including Hoechst, Bayer, BASF, Shell, Unilever, Ciba Speciality Chemicals, du Pont, ICI, CH Chemicals, Cookson, Union Carbide, Monsanto, and Rohm and Haas.

The Chemical and Allied Industries' Association (CAIA), which grew out of the 50-year-old Transvaal Chemical Manufacturers' Association, was founded in 1994. CAIA's responsibilities include fostering South Africa's science base, assisting in education and training, seeking ways to promote growth in the chemical and related sectors, consulting with government and other role players, and promoting the industry's commitment to a high standard of health, safety, and environmental performance. CAIA is the South African custodian of Responsible Care, to which there are now 120 signatories.

Now that South Africa is once again part of the international community, the chemical industry is focusing on the need to be internationally competitive, and the industry is reshaping itself accordingly. Exports have increased annually for the past few years, and, in 1996, the industry became a net exporter of products. Rationalization in some sectors of the industry has been drastic, and the process is not yet complete; however, signs that the industry will emerge leaner and more competitive are clearly apparent.

Reports from IUPAC-Sponsored Symposia

International Symposium on Calorimetry and Chemical Thermodynamics, 5–8 April 1998, Campinas, Brazil

This meeting was the fourth in a series of international symposia on thermodynamics with special emphasis on calorimetry sponsored by IUPAC. The three earlier symposia were held in China (Beijing, 1989) and India (New Delhi, 1993 and Amritsar, 1997). The aim of these meetings has been to organize international conferences of high quality in locations where young scientists, in particular, would be able to participate without prohibitively high travel costs. Traditionally, these types of conferences have been held in Europe or North America.

The symposium in Campinas was the first of its kind organized in South America. It attracted 111 participants, of whom 56 were from Brazil, 36 from Europe, 8 from North America, 8 from Latin America outside Brazil, and 3 from the rest of the world. The program consisted of 4 plenary lectures, 9 invited lectures, and 32 oral presentations in parallel sessions, along with 80 poster presentations. The strong Brazilian participation was also reflected in the large number of scientific presentations. The lectures and posters gave a representative coverage of current activities in chemical and biological calorimetry and thermodynamics. In a final session, possibilities for research collaboration with Latin America were discussed.

The symposium was held at a hotel with good facilities just outside the city. The poster sessions were particularly successful, with ample space for the presentations and a congenial atmosphere stimulating scientific discussion and interchange. The meeting was well organized and the program was conducted in a smooth and efficient manner. Excellent work by the local organizing committee at Universidade Estadual de Campinas (Chairman, Professor C. Airoldi and Secretary, Professor W. Loh) resulted in a successful symposium that fulfilled its intentions. We hope that more conferences of this kind will be organized in "far away" countries to stimulate cooperation and scientific exchange over geographical distances and language boundaries.

Proceedings from the meeting have been published by Elsevier Science as manuscripts in *Thermochimica Acta*, Volume 328 (1-2), 1999, which was available 29 March 1999. Plenary lectures from the symposium are slated for publication in the *Journal of Chemical Thermodynamics*.

Dr. Gerd Olofsson
Lund University, Sweden
Titular Member, IUPAC Physical Chemistry Division (I)

15th International Symposium on Medicinal Chemistry, 6–10 September 1998, Edinburgh, Scotland, United Kingdom

This symposium was organized by The Royal Society of Chemistry's Perkin Division and the Biological and Medicinal Chemistry Sector of the Industrial Division on behalf of the European Federation of Medicinal Chemistry (EFMC) , with the support of IUPAC, the American Chemical Society's Division of Medicinal Chemistry, and the Asian Federation of Medicinal Chemistry. Symposium Chairman was Dr. D. Buckle, Chairman of the Biological and Medicinal Chemistry Sector of The Royal Society of Chemistry.

The series "International Symposia on Medicinal Chemistry" has been organized in Europe since the 1960s. Recent meetings in the series have taken place in 1992 in Basel, Switzerland; in 1994 in Paris, France; and in 1996 in Maastricht, The Netherlands.

The 1998 symposium was held in Edinburgh's International Conference Centre. Scientific sessions included 8 plenary lectures, 52 invited lectures running in 3 parallel sessions, and 2 poster sessions (comprising 365 posters) covering new technologies for drug discovery, ion channels, intracellular signalling, glycine antagonists, predicting DMPK, growth factors, glycochemistry and glycobiology, 7TM receptors, and protease inhibition. The program was supported by 365 posters.

Medicinal chemistry is an interdisciplinary science of great range, with chemistry as its core and with the purpose of producing excellent new pharmaceuticals. The field has made remarkable strides to accompany recent rapid progress in related sciences. The development of a new drug is characterized by new technologies such as high-throughput screening methods and synthesis of combinatorial libraries.

More than 1000 medicinal chemists, mainly from pharmaceutical industries, attended the symposium from 48 different countries around the world. Seventy-one percent of the attendees were from countries other than the United Kingdom.

Plenary lectures were held in the Centre's Pentland suite and invited lectures in three auditoriums. All the conference lecture rooms were well appointed, and the poster sessions were conducted in two separate spacious rooms. Participants enjoyed a buffet reception (sponsored by Astra Charnwood) and a symposium dinner. Symposium activities included evening events, excursions, and an accompanying program for spouses.

Proceedings from the 15th International Symposium on Medicinal Chemistry will be published in Autumn 1999 by The Royal Society of Chemistry as a book, *Medicinal Chemistry into the Millennium*, edited by M. M. Campbell and I. A. Blagborough.

The 16th International Symposium on Medicinal Chemistry will be held in Bologna, Italy, 18–20 September 2000, with Professor Carlo Melchiorre (camelch@alma.unibo.it) of the University of Bologna as Chairman. The 17th meeting will be held in Barcelona, Spain, 1–5 September 2002, with Professor Ferran Sanz of Instituto Municipal d'Investigacio Medica, Barcelona as Chairman.

Dr. Naofumi Koga
President, Medicinal Chemistry Section (VII.M) of IUPAC

49th Annual Meeting of the International Society of Electrochemistry, 13–18 September 1998, Kitakyushu City, Japan

This conference was organized jointly by the Science Council of Japan and the Electrochemical Society of Japan and was sponsored by Kitakyushu City, IUPAC, the Commemorative Association for the Japan World Exposition, Asahi Glass Foundation, Tokyo Ohka Foundation for the Promotion of Science and Technology, and Ishikawa Carbon Foundation for the Promotion of Science and Technology.

Thirteen symposia were held in parallel at two sites, Kitakyushu International Conference Center and Rihga Royal Hotel Kokura, with the common theme of "Electrochemistry for Future Science and Technology". Symposia topics included fundamental electrochemistry, surface electrochemistry, photoelectrochemistry, biological and organic electrochemistry, advances in high-temperature electrochemistry, new tailored materials by electrochemistry, environmental electrochemistry, corrosion and surface technology, battery and energy storage, fuel cells, industrial electrolysis and electrochemical engineering, chemical/electrochemical sensors, and role of electrochemistry in chemistry and chemical education.

Contributed papers from 839 participants included 6 plenary lectures by Professors M. Ito (Japan), H. B. Gray (USA), N. Yamazoe (Japan), W. L. Worrell (USA), D. M. Kolb (Germany), and J. Saveant (France); 2 award lectures by Professors G. Lang (Hungary) and A. Wieckowski (USA); 66 keynote lectures; and 279 invited talks. Several industrial exhibitors also made technical presentations. Foreign attendees from more than 40 countries numbered 298 among the total of 1119 conference participants. During the meeting, a special exhibition of environmentally friendly vehicles also opened at the Conference Center. Eight satellite symposia were also held in Japan and Korea before and after the meeting.

Dr. Rika Hagiwara
49th ISE Secretariat

Report of IUPAC's 1997 Accounts

Treasurer's Comments

I apologize for the late publication of the audited 1997 accounts. This is due to unexplained but extended delays in arranging the audit by Neutra Treuhand, the auditors we have used for many years. These difficulties have forced us to close our business with them and to instruct Batchelor, Tillery, and Roberts of Raleigh, North Carolina, local to the Secretariat. These auditors have carried out the audit using Generally Accepted Accounting Principles in the United States. These principles differ in two important respects from the Swiss principles used hitherto. First, subscriptions and service charges are recorded when earned, and expenses are recorded when the relevant activity actually occurs. Secondly, whereas realized and unrealized capital gains on our investments were previously shown only in the balance sheet, these must now appear as income in the income and expense account. So care must be taken in reading the appropriate items in the accounts. Thus, the total income over expenses item appears as USD 168 380, but includes realized and unrealized gains of USD 362 076, so the excess of income over expenses resulting from our operations over the year, our previous bottom line, is in fact a deficit of USD 193 696.

This deficit takes into account the cost of moving the Secretariat from Oxford to Research Triangle Park, North Carolina, some USD 186K, and the cost of several extraordinary meetings called to discuss and formulate the future strategy of the Union, USD 52K. These items were discussed and approved by the Executive Committee and the Bureau but were not put into the budget because these were nonrecurrent items. If the costs of these items are removed, the deficit becomes a surplus of about USD 44K. Even if these are included, the surplus from 1996 (excluding the Barings windfall) of USD 290 690 added to the deficit of USD 193 696 gives a biennial surplus of USD 96 994. The principal causes that give rise to these figures, and our being able to move the Secretariat and stage several extraordinary meetings, yet finish the biennium with a surplus, are that the Publications surplus was some USD 110K over budget and that the Geneva Assembly came in USD 83K below budget against all expectations due, in turn, to the absence of a number of Titular Members and to the cost of air fares remaining flat. Also, in spite of my exhorting Division Presidents to use all their allocations, and granting substantial extra funds to Division II, there was a divisional biennial underspend of USD 48K.

Our reserves remain strong. The heavy calls on funds to cover the exceptional items during 1997 reduced the value of the total reserves from USD 3 582 324 to USD 3 525 662; a fall of 1.6%; in real terms about 5%; however, over the biennium there was an increase in value from USD 2 753 916 to USD 3 525 662, 28%; in real terms, 19.5%. But this figure is inflated by the Barings windfall; without it, the biennial gain was 7.9%. Our investment strategy continued to give good returns. There was a total gain in the equities (shares) held throughout the year of 23.4% and a total gain on bonds of 6.3%, giving an overall gain on the portfolio of 16.8%.

The windfall received from Barings in 1995, USD 343 800, has been used to found an Endowment Fund. It is intended to use the interest and dividends from it for special purposes, while preserving its capital value in real terms. At the Finance Committee meeting in February 1998, it was decided to dissolve the Building Fund and to move its assets to the Endowment Fund to give a total in this fund of USD 783 405. It is hoped to encourage outside organizations and chemical industries to make contributions to the fund. To this end, part of the fund (USD 219 802) has been set aside as the Endowment Reserve Fund that will be used to match contributions to the main fund.

Overall, aside from the Endowment Fund and the Southern Hemisphere Sinking Fund, the operating reserve remains sufficiently above target to implement at once measures arising from the recommendations of the Strategy Development and Implementation Committee, including extra funding for Divisions and Standing Committees to enable them to accelerate the completion of existing projects.

Professor John Ward
IUPAC Treasurer

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Independent Auditors' Report

The Executive Committee
International Union of Pure and Applied Chemistry:

We have audited the accompanying statements of financial position of the International Union of Pure and Applied Chemistry ("IUPAC") as of December 31, 1997 and 1996, and the related statements of activities, cash flows, and functional expenses for the year ended December 31, 1997. These financial statements are the responsibility of IUPAC's management. Our responsibility is to express an opinion on these financial statements based on our audit.

We conducted our audit in accordance with generally accepted auditing standards. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation. We believe that our audit provides a reasonable basis for our opinion.

In our opinion, the financial statements referred to above present fairly, in all material respects, the financial position of the International Union of Pure and Applied Chemistry as of December 31, 1997 and 1996, and the changes in its net assets and its cash flows for the year ended December 31, 1997 in conformity with generally accepted accounting principles.

Batchelor, Tillery & Roberts, LLP

November 6, 1998

Balance Sheet

Assets	
Fixed Assets (2)	48 985
Cash in Banks (3)	469 742
Marketable Securities (4)	3 055 920
Subscriptions and Service Charges Outstanding (5)	88 200
Other Receivables	735
Prepaid Expenses	24 818
USD	3 688 400

Liabilities	
Capital - General	3 376 144
Accounts Payable	126 422
Paulo Franzosini Fund	5 659
Provisions and Subaccounts (6)	11 395
Prepaid Subscriptions	400
Excess of Income over Expenses	168 380
USD	3 688 400

Schedule of Income and Expenses

Income	
National Subscriptions and Service Charges	631 436
Interest and Dividends	133 706
Other Income	8 504
Publications	374 750
Affiliate Membership Program	58 341
Restricted Income (7)	45 065
Total Operating Income USD	1 251 802

Expenses	
Governance Expense (8)	44 181
Administrative Expense (9)	661 566
Accounting Transactions (10)	14 880
Operations Expense:	
Standing Committees	47 192
Divisions	118 488
Chemistry International	22 109

General Assembly	415 421
Representatives on Other Bodies	3 880
Other	70 308
Contingencies	8 282
Total Operations	685 680
Restricted Expenses (11)	39 191
Total Expenses	1 445 498
Net Income (Expense) from Operations	(193 696)
Realized Gains on Securities	33 554
Unrealized Gains on Securities	328 522
Net Income (Expense)	168 380

Notes to Financial Statements

1. Nature of Organization and Significant Accounting Policies

The International Union of Pure and Applied Chemistry (IUPAC), founded in 1919, is a voluntary nongovernmental, nonprofit association of 43 national adhering organizations representing the chemists of their countries. Additionally, there are 15 observer countries, 32 associated organizations, and more than 140 company associates. The official headquarters of IUPAC are in Zurich, and the administrative headquarters are in Research Triangle Park, North Carolina.

a) *Basis of Presentation:* In accordance with the accrual basis of accounting, subscriptions and service charges are recorded when earned, and expenses are recorded when incurred.

b) *Fixed Assets:* Furniture, fixtures, and equipment and leasehold improvements are recorded at cost. Depreciation is provided over the estimated useful lives of the assets and is computed on the straight-line method.

c) *Leases:* Rents paid under operating leases are charged to expense on a straight-line basis over the period of the lease.

d) *Foreign Currencies:* Transactions in foreign currencies are recorded at the exchange rate ruling at the date of the transaction. Foreign currency differences are recorded as income or expense.

e) *Marketable Securities:* Investments in marketable securities are measured at fair value in the balance sheet. Investment income, including gains and losses on investments, interest, and dividends, is included in the schedule of income and expenses. Interest on bonds is recognized as income as received.

f) *Committed Expenses:* The IUPAC Council meets every two years at the General Assembly to set budgets for the following two years. Starting in 1994, seventy per cent of the budgeted expenses are charged to income and expense accounts in the first year following the General Assembly and thirty per cent in the General Assembly year.

g) *Income Taxes:* The legal domicile of the Union is accepted by the Canton of Zurich as an association under Swiss law. As such, the Union is exempt from any taxation on any net income arising from its activities.

2. Fixed Assets

Equipment, Furniture and Fixtures, and Leasehold Improvements	53 046
Accumulated Depreciation	(4 061)
	48 985

3. Cash in Banks

Merrill Lynch - Cash	(29 814)
Merrill Lynch - Money Market	488 328
Barclays	6 712
Wachovia	4 516
	469 742

4. Marketable Securities

Cost	2 455 398
Unrealized Profit	600 522
Market Value	3 055 920
Designated Funds:	
Reserve Fund	2 172 515
Building Fund	439 605
Southern Hemisphere Sinking Fund	100 000
Endowment Fund	343 800
	3 055 920

5. Subscriptions and Service Charges Outstanding

National Organizations - 1998:	
Argentina	1 100
Belgium	14 800
Chile	3 200
France	800
India	15 400
Portugal	4 900
Republic of Korea	10 000
Russia	15 000
United States of America	33 800
	99 000
Allowance for Uncollectible Accounts	(10 800)
	88 200

6. Provisions and Subaccounts

JCAMP	1 730
Royal Society Contribution to Development Activities	9 665
	11 395

7. Restricted Income

ICSU	27 000
JCAMP-DX	3 065
UNESCO	15 000
	45 065

8. Governance Expense

Officers	3 269
SDIC	20 429
Contributions to ICSU & ICSU Committees	20 483
	44,181

9. Administrative Expense

General:	
Secretariat	461 243
Accounting, Audit, and Bank Fees	32 523
Handbook 1997/96	1 005
	494,771
Publications	109 977
Affiliate Members Program	56 818
	661 566

10. Accounting Transactions

Foreign Exchange Differences	767
Bad Debt Provision	(9 912)
Depreciation &Loss on Disposition of Assets	24 025
	14,880

11. Restricted Expenses

ICSU	23 303
JCAMP-DX	888
UNESCO Grant	15 000
	39 191

Schedule of Income and Expense—Budget and Actual

	Budget 1997	Actual 12/31/97	Over/ (Under)
INCOME			
National Subscriptions	646 000	623 586	(22 414)
Service Charges	13 000	7 850	(5 150)
Interest and Dividends	135 000	133,706	(1 294)
Restricted Income	-	45 065	45 065
Other Income	-	8 504	8 504
	794,000	818 711	24 711
Publications:			
Blackwell	140 000	337 664	197 664
Other Publishers	-	17,086	17 086
BS Grant	-	20 000	20 000
	140 000	374 750	234 750
AMP:			
Contributions	-	57 527	57 527
Royalties	-	643	643
Ties and Scarves	-	171	171
	-	58 341	58 341
Total Operating Income	934 000	1 251 802	317 802
EXPENSES			
Governance Expense:			
Officers	5 000	3 269	(1 731)
SDIC	-	20 429	20 429
Contributions to ICSU & ICSU Committees	21 500	20 483	(1 017)
	26 500	44 181	17 681
Administrative:			
General:			
Secretariat	290 000	461 243	171 243
Accounting, Audit, and Bank Fees	37 000	32 523	(4 477)
Handbook 1997/96	18 000	1 005	(16 995)
	345 000	494 771	149 771
Publications	-	109 977	109 977
AMP:			
CI and Leaflets	-	49 940	49 940
Miscellaneous	15 000	6 878	(8 122)
	15 000	56 818	41 818
Total Administrative	360 000	661 566	301 566
Accounting Transactions:			
Depreciation and Loss on Disposition of Assets	21 000	24 025	3 025
Bad Debt Provision	15 000	(9 912)	(24 912)
Foreign Exchange Differences	-	767	767
	36 000	14 880	(21 120)
Operations Expense:			
Standing Committees	40 000	47 192	7 192
Divisions	99 000	118 488	19 488
CI for Members	23 000	22 109	(891)
General Assembly	500 000	415 421	(84 579)
Representatives to Other Organizations	10 500	3 880	(6 620)
Other	-	70 308	70 308
Contingencies	-	8 282	8 282
	672 500	685 680	13 180
Restricted Expenses:			
ICSU	-	23 303	23 303
JCAMP	-	888	888
UNESCO Grant	-	15 000	15 000
	-	39 191	39 191
Unallocated Reserve	-	-	-
Total Expenses	1 095 000	1 445 498	350 498
Net Income (Expense) from Operations	(161,000)	(193,696)	(32,696)
Realized Gains on Securities	-	33 554	33 554
Unrealized Gains on Securities	-	328 522	328 522
Net Income (Expense)	(161 000)	168 380	329 380

Schedule of Marketable Securities

Quantity	Security Description	Cost Per Books	Estimated Market Value	Unrealized Gain/Loss
CORPORATE BONDS:				
150 000	GENERAL ELECTRIC CAPITAL CORP 5.5%, April 8, 1998	152 280.56	149 175.00	(3 105.56)
100 000	OSAKA GAS CO 5.75%, May 26, 1998	104 428.40	99 875.00	(4 553.40)
50 000	KOREA DEVELOPMENT BANK NOTES 7.0%, July 15, 1999	51 162.34	45 540.00	(5 622.34)
100 000	NIPPON TELEGRAPH & TELEPHONE 7.75%, NOV 18, 1999	109 652.78	102 875.00	(6 777.78)
100 000	SALOMON INCORPORATED NOTES 7.25%, JAN 15, 2000	105 108.88	101 869.00	(3 239.88)
100 000	SOUTHWESTERN BELL TEL CO NOTES 6.125%, MARCH 1, 2000	100 950.39	100 178.00	(772.39)
100 000	CIBA-GEIGY CORP 5.875%, MARCH 23, 2000	100 260.00	99 500.00	(760.00)
100,000	ABBEY NATIONAL TREAS 6.50%, MAY 12, 2003	107 913.89	101 421.00	(6 492.89)
	TOTAL CORPORATE BONDS	831 757.24	800 433.00	(31 324.24)
MUTUAL FUNDS - EQUITY:				
5 007	AETNA EUROPEAN EQUITY FUND CLASS A	183 679.16	242 785.00	59 105.84
423	HAUSSMANN HOLDINGS	285 803.81	473 416.00	187 612.19
13 584	MFS MERIDIAN US EMERGING GROWTH FUND	305 692.38	348 443.00	42 750.62
6 247	ML BASIC VALUE CLASS A	150 231.30	175 192.00	24 960.70
16 297	ML BASIC VALUE PORT CL O	273 610.03	459 097.00	185 486.97
15 434	ML EURO EQUITY PORT CLASS O	247 020.59	369 644.00	122 623.41
	TOTAL MUTUAL FUNDS - EQUITY	1 446 037.27	2 068 577.00	622 539.73
MUTUAL FUNDS - FIXED INCOME				
11 579	ML CORPORATE HIGH INCOME PORTFOLIO CL B	107 765.64	110 344.00	2 578.36
6 230	MLBS USD FIXED INCOME PORTFOLIO	69 838.30	76 566.00	6 727.70
	TOTAL MUTUAL FUNDS - FIXED INCOME	177 603.94	186 910.00	9 306.06
	TOTAL PORTFOLIO	2 455 398.45	3 055 920.00	600 521.55

New Books and Publications

New Books from IUPAC

Drug Metabolism: Databases and High-Throughput Testing during Drug Design and Development. **Edited by P. W. Erhardt. Blackwell Science (1999), pp. xi + 1–340, ISBN 0-632-05342-9.**

Given the exponential proliferation of technical data and our increasing ability to disseminate it rapidly through a vast maze of electronic networks, it is no wonder that new systems capable of managing and integrating information are regarded among the most important of the emerging technologies for future growth and economic development across the globe. And in the midst of its own economics-driven revolution, this theme is probably nowhere more relevant than within the pharmaceutical research and health care enterprise where new technologies having the potential to accelerate drug discovery or to expedite the development of new drug candidates, along with improved systems for enhancing the equitable delivery and pharmacoeconomics of pharmaceutical care, would be immediately greeted with considerable international enthusiasm.

It was into this climate that IUPAC chose to initiate a Working Party (WP) whose specific mission would be to consider the topic "Metabolism Databases and Their Potential Utility in the Development of New Drugs". This text represents the product from the IUPAC-sponsored WP's efforts as it has attempted to address this topic during the course of the last year-and-a-half.

After a brief Introduction, which provides an overview of the extensive background literature associated with this interdisciplinary topic, several short Case Studies are offered by various practitioners from the pharmaceutical industry. Many of these studies convey some of the industry's early experiences with the use of metabolism databases. Besides providing historical lessons and establishing an initial backdrop for the further consideration of this topic, importantly, these case studies were immediately shared within the WP so as to afford an overall theme for this project that was thus prompted from the onset by way of real, practical examples. In several instances, these examples helped shape the contributions offered within the third and most prominent section of the monograph, which pertains to New Directions. Interestingly, as the new directions section was being elaborated by a mix of academic and industrial participants, it became very clear that metabolism databases may be able to be constructed and manipulated so as to partner with enhanced-throughput metabolism data acquisition methodologies in a truly synergistic manner. This unique relationship between "old" and "new" technologies was ultimately captured within the final title for our text.

Participating in a manner explicitly separate from that of the WP, vendors of key commercial products pertinent to this field were also asked to submit contributions. The latter have been gathered within a section entitled Emerging Products. Finally, a Summary chapter, two quick Reference Tables to the available metabolism databases and to high-throughput metabolism contract research organizations, respectively, and a Glossary are offered as a wrapup for the text, while also serving to further highlight some of the key points within the overall work.

P. W. Erhardt, Editor
University of Toledo College of Pharmacy, Toledo, OH, USA

Chemical Thermodynamics. **Chemistry for the 21st Century Monograph. Edited by T. M. Letcher. Blackwell Science (1999), pp. xiv + 1-348, ISBN 0-632-05127-2.**

IUPAC conceived the Chemistry in the 21st Century series to bring to the attention of a wide audience the role that chemistry will play in the future development of society and the preservation of our environment. This imaginative series has therefore set out to produce volumes that contain essays on topics within chemistry written by experts, but appealing primarily to interested nonexperts. The interested individuals may comprise those who wish to study chemistry, make use of it, or enter into research on the subject. Within the IUPAC Commission (I.2) on Chemical Thermodynamics, this initiative of the Union was accepted with enthusiasm.

Chemical thermodynamics is a fundamental part of chemistry and is included in any curriculum designed to educate an all-around chemist. However, unlike most

areas of chemistry, thermodynamics fundamentals are firmly rooted in the 19th century. This phenomenon has sometimes created the image that chemical thermodynamics is important only from a historical point of view. We hope that this collection of essays will serve to counteract such an impression. It introduces the reader to 27 topics in chemical thermodynamics, each of which illustrates a new and potentially useful area of study. The classical areas of chemical thermodynamics involving the measurement of bond enthalpies, properties of gas mixtures and liquid mixtures, standard Gibbs energies and enthalpies of formation, etc. are not included here, as they have been exhaustively reviewed and discussed elsewhere.

The aim of this collection is to show that the applications of chemical thermodynamics are many and are related to the very latest developments in chemistry. Chemical thermodynamics is alive and well and is not only making a valuable contribution to our understanding of the world about us, but is helping to create a better world. This realization is particularly important as we stand on the brink of an unprecedented increase in world population and pollution and the possibility of a significant climatic change. Each essay is aimed not only at those working in the area, but also at the general chemist, at the prospective researcher, and also at those involved in funding chemical research

The areas covered are separation technology, including membrane techniques, solvent extraction, and supercritical properties; colloids and microemulsions; electrolytes; adsorption; nuclear applications; theoretical and quantum chemistry; polymer science; microgravity; new materials, including amorphous materials and glasses; enzyme-catalyzed reactions; biology and cell biology; medicine and pharmacy; food science; and petroleum chemistry.

W. A. Wakeham
Chairman, IUPAC Commission (I.2) on Chemical Thermodynamics
T. M. Letcher
Editor and Titular Member, IUPAC Commission (I.2) on Chemical Thermodynamics

***Macromolecular Symposia, Vol. 132: Ionic Polymerization*. Symposium Editors, J.-P. Vairon, H. Cheradame, P. Hemery, and M. Sepulchre; Editor-in-Chief, Hartwig Hocker; Editors, W. Guth, B. Jung, I. Meisel, and S. Spiegel. Wiley-VCH (1998), pp. 1–462, ISBN 3-527-29800-2 (ISSN 1022-1360).**

Volume 132 of *Macromolecular Symposia* contains invited and contributed lectures presented at the International Symposium on Ionic Polymerization held 7–11 July 1997 in Paris, France, under the sponsorship of IUPAC's Macromolecular Division.

The Symposium began with a lecture entitled "Quo Vadis Ionic Polymerization?" by Professor J. P. Kennedy. That was indeed a good question. We think that the reader will find some answers in this book, or at least will observe some significant trends.

From our point of view, one of the more important conclusions was the fact that it is possible to synthesize block copolymers by switching from carbocationic to radical polymerization while keeping living behavior. The generalization of such a synthetic strategy is certainly a challenge of the near future. The domain of controlled macromolecular architecture is very active, and examples include, for instance, the design of multifunctional macroinitiators and supramolecular aggregates of well-defined shape through carbocationic polymerization, or the polymerization of macromers leading to segmented polymer networks. Examples showing that it is possible to combine not only anionic and cationic polymerizations, but also group transfer (GTP) and anionic polymerizations, are given. It was even shown that it becomes possible for the polymerization to be independent of the reactivity of the monomers in anionic polymerization, for instance, by initiating the polymerization of styrene by a living poly(ethylene oxide) in the presence of an appropriate disilane additive. Changing the relative reactivity of the various monomers was a dream that is beginning to become a reality.

We were also pleased in see that studies, aimed at understanding many points that are still unclear in each of the fields of ionic polymerization, are alive, and that important developments are at hand. It is not possible here to indulge in detailed descriptions, but we quote those that seem very promising. There is the case of anionic polymerization of methylmethacrylate where the classical lithium initiators can be associated with lithium amino alkoxides, giving a truly living system that is able to proceed stereospecifically at temperatures as high as 70°C. Similarly, it has been found that the introduction of Lewis bases, such as esters or some ethers, can be used in the polymerizations of acrylates and methacrylates initiated by aluminum alkyls, allowing living behavior up to 0°C. Quaternary ammonium salts are also worthy of investigation in this context, showing the potential to control tacticity and molecular characteristics. This molecular control allowed preparation of stereoregular uniform PMMA architectures, and also, for instance, the stereocomplex between isotactic and syndiotactic PMMA.

Cationic polymerization is still attracting fundamental studies, either on the structure of the active species and their relationship with the living behavior or the initial reactions leading to active species. The role of additives such as electron donors or proton scavengers

was also examined in further detail.

On the side of cyclic monomers, some papers described the polymerization of cyclic esters, of lactones, of trioxane and oxirane, of cyclocarbonates, and of cyclosiloxanes. This field is very rich and shows very promising developments.

Whatever the mechanism of ionic polymerization applied in the polymerization of monomers with double bonds or of cyclic monomers, control of the molar weights and sometimes of microstructure could be achieved in a much wider temperature range more favorable for industrial developments. Most of the studies provided ways to control the side reactions (termination or transfer) and possibly to eliminate them. Finally, this Symposium saw the triumph of living polymerization, even if there remain unsolved problems.

Professors Herve Cheradame and
Jean-Pierre Vairon
Symposium Editors

Macromolecular Symposia, Vol. 135: Recycling of Polymers. **Symposium Editor, J. Kahovec; Editor-in-Chief, Hartwig Hocker; Editors, W. Guth, B. Jung, I. Meisel, and S. Spiegel. Wiley-VCH, December 1998, pp. 1-373, ISBN 3-527-29803-7 (ISSN 1022-1360).**

Volume 135 of *Macromolecular Symposia* is devoted to recycling of polymers, a subject of great societal importance. All advanced industrial societies protect their environment and conserve resources by recycling materials that still have a useful life. Among currently used materials, polymers in particular, have been a source of concern because they contribute a relatively large volume to the waste streams originating from households. Efforts have therefore been underway to remedy this problem either by reusing the polymers directly or by recovering the chemical or energy content of the polymeric materials that would otherwise be disposed of in wasteful ways, e.g., in landfills.

Most of the papers in this volume were presented at the Microsymposium on Recycling of Polymers that took place at the Institute of Macromolecular Chemistry in Prague from 14-17 July 1997 under the sponsorship of IUPAC and the Czech Chemical Society. The Microsymposium was an exceptional opportunity to bring together about 100 specialists from 18 countries working on this important subject. It was a followup of a previous IUPAC symposium on the same topic that was held in 1991 (see Volume 57 of *Macromolecular Symposia*). Together with the papers presented at the Prague Microsymposium, we are also publishing here the final report of the Working Party on Recycling of Polymers that operated under the auspices of the Macromolecular Division of IUPAC and several papers contributed by specialists from that working party and their colleagues. By combining the papers from these two sources, we hope to enable the reader to be brought up to date on the current state of knowledge in this essential area.

Dr. Norbert M. Bikales
Chairman of the Microsymposium
Chairman, IUPAC Working Party on Recycling of Polymers

New Books from The Royal Society of Chemistry

Science Funding: The European Dimension

The Royal Society of Chemistry published *Science funding: the European Dimension*, the latest in their Science in Society series, in January 1999. Science in Society is a series of five meetings, and subsequent books, exploring the interaction of public policy, technological change, and scientific knowledge. Topics covered are deliberately broad, and those invited to contribute include experts from the social and natural sciences, technologists, engineers, politicians, and policymakers. Three of the five meetings have been held to date—Science, Policy, and Risk (book also currently available from The Royal Society); Science Funding: The European Dimension; and Climate Change and Human Health (book to be published in June 1999). Two meetings will be held in 1999—Science and the Third Age (Spring 1999) and The Social Responsibilities of Scientists (Autumn 1999).

Nation States support scientific research as a contribution to culture and in the expectation of achieving economic benefit. European collaboration is essential for the largest of the "big science" projects, and, as demonstrated by particle physics, can be highly successful; however, there is a growing tendency toward funding of a wider range of science at the European Union, rather than the Nation State, level.

Science funding: the European dimension examines reasons for these developments, problems that can arise, and benefits that are sought and achieved by countries within Europe. The book was edited by Royal Society Treasurer Sir Eric Ash, and contributors include William Waldegrave, Sir Robert May FRS, Sir Robert Nicholson, and Sir Graeme Davies.

Science Funding: The European Dimension. ISBN: 0854035192; 84 pages; Price: GBP 12.50.

Science, Policy, and Risk. ISBN: 0854035133; 87 pages; Price: GBP 12.50.

The books may be ordered from: Jacqueline Knapp, The Royal Society Publications Department, 6 Carlton

House Terrace, London SW1Y 5AG, UK. Tel: +44 (0)171 4512645; E-mail: jackie.knapp@royalsoc.ac.uk.

For further details contact: Debbie Vaughan, The Royal Society of Chemistry (address above). Tel: +44 (0)171 8395561; Fax: +44 (0)171 9761837; E-mail: debbie.vaughan@royalsoc.ac.uk; Web site: http://www.pubs.royalsoc.ac.uk.

Dictionary of Substances and their Effects (DOSE), 2nd Edition

This specialist compilation of data on chemicals with environmental impact has been revised, updated, and expanded for release in October 1999. An easy-to-use, vital reference source for all health, safety, and environmental officers; scientists; toxicologists; and regulatory bodies, it offers the following enhancements:

- latest regulatory requirements
- fully referenced data
- additional chemicals
- seven volumes, released simultaneously

Prepublication purchasers will save GBP 120.00 on the postpublication price of GBP 1295.00.

For further details, contact: Sales & Promotion Department, The Royal Society of Chemistry, Thomas Graham House, Science Park, Milton Road, Cambridge CB4 0WF, UK; Tel.: +44 1223 420066; Fax: +44 1223 423429; E-mail: sales@rsc.org; Web site: http://www.rsc.org/dose.

Use of Matrix Reference Materials in Environmental Analysis

This is the fourth book in a series based on the work of the IUPAC Working Party on Harmonization of Quality Assurance Schemes for Analytical Laboratories. The papers contained in this volume were presented at a workshop on the Proper Use of Environmental Matrix Reference Materials, 22–23 April 1999, in Berlin, Germany. The workshop was organized in conjunction with the ISO Committee on Reference Materials, the Bundesanstalt fur Materialforschung und –prufung, and Eurolab-Deutschland. This activity is an excellent example of the kind of activity envisaged by the founders of IUPAC in 1919.

ISBN: 0854047395; 216 pages; Price: GBP 59.50.

To order, contact The Royal Society of Chemistry, Turpin Distribution Services Ltd., Blackhorse Road, Letchworth, Herts SG6 1HN, UK. Tel: +44 (1)462 672555; Fax: +44 (1)462 480947; E-mail: turpin@rsc.org.

New Publications from the World Health Organization

WHO Expert Committee on Biological Standardization, 47th Report, Technical Report Series No. 878

1998, vi + 101 pages (available in English; French and Spanish in preparation), ISBN 92 4 120878 3, CHF 20.-/USD 18.50; In developing countries: CHF 14, Order no. 1100878. WHO distribution and sales, CH-1211 Geneva 27, Switzerland.

This report presents the recommendations of a WHO expert committee commissioned to coordinate a range of research and other activities needed to assure the purity, potency, safety, and stability of biological products used in medicine. Work includes the development and adoption of detailed requirements for the manufacturing, licensing, and control of vaccines and other biologicals. The committee also coordinates the establishment of international reference materials for measuring the potency and other characteristics of biological products. These reference materials are used worldwide and play a crucial role in ensuring the comparability of products on a global basis.

The report has three parts. The first provides a brief discussion of general issues that shape the committee's work. Issues discussed include the implications of reverse transcriptase activity in avian cells, the need for reference preparations for evaluating hepatitis B, hepatitis C, and HIV diagnostic kits, and progress toward the standardization of gene-amplification methods for the viral safety testing of blood and blood products. The second part summarizes activities relating to the status of some 24 biological reference preparations categorized as antibiotics, antibodies, blood products and related substances, cytokines, endocrinological and related substances, toxins, and other substances.

The third and most extensive part issues detailed requirements for the use of animal cells as *in vitro* substrates for the production of biologicals, guidelines for the production and control of the acellular pertussis component of monovalent or combined vaccines, and guidelines for assuring the quality of DNA vaccines.

Basic Tests for Drugs, Pharmaceutical Substances, Medicinal Plant Materials, and Dosage Forms

1998, iii + 91 pages (available in English; French and Spanish in preparation) ISBN 92 4 154513 5 CHF 26.-/USD 23.40; In developing countries: CHF 18.20, Order no. 1150462

This book provides a step-by-step guide to simple methods for verifying the identity of commonly used pharmaceutical substances and dosage forms. The basic tests described can also be used to detect mislabeled,

substandard, or counterfeit products when the labeling or physical attributes give rise to doubt. Intended for use in developing countries, where resources and specialized skills may be scarce, all tests rely on a limited range of easily available reagents and equipment and need not be performed in a fully equipped laboratory or by persons with specialized training in pharmacy or chemistry.

The book describes tests for 23 pharmaceutical substances and 58 pharmaceutical dosage forms, most of which are included in the WHO Model List of Essential Drugs. Basic tests for confirming the identity of four commonly used medicinal plant materials are also included. As stressed in the text, these tests, which merely confirm identity, are intended for use as primary screening tools and may need to be followed, in cases of adverse test results, by a full pharmacopoeial analysis.

The book opens with a brief description of the importance of basic tests as one of the many steps needed to ensure a supply of safe and effective drugs. Chapter 2 describes several collections of more sophisticated tests, including volumetric or spectrophotometric analysis and thin-layer chromatography, that can be useful in the primary screening of imported pharmaceutical substances and dosage forms. Information on how to obtain and use these guides to tests, which have not been published by WHO, is also provided.

Against this background, the main part of the book sets out test procedures for verifying the identity of selected pharmaceutical substances, pharmaceutical dosage forms, and medicinal plant materials. The book concludes with a cumulative index of test procedures described here and in the related WHO publications, *Basic Tests for Pharmaceutical Substances* and *Basic Tests for Pharmaceutical Dosage Forms.*

Quality Control Methods for Medicinal Plant Materials

1998, viii + 115 pages (available in English; French and Spanish in preparation), ISBN 92 4 154510 0, CHF 35.-/USD 31.50; In developing countries: CHF 24.50, Order no. 1150451.

This manual provides a collection of recommended test procedures for assessing the identity, purity, and content of medicinal plant materials. Intended to assist national laboratories engaged in drug quality control, the manual responds to the growing use of medicinal plants, the special quality problems they pose, and the corresponding need for international guidance on reliable methods for quality control. Recommended procedures—whether involving visual inspection or the use of thin-layer chromatography for the qualitative determination of impurities—should also prove useful to the pharmaceutical industry and pharmacists working with medicinal plant materials.

Test procedures are intended to support the development of national standards based on local market conditions, with due regard to existing national legislation and national and regional norms. The book also includes advice on general limits for pesticides and other contaminants commonly found in medicinal plant materials.

The book opens with a brief discussion of general principles for the analysis of plant materials, including advice on the special handling procedures required during sampling, and guidance on macroscopic and microscopic examination as the first step toward establishing the identity and degree of purity of plant materials. Subsequent chapters describe procedures for the determination of foreign matter, ash**,** extractable matter, water and volatile matter, volatile oils, bitterness value, haemolytic activity, tannins, swelling index, and foaming index. Where relevant, suitable test apparatuses are illustrated and explained.

Additional chapters set out test methods for the determination of such important contaminants as pesticide residues, arsenic and heavy metals, and microorganisms, including aflatoxins. The remaining chapters cover procedures for preparing culture media, strains of microorganisms suitable for use in tests, specifications for adsorbents for use in thin-layer chromatography, and detailed descriptions of the reagents, test solutions, and volumetric solutions used in the recommended tests.

Provisional Recommendations

IUPAC Seeks Your Comments

In this section, we publish synopses of IUPAC's latest provisional recommendations on nomenclature and symbols. All comments on these recommendations are welcome and will be taken into consideration. The final revised versions are published in *Pure and Applied Chemistry*, and synopses of these are published in *Chemistry International* as recent reports.

If you would like to comment on the provisional recommendations, please write to your nearest national/regional center to request a copy of the full report. Copies are not available from the IUPAC Secretariat. The most recent list of national/regional centers appeared in *Chemistry International* 1997, **17**, 141. This information is also available on the IUPAC web site: http://www.iupac.org.

Organic Chemistry Division. Commission on Physical Organic Chemistry— Glossary of Terms Used in Theoretical Organic Chemistry

The glossary contains definitions and explanatory notes for more than 400 terms used in the context of multidisciplinary research and publications related to applications of modern theoretical concepts, computational and graph-theoretical methods to investigation in structure, reactivity, spectroscopic and other physical and physicochemical properties of organic, organometallic, and metal coordination compounds. The aim of the glossary is to provide guidance on terminology used in theoretical organic chemistry and to contribute to the elusion of inconsistencies and ambiguities in the meanings of terms in the area.

Comments by 31 October 1999 to Prof. Vladimir I. Minkin, Institute of Physical and Organic Chemistry, Rostov University, Stachka Avenue 194/2RU-344090, Rostov on Don, Russia. Tel: +7 (8632) 285700, Fax: +7 (8632) 285667, E-mail: minkin@ipoc.rnd.runnet.ru.

Reports from Commissions

Commission on Agrochemicals and the Environment—VI.4

Summary of Minutes of Commission Meeting in Cambridge, England, 8–10 August 1998

Twenty-three members of the Commission on Agrochemicals and the Environment (VI.4), including national representatives and observers, met for three days of productive work in Cambridge immediately following the 9th IUPAC International Congress of Pesticide Chemistry in London. Members were welcomed to historic Cambridge and were most grateful to the UK members of the Commission who had made arrangements for the meeting. Chairman and secretary of the Commission are Dr. Kenneth Racke and Mr. Denis Hamilton, respectively.

In the discussion on membership, it was noted that the two observers (Dr. Katayama and Dr. Bellin) invited to the 1998 meeting had participated actively and usefully in the project work and should be invited to participate further by attending the Berlin meeting in 1999. Possible additional participants could attend from Egypt, Brazil, Costa Rica, Chile, Germany, and Switzerland. It was suggested that National Adhering Organizations should consider funding of their national representatives to encourage more active involvement. Some national representatives are already very active in the Commission, but they do this with little assistance, contributing their own time and resources.

Attending the 9th IUPAC International Congress of Pesticide Chemistry in London in August 1998 were 1700 registrants and 124 accompanying persons representing 58 countries. Affiliation of delegates was roughly 3:1 industry:public sector. The bulk of presentations were in poster format, with over 1100 displayed, and were of a high standard. A copy of the IUPAC Pesticide Glossary, including a brief summary of the Commission's role and listing of recent publications, was put into each delegate's satchel. There were good media relations established before and during the Congress by the organizers and, in addition to active coverage of the Congress in the popular press, pre-meeting articles also appeared in *Pesticide Outlook* and *Chemistry in Britain*.

The 10th IUPAC International Congress of Pesticide Chemistry will take place in Basel from 4–9 August 2002, with the theme "Innovative solutions for healthy crops". The Commission was informed that the word "pesticide" in the Congress title was causing commercial difficulty for the organizers and carried the connotation of "pestilence" in some European languages. Commission members were generally disappointed that the word "pesticide," which has a clear meaning, was to be dropped but, of the suggested options, members favored 10th IUPAC International Congress on the Chemistry of Crop Protection.

The Commission maintains a strong desire to continue its series of regional pesticide workshops and is planning a workshop (leader, Sue-Sun Wong) in Taiwan for 4–7 October 2000, with the theme "Harmonization of pesticide management—regulation, monitoring, and evaluation".

Dr. Miyamoto (Chairman of the Division of Chemistry and the Environment, VI) explained the Strategy Development and Implementation Committee (SDIC) report and changes in the structure of IUPAC. He stressed the importance of the visibility of IUPAC and its ability to influence future directions. During discussion, members raised a number of points:

(1) Multiorganizational projects may not be able to be completed within the schedule because of extra delays resulting from the required coordination.
(2) IUPAC project recommendations should not need approval from other organizations; rather, IUPAC recommendations should be recognized as scientifically independent.

(3) IUPAC may seek funding from outside agencies for a project.
(4) Results of our work are not very visible because of the poor availability of *Pure and Applied Chemistry.*
(5) International character and geographical spread of the Commission will diminish if we pursue the proposed task force approach. The pressure will be to choose a small group of experts from a limited geographic area and preferably with good English writing skills.
(6) The Commission should obtain information on the effects or impacts of its workshops held in developing countries.

Most of the Commission meeting time was occupied with developing its projects, the heart of the Commission's work.

A near-final report of Project 20/87, "Relevance of impurities in technical grade pesticides" (leader, Arpad Ambrus), has been circulated to members and is essentially ready for publication.

Project 29/91, "Significance of long-range transport of pesticides in air" (leader, John Unsworth), is final and ready for publication.

An advanced draft report of Project 31/91, "Disposal and degradation of pesticide waste" (leader, Allan Felsot), was available; team members will check national systems for classification of wastes for inclusion in the next draft.

The final report of Project 36/93, "Bound xenobiotic residues in food commodities of plant and animal origin" (leader, Mike Skidmore), has been submitted for publication.

An advanced outline of Project 40/97, "Mass spectrometric techniques for multiresidue monitoring of pesticides in food and animal feedstuffs" (leader, Stewart Reynolds), was available for discussion in Cambridge.

Little progress had been made with Project 41/97, "Regulatory limits for pesticide residues in water" (leader, Denis Hamilton). The project will examine the reasons and the basis for setting standards for residues in waters.

An outline of Project 42/97, "Interception and retention factors for pesticides applied to plant foliage" (leader, Jan Linders), was available for discussion in Cambridge. The objective is to develop new estimation rules for an environmental exposure analysis where information on fraction of spray contacting the foliage and fraction of spray retained by the foliage are needed.

A detailed workplan for Project 43/97, "Pesticide soil sorption parameters K_d and K_{oc}; theory, measurement, uses, limitations, and reliability" (leader, Don Wauchope), was decided in Cambridge. The objective is to analyze the variability of K_d and K_{oc} and to recommend rules for estimating the probable errors and limitations of these parameters when used to predict pesticide mobility.

The following proposals for projects were raised for the first time at the Cambridge meeting:

(1) Trends in research in agrochemicals: Do we have the critical mass of open science (publication) needed both to advance the open science of crop protection and to protect the public's interest?
(2) Bioavailability of agrochemicals in the soil environment
(3) Pesticide residues in food—acute dietary exposure
(4) Harmonized practical approach for the validation of multiresidue methods for pesticide residue analysis
(5) Impact of large-scale breeding of transgenic crops on the use of agrochemicals and the environment
(6) Chemicals in integrated pest management.

Project reports are currently published in *Pure and Applied Chemistry*, but the journal has poor visibility for pesticide chemistry. In the future, project summaries and recommendations will appear in *Pesticide Science* to improve their visibility. The Commission considered the possibility of publishing its reports in journals other than *Pure and Applied Chemistry*, but was not clear on IUPAC publishing policy.

The Commission decided on the contents of a web site, to be planned by Jan Linders:

(1) Role or mission of the Commission
(2) List of members
(3) Current projects with progress reports
(4) Abstracts and recommendations of completed projects
(5) List of published papers
(6) Meeting reports
(7) Future activities, e.g., planned workshops

Denis Hamilton
Secretary of Commission VI.4

Awards

Erwin Buncel Wins Canadian Society for Chemistry Lemieux Award

Professor Erwin Buncel, FCIC, Department of Chemistry, Queen's University, Kingston, Ontario, Canada, and since 1993 Canadian representative on the IUPAC-CHEMRAWN (Chemical Research Applied to World Needs) Committee, has won the Canadian Society for Chemistry's prestigious R. U. Lemieux Award for organic chemistry. He was honored for his studies of the alpha effect and solvent effects, extension of the investigation of carbanion structure and reactivity to group 14 anions, exploitation of anionic sigma complexes as biochemical and biophysical probes, and research with aromatic dye molecules.

Born in Czechoslovakia and educated in England, Professor Buncel performed postdoctoral research in the United States and Canada, worked briefly for industry, and has spent virtually his entire career since then at Queen's University, except for numerous visiting professorships in different countries. He has written or coauthored more than 250 research articles, 20 reviews and chapters, and 2 books; and he has edited or coedited 15 books and symposia. More than 50 graduate students have earned degrees by working with him, and he has collaborated with scientists in over a dozen countries.

Dr. Buncel received the 1985 Syntex Award in physical organic chemistry from the Canadian Society for Chemistry (CSC), and a special issue of the *Canadian Journal of Chemistry* was dedicated in his honor in 1998. He served as physical organic chemistry editor for that journal from 1981 to 1993, and he currently edits manuscripts for the *Journal of Labelled Compounds and Radiopharmaceuticals*.

In recent years, Professor Buncel has become increasingly involved in international scientific activities via participation in the International Isotope Society as trustee, conference chair, editor, and Canadian Chapter President, and through activities on IUPAC Working Committees, especially in work directed at developing countries.

Conference Announcements

3rd IOCD/IUPAC International Workshop for Regulatory Chemists and Laboratory Managers in Central European Countries, 16–18 June 1999, Prague, Czech Republic

This workshop is sponsored by the International Organization for Chemical Sciences in Development (IOCD)/IUPAC Joint Working Party on Environmental Analytical Chemistry in Developing Countries.

For information, please contact Dr. Pavel Drasar, Czech Chemical Society, E-mail: drasar@uochb.cas.com; *Tel: 420-2-2108-2383; Fax: 420-2-288-2248; or Dr. Robert Maybury, E-mail:* iocd@igc.apc.org; *or Dr. Ilona Boros, President, AOACI Central Europe Subsection, E-mail:* ilona.cukorkutato@mail.datanet.hu; *Web site:* http://www.iocd.unam.mx.

UNITAR/IFCS Thematic Workshop on Developing & Strengthening National Legislation and Policies for the Sound Management of Chemicals, 22–25 June 1999, Geneva, Switzerland

This workshop is the third in a series of Thematic Workshops on Priority Topics of National Chemicals Management Capacity Building. It is being organized by the United Nations Institute for Training and Research (UNITAR) in cooperation with the Intergovernmental Forum on Chemical Safety (IFCS), as well as several international organizations, including FAO, ILO, UNEP, WHO, and the Secretariat of the Organization for the Prohibition of Chemical Weapons. The workshop is aimed toward government officials who have direct responsibility for the development and implementation of national chemicals legislation in developing countries and countries with economies in transition. In addition, representatives from countries with advanced chemicals legislation, nongovernmental organizations (i.e., industry, labor, public interest, and the academic sector), international/intergovernmental organizations, and development cooperation agencies will participate.

The workshop is expected to make a constructive contribution to the international debate on building national capacities in the area of chemicals legislation and policies and to provide pragmatic and innovative ideas that countries can use in developing strategies to fit their national needs. It is also meant to respond to the recommendations issued by Forum II and ISG3 for enhanced capacity building in this area, and its conclusions are expected to shape further discussions among Inter-Organization Programme for the Sound Management of Chemicals (IOMC) Participating Organizations, as well as others involved in providing assistance to countries in this area.

Specific workshop objectives include (1) systematically identifying and documenting problems countries are facing in developing, implementing, and enforcing chemicals legislation and policies; (2) identifying possible elements of a systematic national strategy, e.g., measures, steps, and "best practices" countries may want to consider toward strengthening their national chemicals legislation and policies, including voluntary measures; (3) promoting development of national chemical safety legislation/regulations that are consistent with and complementary to recognized international agreements and technical standards; and (4) identifying precise needs of countries for external assistance and/or for additional guidance material.

While participants are expected to secure their own funding to participate in the workshop, UNITAR will be in a position to cover travel costs for a number of representatives from developing countries and countries with economies in transition. Those interested in being considered for sponsorship are expected to contribute a paper to the workshop. The working language of the meeting will be English. An invitation letter, as well as additional details on the event, including an information note, a tentative agenda, and information on how to apply for sponsorship, will be mailed out to interested parties.

For additional information, please contact Achim Halpaap, Senior Program Coordinator, Training and Capacity Building Programs in Chemicals and Waste Management, UNITAR, Palais des Nations, CH-1211 GENEVE 10, Switzerland, E-mail: achim.halpaap@unitar.org; Fax: +41 22 917 80 47; Web site: http://www.unitar.org/cwm.

lims^{99} (International LIMS Conference & Exhibition), 23–25 June 1999, Basel, Switzerland

This biennial European Laboratory Information Management Systems (LIMS) Conference and Exhibition, with the theme "Crossing the Millennium", is sponsored by The Royal Society of Chemistry, *Scientific Computing World*, Eurachem, the AOAC International European Section, and the New Swiss Chemical Society (NCS). In addition to its traditional core LIMS focus, the meeting will highlight integration strategies, re-engineering, human issues, web-based operation, and updates from regulatory agencies. Attendees are expected to include IT policymakers, laboratory and QA managers, LIMS users, MIS/IT staff, and software engineers.

Each day of programs will be directed at a slightly different target group. On Wednesday, the focus will be on radical changes that are affecting industry and the strategic thinking needed to deliver business benefits; on Thursday, integration and optimization of MES, SAP, MIS, and codependent LIMS systems; and on Friday, total and distributed laboratory automation and the LIMS response. Each day will feature plenary lectures by experts in LIMS, laboratory computing, and analytical measurement and will cover a variety of industrial applications ranging from biotechnology, environmental, clinical, food, pharmaceutical, and petrochemical applications through a series of intensive parallel sessions, two of which will be presented in French (on Wednesday) and German (on Friday).

Specific presentations will include the following topics:

- External factors shaping the analytical and IT environment
- Concept and implementation of a company-wide LIMS package
- FDA update—regulatory requirements into the next millennium
- TABAK consortium—towards a standard pharmaceutical LIMS
- Knowledge management—a role for LIMS
- FDA 21 CFR part 11—electronic signatures applied to LIMS
- Quality management—its key role in business integration
- Globalization and validation
- From operational to strategic LIMS in drug metabolism and pharmacokinetics
- SAP-ERP systems and LIMS are coming together
- Modeling the laboratory
- Workflow and optimization
- Integration of LIMS across research, development, and manufacturing
- LIMS and robotic applications
- LIMS—the next generation
- What is the next step after the fully automated system in the clinical laboratory?
- "Lab in the bag": automated continuous yield of chemical information
- LIMS in a distributed environment

- Bioanalytical LIMS
- New approaches to LIMS and instrument interfacing
- Portable systems
- Using LIMS to monitor and control workflow and production
- Internet/intranet applications
- LIMS and total automation

For information, contact Conference Secretariat, lims[99], 45 Hilltop Avenue, Hullbridge, Hockley, Essex, SS5 6BL, United Kingdom, E-mail: jay@limsconf.com; *Tel: +44 1702 231268; Fax: +44 1702 230580; Web site: http://www.limsconf.com.*

2nd Postgraduate Summer School on Green Chemistry, 6–12 September 1999, San Servolo (Venice), Italy

This seven-day training course is organized under the auspices of the Italian Interuniversity Consortium "Chemistry for Environment" within the framework of the "Training and Mobility of Research" (TMR) program of the European Commission. Its purpose is to provide graduate students and young researchers with appropriate scientific and technological know-how to help prevent pollution and reduce environmental contamination.

Sessions will focus on industrial processes, alternative solvents, new feedstocks and products, new reactions, new synthetic methods, and selected special topics. Case histories will be used to demonstrate examples of clean organic processes and strategies behind planning and designing efficient "greener" synthetic routes.

Attendance is limited to 60 postgraduate students and postdoctoral researchers under 35 years of age from European Union countries, Eastern Europe, the Balkans, and Asia.

For further information, please contact Dr. Alvise Perosa, Dipartimento di Scienze Ambientali, Universita Ca'Foscari, Dorsoduro 2137 – 30123 Venezia, Italy, E-mail: alvise@unive.it; Tel: +39 041 2578676; Fax: +39 041 2578620; Web site: http://www.unive.it/inca.

CITAC '99 Japan Symposium, 9–11 November 1999, Tsukuba, Japan

This CITAC (Co-operation on International Traceability in Analytical Chemistry) Symposium, is organized by the Japan Society for Analytical Chemistry (JSAC) and the National Institute of Materials and Chemical Research (NIMC). Featured lectures, workshops, and poster sessions will focus on traceability in chemical measurements, laboratory accreditation, quantification of uncertainties, reference materials, proficiency testing, and education and training for quality assurance.

For further information, please contact Dr. Kensaku Okamoto, Secretary, CITAC '99 Japan Symposium, National Institute of Materials and Chemical Research (NIMC), Ministry of International Trade and Industry (MITI), 1-1, Higashi, Tsukuba, 305-8565, Japan, E-mail: kokamoto@nimc.go.jp; Tel/Fax: +81-298-54-4628.

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 6 879 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.: +7 812 323 2907
Fax: +7 812 328 6869
E-mail: imc@macro.spb.su

CHEMRAWN - Postponed

~~20–24 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

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.
Tel.: +55 31 339 7675
Fax: +55 31 339 7666
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, Heyrovskeho nam. 2, 162 06 Praha 6, Czech Republic.
Tel.: +420 2 20403332
Fax: +420 2 367981
E-mail: sympo@imc.cas.cz

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 IUPAC 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.
Tel.: +44 (151) 794 4336
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, Heyrovskeho nam. 2, 162 06 Praha 6, Czech Republic.
Tel.: +420 2 20403332
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 606-8501, Japan.
Tel.: +81 75 753 5628
Fax: +81 75 753 4911
E-mail: ip99@mat.polym.kyoto-u.ac.jp

Analytical Science

25–30 July 1999
Analytical Science into the Next Millennium (SAC 99), Dublin, Ireland.
Prof. Malcolm R. Smyth, School of Chemical Sciences, 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
26th International Conference on Solution Chemistry, Fukuoka City, Kyushu, Japan.
Prof. Shin-ichi Ishiguro, Department of Chemistry, Faculty of Science, Kyushu University, 6-10-1 Hakozaki, Higashi-ku, Fukuoka, 812-8581, Japan.
Tel.: +81 92 642 2581
Fax: +81 92 642 2607
E-mail: 99icscc@mbox.nc.kyushu-u.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
31st Colloquium Spectroscopicum Internationale 1999, Ankara, Turkey.
Prof. Dr. O. Yavuz Ataman, Department of Chemistry, Middle East Technical University, 06531 Ankara, Turkey.
Tel.: +90 312 210 3232
Fax: +90 312 210 1280
E-mail: xxxicsi@rorqual.cc.metu.edu.tr

Macromolecule-Metal Complexes

5–9 September 1999
8th International Symposium on Macromolecule-Metal Complexes (MMC-VIII), Tokyo, Japan.
Prof. Eishun Tsuchida, Department of Polymer Chemistry Waseda University Toyko 169-8555, Japan.
Tel.: +81 3 5286 3148
Fax: +81 3 3205 4740
E-mail: teruyuki@mn.waseda.ac.jp

Organic and Organoelement Chemistry

6–11 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. Bubnov, INEOS, Vavilov str. 28, Moscow.
Tel.: +7 (095) 135 6165
Fax: +7 (095) 135 5085
E-mail: dir@ineos.ac.ru

Chemistry and the Internet

25–27 September 1999
ChemInt'99—Chemistry and the Internet, Georgetown University, Washington DC, USA.
Dr. Stephen R. Heller, NIST/SRD, 820 Diamond Avenue, Gaithersburg, MD 20899-2310 USA.
Tel.: +1 301 975 3338
Fax: +1 301 926 0416
E-mail: srheller@nist.gov

Toxicology

6–10 November 1999
4th Congress of Toxicology in Developing Countries, Antalya, Turkey.
Prof. Semra Sardas, Gazi University, Faculty of Pharmacy Toxicology Department, 06330, Hipodrom, Ankara, Turkey.
Tel.: +90 312 212 30 09
Fax: +90 312 222 23 26
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

How to Apply for IUPAC Sponsorship

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

High Temperature Materials Chemistry

10–14 April 2000
10th International Conference on High Temperature Materials Chemistry, Aachen, Germany.
Prof. Klaus 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

Flow Analysis

25–29 June 2000
8th International Conference on Flow Analysis, Warsaw, Poland.
Prof. Marek Trojanowicz, Department of Chemistry, University of Warsaw, Pasteura 1, 02-093 Warsaw, Poland.
Tef/Fax: +48 22 822 35 32
E-mail: trojan@chem.uw.edu.pl

Organic Synthesis

1–5 July 2000
13th International Conference on Organic Synthesis (ICOS-13), Warsaw, Poland.
Prof. M. Makosza, 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/Lodz, 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, Heyrovskeho nam. 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 IUPAC 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 3681
Fax: +49 (208) 306 3951
E-mail: braslavskys@mpi-muelheim.mpg.de

Solubility Phenomena

25–28 July 2000
9th International Symposium on Solubility Phenomena (9th ISSP), Hammamet, Tunisia.
Prof. Najia Kbir-Ariguib, National Institute for Scientific and Technical Research, P.O. Box 95, Hammam-Lif, 2050 Tunisia.
Tel: +216 1 430 215
Fax: +216 1 430 934
E-mail: ariguib@planet.tn

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.: +1 902 494 3894
Fax: +1 902 494 1310
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 Department
Riso National Laboratory DK-4000, Roskilde, Denmark.
Tel: +45 4677 5800
Fax: +45 4677 5758
E-mail: o.toft.sorensen@risoe.dk

Biotechnology

3–8 September 2000
11th International Biotechnology Symposium, Berlin, Germany.
Prof. G. Kreysa, DECHEMA e.V.— c/o 11th IBS, Theodor-Heuss-Allee 25, 60486 Frankfurt/Main, Germany.
Tel.: +49 69 7564 241
Fax: +49 69 7564 201
E-mail: info@dechema.de

Natural Products

4–8 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, Sao Paulo, Brazil.
Tel.: +55 16 274 8208
Fax: +55 16 274 8350
E-mail: dmfs@power.ufscar.br

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) 771 0014
Fax: +32 (2) 762 0044
E-mail: laura@ilsieurope.be