Report to the Executive Committee

by the Strategy Development and Implementation Committee

Proposed changes in organization and management of IUPAC scientific activities

The final report by the Strategy Development and Implementation Committee (SDIC) is given in the following pages The IUPAC Executive Committee has accepted the SDIC report and voted unanimously to recommend to the Bureau that the proposals by the SDIC be adopted. The *Strategic Plan, 1998–99*. has already been approved by the IUPAC Executive Committee. The recommended changes in organization and management that will occur are far-reaching and will alter many aspects of the IUPAC structure and operations. I strongly believe that these proposals should be implemented and will enable the Union to play a major role in the development of chemistry in the 21st century.

Under the SDIC proposals, the seven Division Committees will assume direct responsibility for initiating, developing and managing the Union's scientific work, with each scientific project carried out by a short-term Task Group. Allocation of financial resources is to be tied directly to individual projects, and meaningful dates are to be established for completion of projects. These proposals thus envision a structure that is far more dynamic than the present one with 37 relatively permanent Commissions. In fact, the SDIC recommends that Council be asked in 1999 to terminate all existing Commissions at the end of 2001 and permit a smaller number of new Commissions to be formed as planning and advisory bodies when needed.

The SDIC has considered in considerable detail just how ideas for new projects can be generated and individuals recruited to carry out the projects in the absence of a large cadre of Commission members. We expect to reach out to the world-wide chemistry community and anticipate that National Adhering Organizations will become more actively involved in project generation and in suggesting scientists to serve on Task Groups. During the next three years the current Commissions, in collaboration with their Division Committees, will play a central role in defining areas of science that need study by IUPAC and in proposing specific projects and individuals who might carry out such projects.

The Bureau will be asked to approve in September a major new policy for IUPAC's future development. Prior to that time it is important that we have a wide-ranging discussion within the Union of the details and ramifications of these proposals. The report by the SDIC is comprehensive and provides detailed explanations for the recommendations that are made. Nevertheless, there are undoubtedly some aspects that have not been considered and some consequences of the proposals that have not been fully appreciated. We begin now to solicit views from the National Adhering Organizations that provide the resources for our activities; from the many people who carry out the work within the Union; and from the world-wide community of chemists and the chemical industry, whom we ultimately serve.

I would appreciate receiving your comments and questions. They should be submitted through the Secretariat, either by e-mail: secretariat@iupac.org, or at the address given on the inside front cover.

Joshua Jortner,
President, IUPAC

Executive Summary

The Strategy Development and Implementation Committee (SDIC) was established by the IUPAC Executive Committee (EC) on 7 April 1997 with the following charge:

1 Develop long-range goals or mission statements, based initially on the recommendations in the 1997 Vice-President's Critical Assessment.
2 Propose strategies for achieving these goals.
3 Examine the feasibility of converting the bulk of IUPAC's scientific work to a project-driven system, with time-limited Commissions, as expressed in the concept endorsed by the EC.
4 Propose specific means by which this concept (if found feasible) can and should be implemented, with desirable target dates.

The SDIC completed tasks 1 and 2 at the end of 1997 and submitted a proposed Strategic Plan to the Executive Committee (EC) in January 1998. This Plan, which is also presented and described in this report, was approved by the EC and has been widely disseminated. The Strategic Plan provides a succinct statement of IUPAC's Mission, a statement of 10 long-range Goals

and a set of Strategies to achieve each Goal. The Plan constitutes a declaration of the Union's global policy. It also provides a guide to the development of operational programs and a set of criteria against which to evaluate the accomplishments of IUPAC bodies.

Tasks 3 and 4 refer to changes in operational policies and procedures that would significantly change many aspects of the way in which the Union carries out its scientific activities. Since these activities are carried out primarily through the Divisions and Commissions, the SDIC has directed its attention to these bodies, not to the Bureau and Standing Committees, which have responsibilities in other areas. The SDIC has concluded that it is feasible to convert the Division/Commission structure and operations into one that focuses largely on specific projects carried out by time-limited bodies. However, the SDIC believes that successful operations in the future require the implementation of a number of concurrent changes. The SDIC has developed an integrated program to refocus IUPAC's efforts, to insure continuing quality and expertise in its scientific leadership, and to involve the world-wide chemistry community in the development and conduct of the Union's projects.

The following steps must be taken in concert to achieve the desired goals:

- Each Division Committee will become the clear focus in its branch of chemistry for the initiation of scientific efforts and for the development and management of individual projects. The duties of the Division Committees will be redefined; the membership augmented as needed to provide sufficiently broad scientific expertise; and the mechanism for nominating members of Division Committees modified to insure a continuing source of top-notch leadership drawn widely from the world's chemists.
- Ideas for projects will be solicited widely from National Adhering Organizations, national and regional chemical societies, industrial organizations and the general chemistry community. Proactive efforts will be made to assess needs for IUPAC action through presentations and discussions at IUPAC-sponsored symposia and other specialized meetings in the chemical sciences.
- It is expected that most projects will be carried out by Task Groups appointed for the (usually short-term) duration of the project and funded adequately to permit completion of the project in the planned time frame.
- The professional staff of the Secretariat will be developed to provide assistance to the Task Groups as needed and to assist in seeking ideas for IUPAC projects. The Secretariat staff will help to develop new projects and will actively seek outside funding when appropriate.
- In 1999 at Berlin, Council will be asked to amend Bylaw 4.307, effective 1 January 2002, to remove the 'right' of Titular Members to receive funds for travel and subsistence. Expenses will henceforth be paid as needed to accomplish particular objectives—e.g. to plan a program, provide advice to the Division Committee or carry out a project. By eliminating these automatic expenditures, the SDIC believes that a significant fraction of the $525 000 budgeted for each General Assembly and funds allocated for 'even year' meetings of Commissions can be redirected to high priority projects.
- In 1999 at Berlin, Council will be asked to terminate all existing Commissions on 31 December 2001. Requests by the Divisions to form new Commissions, for operation in 2002 and beyond, primarily as long-range planning and advisory bodies, will be considered by the Bureau and by Council in 1999 and 2001.

The SDIC anticipates that this report will be widely read and discussed within IUPAC and by its National Adhering Organizations. Hence, the body of the report and the appendices contain considerable background information. Furthermore, the presentation of recommendations is often rather detailed in order to provide an indication of the thorough discussion by the SDIC and of the rationale for each proposal. The financial implications of the Strategic Plan and the recommended operational changes are discussed and shown to require no additional resources.

A more succinct presentation of the recommendations and a timetable for actions is given on pp. 22–24. The SDIC recommends that the EC approve this program, request comments from IUPAC bodies and the Union's National Adhering Organizations, modify the details as needed as a result of comments received, and submit the proposal to the Bureau for action. The Bureau will be asked to endorse this program in September 1998 and set in motion the steps outlined above.

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Report to the Executive Committee by the Strategy Development and Implementation Committee

The Strategy Development and Implementation Committee (SDIC) was established by the IUPAC Executive Committee (EC) on 7 April 1997 as an *ad hoc* committee with the charge given below and instructions to report to the EC before its meeting in April 1998. Members of the SDIC were appointed by the President of IUPAC, as described below. This document constitutes the final report by the SDIC in fulfillment of its mission.

Formation of the SDIC

Background

During 1996 and 1997, the Officers of IUPAC undertook efforts to solicit opinions from the world-wide chemistry community on the future role of IUPAC. Out of the conferences held in the USA in June 1996 and in London in February 1997 (later reinforced by the conference held in Singapore in June 1997), there emerged many specific ideas for future developments of the Union, but there were three overriding major points: (i) IUPAC needed to develop an updated Mission in order to regain relevance to the international community of chemistry and the chemical industry; (ii) the Objectives given in IUPAC Statute 1 should be augmented by specific, achievable Goals; and (iii) IUPAC should broaden the geographic base of the Union's activities to achieve its full potential as a global organization. These concepts formed part of the underpinning of the statutory Vice-President's Critical Assessment (VPCA), and Vice-President Jortner proposed a number of specific goals. In April 1997 the EC endorsed the general thrust of these proposed goals but recognized that they needed to be considered carefully and fleshed out into a Strategic Plan for the Union.

Meanwhile, the organization and management of IUPAC's scientific work had been the subject of extensive discussion and debate within the Union over a period of several years. There was general recognition that the relatively static Commission structure is outdated and that it is inadvisable to spread IUPAC's limited resources among seven Divisions and 37 Commissions, which attempt to carry out nearly 500 projects concurrently. Various proposals had been advanced for restructuring Divisions and Commissions, and great efforts had gone into developing a scientific policy for the Union. Options for restructuring and for allocating resources by project were discussed in detail at the annual Division Presidents meeting in September 1996 and at a special meeting of Division Presidents and Vice-Presidents in March 1997. It was clear that the Divisions wanted and needed more flexibility in managing their programs. Against this background, the Secretary General prepared a paper for the EC meeting in April 1997 that advocated an emphasis on funding projects that would be carried out primarily by time-limited Commissions. After much discussion, the EC endorsed this concept but recognized that the proposed major changes in the organization and management of the Union's scientific work needed considerable further study and analysis.

The EC decided therefore that the separate but related issues of formulating long-range goals and strategies and of implementing the management changes needed to achieve the goals could best be addressed by a single broad-based *ad hoc* committee, the SDIC.

Charge to the SDIC

The charge to the SDIC is as follows:

1. Develop long-range goals or mission statements, based initially on the recommendations in the 1997 Vice-President's Critical Assessment.
2. Propose strategies for achieving these goals.
3. Examine the feasibility of converting the bulk of IUPAC's scientific work to a project-driven system, with time-limited Commissions, as expressed in the concept endorsed by the EC.
4. Propose specific means by which this concept (if found feasible) can and should be implemented, with desirable target dates.

The SDIC is to report to the EC in time for its meeting in April 1998.

Membership

To assure that all facets of the Union's programs would be considered by the SDIC, its membership was drawn broadly—two IUPAC Officers, two Elected Members of the Bureau, one Standing Committee chairman, two Presidents-elect of Divisions, and three outstanding chemists not currently in IUPAC posts but who are familiar with the Union's activities. President Fischli accordingly appointed the following members:

Prof. Joshua Jortner (chairman)
Dr Edwin D. Becker
Prof. Heindirk tom Dieck
Prof. Mostafa El-Sayed
Prof. Robert Gilbert
Dr Alan Hayes
Prof. Upendra K. Pandit
Prof. Pieter Steyn
Prof. Leiv K. Sydnes
Prof. Andrea Vasella
Dr John W. Jost (staff support)

A secondary, but important, consideration was geographic diversity. The SDIC members come from North America, the Asia-Pacific area, the Middle East, Africa and Europe. Appendix 1 gives institutional affiliation and IUPAC office (if applicable) for each member of the SDIC.

Committee Meetings

The SDIC has held three full-day meetings (24 June 1997; 21 November 1997; and 24 January 1998) and a short meeting at the General Assembly in Geneva (25 August 1997). Participation was excellent. Although not all members could attend every meeting, an average of eight of the 10 members were present at each meeting, and absentees frequently sent written comments in advance. All members contributed actively to the discussions, and a great many ideas were exchanged by e-mail. The findings and recommendations given here represent the result of ideas obtained from many sources, which were subjected to careful analysis and much friendly debate within the Committee.

The SDIC members were quite sensitive to input from many sources outside the Committee. Comments and ideas from the Division Presidents meetings listed above and at the General Assembly in Geneva were important. Views expressed by Bureau and Council members in Geneva and by Commission officers and members during a number of informal meetings provided valuable sources of information. The semi-final draft of the Strategic plan was circulated to the Bureau for comments, and several suggested improvements in wording were subsequently incorporated into the final version.

Strategic plan

Although all aspects of the Committee's work were dealt with concurrently, the SDIC gave priority to completion of a Strategic Plan for the 1998–99 biennium. The recommended Plan was submitted to the EC and approved by that body on 23 February 1998.

The goals proposed in the VPCA (see Appendix 2), along with papers prepared for the initial SDIC meeting by Profs. Pandit and Steyn (also in Appendix 2), served as the starting point but were modified extensively as a result of discussion by the Committee. The SDIC decided that the Strategic Plan should articulate the scientific policy of the Union in a concise manner that will guide the development of operational plans by the Divisions and other IUPAC bodies. The document should also be valuable in explaining to chemists world-wide and to potential funding organizations just what IUPAC is and what roles it now plays and expects to play in the advancement of the chemical sciences. A preamble provides a short background statement, primarily for use outside the Union.

The Plan itself begins with a brief Mission Statement and is built around a set of long-range goals. The SDIC discussed at length the particular number and statement of the goals and decided that the 10 goals listed seemed to be the smallest number that clearly encompass the broad range of the Union's activities. The first seven goals express IUPAC's commitment to serving the global chemistry community, while the last three describe actions that should be taken to enhance the scope, image and management of the Union itself. Under each goal there are several strategic thrusts. These explain aspects of the goal where necessary and point out specific areas in which IUPAC can realistically develop or continue programs to achieve the goal.

The Plan concludes with a short section on Implementation and Updating. This portion has deliberately been kept brief in recognition of the potentially broad

distribution of the Plan outside IUPAC. The Secretary General, in consultation with other Officers, will develop and present to the EC a more detailed proposal that discusses the relation between the VPCA and the implementation and updating of the Strategic Plan. It will suggest procedures for soliciting views and approving updates and for assigning responsibilities for implementation of various aspects of the Plan.

The full text of the Strategic Plan for 1998–99 is given on the following pages.

IUPAC Strategic Plan—1998

The International Union of Pure and Applied Chemistry (IUPAC) was formed in 1919 by chemists from industry and academia. Over nearly eight decades the Union has succeeded in fostering world-wide communications in the chemical sciences and in uniting chemistry—academic, industrial and government—in a common language. IUPAC has long been recognized as the world authority on chemical nomenclature, terminology, standardized methods for measurement, atomic weights and many other critically evaluated data. The Union continues to sponsor major international meetings that range from specialized scientific symposia to CHEMRAWN meetings with societal impact. During the Cold War, IUPAC became an important instrument for maintaining scientific and technical dialogue among the world's chemists.

With the major changes that have occurred worldwide in chemistry and the chemical industry, it is important that IUPAC examine its activities and define its role as the organization principally responsible for promotion of the chemical sciences internationally. Following a series of meetings to obtain input from leaders in chemistry on four continents, IUPAC has redefined its mission and established goals and strategies to guide its approach to the shaping of the chemical sciences and the service of chemistry in a rapidly changing world.

Mission statement

> *IUPAC's mission is to advance the world-wide aspects of the chemical sciences* and to contribute to the application of chemistry in the service of Mankind. In so doing, IUPAC promotes the norms, values, standards and ethics of science and advocates the free exchange of scientific information and unimpeded access of scientists to participation in activities related to the chemical sciences.*

*In recognition of the role of chemistry as a central science in a wide range of fields, the term 'chemical sciences' is used here to refer to chemistry, broadly defined, and to those disciplines and technologies that make significant use of chemistry.

Long-range goals

To further its mission, IUPAC has established a set of long-range Goals and has formulated strategic thrusts that are aimed at achieving each of the Goals. The Goals are summarized here, and the complete set of Goals and Strategic Thrusts for the current biennium is given on the following pages.

1 IUPAC will serve as a scientific, international, non-governmental body in objectively addressing global issues involving the chemical sciences Where appropriate, IUPAC will represent the interests of chemistry in governmental and non-governmental forums.

2 IUPAC will contribute to the advancement of research in the chemical sciences throughout the world.

3 IUPAC will assist chemistry related industry in its contributions to sustainable development, wealth creation and improvement in the quality of life.

4 IUPAC will facilitate the development of effective channels of communication in the international chemistry community.

5 IUPAC will promote the service of chemistry to society in both developed and developing countries.

6 IUPAC will utilize its global perspective to contribute toward the enhancement of education in chemistry and to advance the public understanding of chemistry and the scientific method.

7 IUPAC will make special efforts to encourage the career development of young chemists.

8 IUPAC will broaden the geographical base of the Union and insure that its human capital is drawn from all segments of the world chemistry community.

9 IUPAC will encourage world-wide dissemination of information about the activities of the Union.

10 IUPAC will assure sound management of its resources to provide maximum value for the funds invested in the Union.

Goals and Strategic Thrusts—1998–1999

To further its mission, IUPAC has established a set of long-range Goals and has formulated strategic thrusts that are aimed at achieving each of the Goals. These strategies are intended to guide the development of operational plans and the setting of priorities for optimal use of the Union's resources, both human and financial.

1 *IUPAC will serve as a scientific, international, non-governmental body in objectively addressing global issues involving the chemical sciences. Where appropriate, IUPAC will represent the interests of chemistry in governmental and non-governmental forums.*

- IUPAC will conduct projects pertaining to the chemical aspects of important issues of international concern. In addition to projects initiated within IUPAC, input for new projects of scientific and industrial importance may come from international governmental and non-governmental bodies and from appropriate public groups. Examples are the series of CHEMRAWN conferences, the recent *White Book on Chlorine* and the studies of methods for disposal of chemical weapons. IUPAC will not undertake projects that cast it in the role of policy development or as an advocate for special interest groups.
- Collaborations with international governmental bodies, such as UNESCO and the World Health Organization, should continue and be strengthened. The IUPAC/UNESCO International Council for Chemistry will serve as the central forum for planning and coordinating work with UNESCO. Collaborations with other individual scientific Unions, with international scientific societies, and with the International Council of Scientific Unions (ICSU) should be enhanced to plan and carry out projects of an interdisciplinary nature.

2 *IUPAC will contribute to the advancement of research in the chemical sciences throughout the world.*

- The importance of standardized nomenclature, symbols, terminology and methodology is critical to communication in the chemical sciences. To remain the recognized international authority in this area, IUPAC must ensure that important problems are recognized and treated fairly and expeditiously. Collaborations with national and regional chemistry societies, with governmental bodies and with commercial information organizations should be augmented. Greater efforts should be made to encourage adoption of IUPAC recommendations through contacts with authors, editors and publishers.
- The biennial IUPAC Congress is intended to present the most outstanding relevant developments in modern chemistry and to inspire high research standards. Future Congresses should adhere to this principle.
- An assessment should be made of IUPAC sponsorship of specialized symposia in order to strengthen this well accepted program. New significant research fields in chemistry should be highlighted by the initiation of relevant high quality symposia.
- Special attention should be devoted to improving the quality of the Union's scientific publication program. Bibliometric analysis and other criteria can be used to assess the impact of IUPAC books and the journal *Pure and Applied Chemistry*. IUPAC should take advantage of advances in electronic publishing methods to ensure high quality publications that are disseminated in a rapid and cost-effective manner.
- Policies should be developed for IUPAC's role in the preparation and dissemination of critically evaluated databases, from atomic weights to thermodynamic and other chemical data.

3 *IUPAC will assist chemistry related industry in its contributions to sustainable development, wealth creation and improvement in the quality of life.*

- IUPAC is unique among the International Scientific Unions in including within its scope a large industrial base. IUPAC is often perceived as being oriented primarily toward academic institutions, but industry benefits equally from much of the Union's work in standardized symbols, nomenclature and terminology, as well as from critically evaluated data. Greater efforts should be made to demonstrate the ways in which IUPAC serves industrial needs directly and indirectly. In addition to the present links provided by the Committee on Chemistry and Industry, serious efforts are needed to engage leaders in the chemical industry and national and international industry associations in dialogue to explore ways in which IUPAC and industry can enhance mutually beneficial interactions.
- IUPAC should be particularly alert to projects that help develop the scientific basis for practices and procedures that protect society while encouraging responsible and sustainable development. Such projects may be initiated in the basic chemistry Divisions, as well as in the mission-oriented Divisions [Chemistry and the Environment, and Chemistry and Human Health].

4 *IUPAC will facilitate the development of effective channels of communication in the international chemistry community.*

- The vast potential of the Internet should be utilized to enhance information transfer between IUPAC and chemists in many countries. The Affiliate Member Program already provides a base, which should be expanded many-fold.
- *Chemistry International* should be developed as a forum for highlighting important problems and advances in chemistry and for discussion of science policy and global issues in chemistry.
- Increased efforts should be made to provide information on IUPAC activities and news about important matters of international chemistry to major scientific journals and national and regional chemistry news magazines, which routinely reach hundreds of thousands of chemists world-wide. Feedback should be encouraged.

5 *IUPAC will promote the service of chemistry to society in both developed and developing countries.*

- CHEMRAWN Conferences have long provided the principal mechanism for IUPAC to address issues that transcend pure science and have important socio-political aspects. Such Conferences should continue to be promoted, along with follow-up Future Action Programs.
- IUPAC bodies should continue to be alert to projects on matters of societal importance (e.g. chemical weapons disposal, environmental cleanup, biodiversity) that depend heavily on chemical sciences and technology.
- Within its limited funds, IUPAC should consider ways to foster chemistry in developing countries. In many instances, IUPAC's initiative and scientific expertise has been paired with outside funding sources (e.g. recent UNESCO-supported work in the least developed countries and the UNESCO/UNIDO/IUPAC program in chemical safety) to produce valuable results, and this model should be further elaborated.

6 *IUPAC will utilize its global perspective to contribute toward the enhancement of education in chemistry and to advance the public understanding of chemistry and the scientific method.*

- Scientists everywhere recognize the critical role played by formal and informal education at all levels, from kindergarten through graduate school, not only for future scientists but also for the general public. The problems associated with such educational programs are enormous. Educational systems, administration and curricula vary drastically by country, locality and individual school and teacher. IUPAC cannot hope to make an impact on detailed curricula or outreach activities in individual countries and localities, but it may be able to complement the efforts of national chemical societies and to coordinate exchange of information. IUPAC should examine carefully what long-range role it can realistically play in international science education and develop appropriate policies. Meanwhile, a number of specific activities can usefully be initiated or continued, as described below.
- The Committee on Teaching of Chemistry (CTC) has been effective in carrying out its program on exchange of information on teaching methods, equipment, etc. CTC should continue to serve as the focal point for IUPAC's programs in this area, but its programs should be broadened. In addition, IUPAC Divisions should be invited to develop complementary projects to enhance education at all levels and to coordinate them with CTC.
- IUPAC should cooperate in whatever ways are feasible with the major new program established by ICSU on Capacity Building in Science, which will endeavor to disseminate information on science teaching in primary schools and science education for the public.

7 *IUPAC will make special efforts to encourage the career development of young chemists.*

- It is apparent that the future development of the chemical sciences lies largely in the hands of the younger generation of scientists, who often encounter severe obstacles in an era of constrained resources. IUPAC should develop programs that are perceived by 'younger chemists' to be helpful to them and feasible for the Union to undertake within its resources. Young chemists from developing countries who return after advanced training elsewhere may benefit particularly from these programs and from exchange of information with IUPAC via the Internet.
- IUPAC should strongly encourage organizers of the IUPAC Congress and IUPAC-sponsored symposia to provide travel support for younger scientists and to include younger scientists among the invited lecturers.
- IUPAC Commissions and other bodies should make special efforts to recruit well qualified younger scientists for their projects. Several National Adhering Organizations (NAOs) now provide travel support for younger scientists to attend the General Assembly as Associate Members, National Representatives or Observers; other NAOs should be encouraged to follow this lead.

8 *IUPAC will broaden the geographical base of the Union and insure that its human capital is drawn from all segments of the world chemistry community.*

- The Union is taking active steps toward globalization of its activities with regional meetings and solicitation of input from the world's chemists.
- The 42 National Adhering Organizations and 14 Observer Organizations that currently comprise IUPAC are broadly distributed throughout the world, but there are several geographic regions with little or no representation in the Union and a number of countries with substantial academic and industrial developments in chemistry that do not adhere to the Union. IUPAC should encourage such countries to apply for membership. In addition, IUPAC should stimulate less developed countries to seek Observer status.
- The Union has long had a formal policy of 'fair geographical representation' among Elected Members of the Bureau and informally strives to obtain geographic diversity among IUPAC and Division Officers. While maintaining the focus on expertise, IUPAC's scientific bodies should make efforts to recruit younger chemists, women chemists and chemists from recently developed regions, including in some instances countries that are not yet full Members of the Union.

9 *IUPAC will encourage world-wide dissemination of information about the activities of the Union.*

- Much of the valuable work done by IUPAC bodies is published only in *Pure and Applied Chemistry* or in specialized books and journals. Although such formal and archival publication is essential, greater efforts should be made by individual IUPAC bodies, the Secretariat and the NAOs to disseminate this information as early and as widely as possible to the relevant scientific community. In many instances, high quality reports from symposia, workshops and Commission activities should be prepared not only as formal scientific publications but also as semi-popular documents emphasizing applications. For topics that warrant attention in the popular scientific press, carefully drawn news releases are needed.
- Contacts with major national chemical societies, regional chemistry federations, industrial associations, and government/industry/university consortia should be expanded to ensure that these organizations are fully aware of IUPAC activities and can provide credit to the Union where its activities complement theirs.
- Improved two-way communication with NAOs concerning science policy, planning and implementation of projects and other activities is needed. Special efforts should be made to prepare suitable material describing IUPAC programs and accomplishments in a form that will assist NAOs in recruiting Company Associates.

10 *IUPAC will assure sound management of its resources to provide maximum value for the funds invested in the Union.*

- The Union can undertake its many activities only because of stable financial support from its National Adhering Organizations, which in turn usually obtain their resources from government and/or industrial sources. IUPAC has a continuing responsibility to demonstrate to its sponsors that all relevant management tools, including the use of modern information technology, are employed to maximize productivity in the administration of the Union.
- IUPAC should encourage philanthropic donations to the Union's endowment. With continued wise investment strategies that assure maximum return consistent with reasonable safety, the endowment and operating reserves will provide a continuing source of funding that augments and leverages the subscriptions from the NAOs.
- Although the purpose of the IUPAC publications program is the dissemination of scientific information, this program has for a number of years provided substantial income to help support IUPAC's other work. As the program is redirected in the era of electronic publishing, efforts should be made to continue to have publications as a source of funds, rather than a drain on the Union's resources.
- Officers of IUPAC bodies and the Secretariat should continue to be alert to possible sources of funds for specific projects from outside groups (e.g. UNESCO, ICSU, charitable foundations and industry) to augment the base funds provided by NAO subscriptions.

Implementation and updating of the Strategic Plan

The Strategic Plan is intended to articulate the scientific and operational policy of IUPAC, providing overall policy guidance to the IUPAC Divisions and Standing Committees for assistance in the development of coordinated programs to advance the Union's mission. This Plan should not impede or replace initiatives at all levels within the Union. The Council, Bureau and Executive Committee will formulate procedures for ensuring that operational programs will be drafted and resources allocated within the context of the Strategic Plan, that responsibilities will be assigned for implementation of programs, and that outcomes will be evaluated.

Each biennium the strategic thrusts will be analyzed and updated as needed. The long-range goals may also be revised when appropriate, but probably on a longer time frame.

Organization and management of scientific work

Most of the Union's core scientific programs have been built around the work carried out in its seven Divisions and a large number of Commissions (currently numbering 37), with support from the Standing Committees and several Divisional subcommittees. With limited financial resources from IUPAC, principally to defray costs of travel and administrative expenses, and far larger in-kind support from their employers, the members of these IUPAC bodies voluntarily devote enormous amounts of time to advancing chemistry. Their accomplishments in obtaining international agreement on nomenclature, symbols, terminology and methodology have produced a world-wide language of chemistry. Many of these groups continue to establish values for critically evaluated chemical data, from precise atomic weights to thermodynamic properties, while others provide physical and chemical characterization of various substances. Some IUPAC bodies are concerned with criteria for training and education in specific branches of chemistry, and many bodies traditionally organize high quality international symposia in a wide range of chemical fields.

In spite of the widely acclaimed past accomplishments of the Union and its continuing successes in very many areas, increasing concern has been expressed by the world-wide chemistry community and by several of

IUPAC's National Adhering Organizations (NAOs) as to the overall impact of the Union's programs on contemporary problems in chemistry. Over the last decade there has been much introspective evaluation of the Union's scientific work, frequent calls to modify the structure of the Divisions and Commissions, and imposition of a large number of requirements designed to assure that only projects of high quality and high priority are undertaken. The results of these efforts have been largely disappointing in that they have resulted in little change in the organization and management of the Union's work. Moreover, these continuing efforts to change first one, then another IUPAC body have proved frustrating and sometimes demeaning to many of the dedicated individuals who voluntarily carry out this work.

Following detailed discussions among the IUPAC Officers and the Division Presidents and Vice-Presidents during 1996–97, the Secretary General presented an analysis of the problems and made recommendations for major changes in both organization and management of the scientific activities of the Union. The Secretary General's Report [SGR] was presented to the Executive Committee in April 1997 and after considerable discussion the basic concepts were accepted and the SDIC was assigned the task of assessing the feasibility of specific proposals and recommending in detail how the desired changes could be accomplished. The full SGR is given in Appendix 3. The Report has been widely disseminated within IUPAC bodies and among the Union's NAOs, and many comments on the Report have been provided to the SDIC to help guide its work and recommendations.

The SDIC's analysis of the present organization and of the means by which its projects are initiated and managed has highlighted a number of factors that are of concern, as follows:

- Responsibility for initiation, development and management of IUPAC's projects is divided among seven Division Committees and 37 Commissions.
- Largely because of this highly decentralized structure and resulting fragmentation of areas of responsibility, it has frequently proved difficult, time-consuming and sometimes impossible to develop interdisciplinary projects in spite of the acknowledged importance of such projects to the future of chemistry and to the future of IUPAC.
- About half of the Union's limited financial resources are devoted to supporting the Commissions, with no clear relation between resource utilization and specific projects. Although individual expenditures are quite modest, collectively the sums are significant. A large fraction of the approximately $525 000 cost of a typical General Assembly pays for travel and subsistence of Titular Members, and much of the Divisions' collective biennial budgets of about $420 000 is devoted to meetings of Commissions in the years between General Assemblies.
- There has been a proliferation of projects (numbering more than 400 in the last biennium) of varying quality and urgency, often approved routinely without stringent outside review. There is little incentive to limit the number of projects or give serious consideration to priorities since there is virtually no relation between the importance of a project and the (often meager) financial resources allocated to it.
- Ideas for projects usually arise within Commissions, sometimes because the Commission has established a clear international need, at other times simply because an individual Member is interested in the subject and willing to devote time to pursuing the project. Overall, there has been relatively little formal effort to solicit views from NAOs, chemical societies and the world-wide chemistry community. Refereeing of proposed projects outside IUPAC has been spotty, and retrospective evaluation has been uneven.
- Although the Secretariat has, over the years, done an excellent job of providing administrative and logistical services to all IUPAC bodies, it has not been staffed to provide professional help to groups carrying out scientific projects. Even very modest professional staff assistance could be valuable in developing projects and in insuring their timely completion.
- The process by which Members of Commissions and Division Committees are selected has long given rise outside the Union to the view expressed in 1979 that IUPAC is a 'charmed circle'. Although the Union has made efforts to limit the length of terms in order to allow more people to participate, the procedure by which Members elect their own successors with no formal outside input strengthens the perception of an inward-looking organization.

The Secretary General's Report addressed many of these perceived deficiencies and advocated the conversion of most of the Union's scientific activities 'from a primarily static Commission structure to one that is largely based on time-limited Commissions formed to carry out specific, well defined tasks.' The Executive Committee approved this concept but recognized that many details needed to be examined. The SDIC was asked [Tasks 3 and 4] to determine whether such a radical change in IUPAC operations would be feasible and if so to provide specific recommendations on how to achieve this objective.

The SDIC concludes that it will be feasible to reorient much of the Union's scientific work to a project-driven system carried out by short-term Task Groups that report to Division Committees, with much less emphasis

on long-term Commissions. However, implementation will require adoption of an integrated program, as described below. The time frame for implementation has been carefully thought out in order to move the Union forward as rapidly as possible but to allow adequate time for completion of existing projects and for phased conversion from the present Division/Commission structure to one that is more dynamic.

Responsibilities of Division Committees

One key element of the SDIC proposal is the consolidation within the Division Committees of the responsibility for organization and management of both continuing programs (such as symposia) and short-term projects. These Committees and their Officers will provide the scientific leadership of the Union. They must be carefully chosen to ensure that each Committee has the necessary vision, breadth and expertise to seek out promising areas for IUPAC involvement, to select the highest quality proposals and to manage the implementation of projects.

Bylaw 4.1 (see Appendix 4) describes the role of Division Committees in some detail, largely in terms of structure and process (membership and size, elections, limitations of authority, reports, Committee meetings, etc.). The functions of the Division Committee emphasize its administrative role in forming and dissolving Commissions and as an intermediary between Commissions and the Bureau. However, the Bylaws provide broad (if somewhat nebulous) authority to the Division Committee 'to plan and organize scientific meetings and other activities…' and 'to prepare a budget for the Division…' *The SDIC proposes that the Bureau promulgate a policy that builds on the statutory framework and makes it clear that the Division Committee is to be the focus of scientific work in the Division and has the overall responsibility itself for initiating, developing and managing the work of the Division.*

As described below, the Division Committee will be expected to select scientific Task Groups to carry out individual projects and may appoint advisory groups as needed. Although the proposed policy is formulated in terms of each Division Committee individually, the SDIC believes that interdisciplinary activities will be of increasing importance; hence, each Division Committee must be charged with making positive efforts to initiate interdisciplinary projects and to work collegially with other Division Committees to provide effective development and management of such projects.

Election of Division Committees and Division Officers

Bylaw 4.1 specifies that the Division Committee is to be elected by all Members of the Division (Titular and Associate), i.e. the members of all Commissions in that Division plus members of the existing Division Committee. With long-range changes in Commission structure as proposed below, it may eventually be necessary to change the election process, but the SDIC believes that the procedure in the Bylaws need not be altered at present. Bylaw 4.1 provides no guidance on nomination of candidates for Committee Members and Officers, but rather leaves this aspect entirely up to each Division. Here the SDIC believes that specific criteria and procedures are essential to ensure the nomination of candidates who will provide the necessary scientific leadership, breadth of expertise and management skills required of the revitalized Division Committee.

The SDIC recommends that the Bureau be asked in September 1998 to adopt uniform nomination policies and procedures for all Divisions, as given below, to be effective immediately and thus govern the 1999 election process. The Bureau should also formally give Divisions authority to suspend the application of all Division Rules that are in conflict with the Bylaws [as several are now] or with the new policy enunciated by the Bureau. After some experience is gained, the Bylaws and Division Rules should be suitably revised, but that could better wait until later years.

The policy should state the intention of insuring that the Committee will seek members from as broad a segment of the world-wide chemistry community as is consistent with the charge to the Division. The Bylaws already recognize the need to renew the Committee's membership by limiting terms to four years for non-Officers. With the procedures given below, this limitation should ensure that there is a broadly based Committee with a healthy turnover in membership. The Bylaws provide that Officers may serve for an additional 4–6 years, a provision that allows flexibility to provide adequate continuity and experience.

Nominating Committee

The SDIC recommends that each Division President/Division Committee appoint a nominating committee of five members unless the Bureau or EC agrees to an exception. The nominating committee should consist of no more than two current members of the Division Committee and three others chosen for the breadth of their expertise. While two of these three should come from outside IUPAC, it may be desirable in some instances for one member to be from another IUPAC Division. The overall membership should be approved by the EC. Af-

ter consultation with the Division Presidents, the Bureau should establish a timetable for making nominations, including sufficient time to permit the nominating committee to solicit suggestions from inside and outside the Division.

Nominees for Division Committee

The nominees should be widely known and respected scientists from academia, government and industry. If feasible, a journal editor should be included among the nominees. The aim should be to create and maintain a Committee that has scientific stature and breadth. Within these guidelines, each Division and its nominating committee should have considerable flexibility to meet the specific needs for each election --for example, to designate categories of vacancies if desired to ensure diversity in subject matter, geographic distribution, or other characteristics. More than one nominee for each vacancy is desirable but should not always be required. The President of IUPAC should review the list of nominees prior to the election to ensure that the Bureau policy has been followed.

Size of Division Committees

The size of the Division Committee is set by the Bylaws as 10 Titular Members (TMs) unless otherwise specified by the Bureau, plus up to six Associate Members (AMs). At present, the Committees range from seven to nine TMs [except for the Division of Chemistry and Human Health (DCHH), where the Sectional structure adds complexity]. If the Division Committee is expected to be broadly based, 10 TMs seems reasonable as a general rule. However, some Division Presidents spoke very favorably at Geneva about improving the science orientation of the Committee by having the Commission chairmen become part of the Committee. As an interim step toward establishing new Division Committees, a Division might propose that an existing Committee be expanded temporarily in this way. The Bureau should provide flexibility and, on a case-by-case basis, allow the maximum size for each Division Committee to exceed 10 TMs/6 AMs for a specified period.

Division Officers

The Bylaws state that the Division Committee shall elect its Officers from among the current and incoming Committee TMs. The elections are subject to approval by Council, but this retrospective approval is virtually automatic. *The SDIC recommends that, following discussion with the Division Presidents, the Bureau specify a uniform procedure to insure that the nomination of one or more candidates for each Division office is conducted in a thoughtful way, with adequate consultation within the Committee and with the President of IUPAC.* Each Division Committee should choose its own leaders, but the SDIC believes that appropriate advance consultation will strengthen the mandate of the elected Division Officers.

There is currently some variation among the Divisions in the length of the term for each Officer and the practice of succession through different offices. The SDIC does not believe that there is necessarily one 'best' policy, but the Division Presidents should discuss the alternatives and initiate change where desirable. It has been pointed out that some high calibre, busy chemists might be more willing to serve if the period of service is not excessive.

The Bureau and Executive Committee should give special attention to the application of the above recommendations within the current Sectional structure of the Division of Chemistry and Human Health. The SDIC does not believe that it is within the Committee's mandate to make specific recommendations for this unique situation.

Project-driven system

The proposal in the SGR to convert the bulk of IUPAC's scientific work to a project-funded system with primarily time-limited commissions has elicited considerable discussion at all levels within IUPAC. The Division Presidents who have expressed opinions seem to be completely in favor of a project-funded system, and a number of individuals from Commissions also have given a positive response to this concept. In fact, many Commissions already carry out individual projects with short-term Working Groups, usually composed partly or entirely of Commission members, and in some instances modest funds are allocated to specific projects.

The second part of the proposal, 'time-limited commissions,' and its corollary of giving up 'permanent' commissions has elicited considerable concern from most Commission members. The SDIC is well aware of and sensitive to these concerns. Abolishing a single Commission might appear to be tantamount to saying that the sub-field covered by that Commission is of little importance. Moreover, there are questions as to how suitable projects could be generated without a Commission devoted to a particular subject area.

Current status of Commissions

The existence of a more or less permanent Commission in a particular subject area has many virtues: There is a cadre of chemists who have accepted responsibility to think about that area and to develop ideas for useful IUPAC projects. The awarding of the title 'Titular Member' or 'Associate Member' of a Commission often pro-

vides sufficient prestige to enable the individual to obtain his/her employer's approval to devote time to IUPAC work—an important consideration in a company or government laboratory but not generally in academia. Also, the 'Member' designation often permits an individual to obtain financial resources for travel and administrative costs—important in all employment sectors, especially for Associate Members. In addition, the existence of a permanent Commission provides an opportunity for appointment of National Representatives—an important consideration for many NAOs in bringing forward some of their better chemists who might not be widely known.

The SDIC believes that the principal shortcomings of the present system of 'permanent' Commissions are (i) perpetuation of the Commission's membership by self-selection, with only nominal approval at higher levels; (ii) generation of projects largely within a Commission in accord with the interests of its members; and (iii) allocation of a large fraction of IUPAC's budget to maintenance of the Commissions and provision for their meetings, irrespective of the quality, quantity and timeliness of the work carried out by the Commission.

Proposed funding for Commissions

These problems disappear if there are only time-limited Commissions to carry out specific projects, where the project is defined and the Commission membership is chosen by someone or some group outside the Commission. The question addressed by the SDIC was: How can IUPAC best accomplish these goals and yet retain some or all of the advantages listed above for 'permanent' Commissions? The SDIC believes that the answer is to have projects carried out by short-term Task Groups *reporting to the Division Committee*, while permitting a limited number of Commissions to be formed, under strict conditions, as advisory groups that would meet only as needed.

One key aspect in effecting such a change is to break the link between Titular Membership and financial support. This could be accomplished most cleanly by a repeal or modification of Bylaw 4.307:

> 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.

Removing the 'right' to receive contributions changes an entitlement to a discretionary expenditure that is related to the need for particular travel. Rather than having each of its Commissions meet at every General Assembly, a Division Committee could authorize meetings and travel only when necessary. This change in policy would leave permanent Commissions in essentially an advisory role unless some or all members were actively engaged in one or more projects for which funding has been approved. However, such an advisory role can be very important in developing new projects. With modern communications technology, much can be accomplished, even without regular meetings.

Formation and Termination of Commissions

Withdrawal of automatic funding for TMs would not solve the problem of having in perpetuity 37 Commissions on subjects that might not be optimal, even for advisory groups. Experience has shown that it is virtually impossible to terminate a single Commission unless there is almost unanimous agreement among all members of the Commission. The SGR [Appendix 3] gives illustrations dating back to 1955 of efforts by IUPAC Presidents to terminate permanent Commissions. However, Council can be asked to exercise its authority under Bylaw 4.302 [see Appendix 4] not to approve the extension of any current Commission beyond 2001. The SDIC believes that it will be less divisive to the Union and more acceptable to each Commission to have *all* Commissions formally terminated than to try to terminate some and leave others.

Under this plan, Division Committees would examine their needs during the period 1999–2001 and request the Bureau and Council to form new Commissions as needed. These could be long-term (but with a specified term—no more than 8–10 years) to provide continuing attention to a field or to organize or manage a continuing activity, such as a series of symposia. In some instances they could be short-term (2–4 years) to accomplish a specific task for which the prestige of a Commission, not just a Task Group, is needed. For each proposed Commission, the Division Committee would have to make a persuasive case and follow the procedures given in Bylaw 4.301 [see Appendix 4]. To prevent a recurrence of the present situation with a large number of long-term Commissions, the Bureau should go beyond the requirement in Bylaw 4.301 for 'an indication as to the probable duration of the life of the new body' by specifying a lifetime and thus ensuring the automatic termination of the Commission unless positive action is taken to extend its life. The SDIC believes that this can be done at present on the basis of Bureau policy but that eventually Bylaw 4.301 should be modified.

National Representatives

National Representatives (NRs) play an important role in increasing the geographic breadth of IUPAC bodies and permitting the close involvement of individual NAOs

with IUPAC work. Bylaw 4.305 [Appendix 4] defines the participation of NRs in Commissions, and there are many active NRs. Although there is no statutory underpinning, two of the seven Division Committees and several Standing Committees also have NRs.

Under the new structure proposed here, NRs can still participate in any Commissions that are formed, but opportunities may be limited. There should be provision for direct links of NRs to all Division Committees, which will become the centers of scientific activity. Such NRs could provide extremely valuable links to NAOs and thus facilitate the generation of ideas for projects and suggestions for individuals to serve on Task Groups. The SDIC recommends that the Bureau, after consultation with Division Presidents, establish a policy for appointment of National Representatives to Division Committees as non-voting members, and for participation of NRs in the work of the Divisions' Task Groups.

Conversion to a new project-driven system

The SDIC recommends that the Bureau approve and implement a policy of relying on short-term Task Groups to carry out specific projects under the direction of Division Committees. A limited number of long-term Commissions could be formed to advise each Division Committee and augment its breadth of expertise. Three concurrent actions are required, as follows:

1 In September, 1998, the Bureau should approve a policy of providing IUPAC funds for support of approved projects and other specific activities, not support of Titular Members *per se*. The Bureau should endorse repeal or amendment of Bylaw 4.307, and Council should be asked to take this action in 1999, to be effective January 1, 2002.

2 In September 1998, the Bureau should endorse the phasing out of *all* existing Commissions by the end of 2001 and to recommend that Council take this action at the General Assembly in 1999. The Bureau should indicate that it will be receptive to very well justified proposals from Divisions to form a small number of new long-term Commissions, each with a termination date of no more than 10 years, to carry out activities that require such a long-term commitment.

3 The Divisions should be encouraged by the Bureau to accelerate the timetable in (1) and (2) to the extent feasible. Since all appointments to Commissions are now made for a two-year period, it may be desirable for a Division, on a case by case basis, to reduce the size of particular Commissions and to divert the financial resources to support of specific projects. The Treasurer should be asked to cooperate with Divisions in redirecting financial resources, including funds reserved for the General Assembly, away from support of TMs *per se* toward support of individuals working on projects. Beginning in 2002, major changes in Division budgets will occur, as described in a later section.

Operation of a project-driven system

One of the principal concerns about the conversion of the Union's scientific activities from a Commission-based system to one based on individual projects is the lack of a very large permanent structure that can initiate and develop suitable projects. This is a valid concern, as pointed out in the SGR and confirmed by many comments from Commission members. The SDIC believes that the problems can be overcome as discussed below. There are three aspects that must be considered—(i) ideas for new projects, (ii) personnel interested in and capable of carrying out the project, (iii) development of the project in detail and management of the project.

Sources of ideas

Under the current system, ideas for projects are largely generated within an individual Commission. The ideas come from one or more individuals who are expert in a particular field and who have thought about the problems that give rise to a project. In some instances there may be a widely perceived need within the relevant scientific community for IUPAC action. At the other extreme, there may be a single individual who thinks that IUPAC could make a useful contribution to a particular problem or discipline. The SDIC believes that under the proposed structure these and other sources can be tapped for ideas.

Division Committees are to be given the principal responsibility for developing projects. To some extent, projects should emerge from discussions within the Committee, augmented initially by the chairmen and members of current Commissions as long as those Commissions exist. Division Committees should solicit views on potential projects from participants at relevant IUPAC symposia and other specialized meetings. This will require some planning and organization to arrange suitable feedback, perhaps by designating one or more Committee members to attend suitable meetings. The Secretariat may eventually be able to provide a professional staff member to assist, but the extent of the Secretariat's role needs to be worked out.

Ideas for projects should be actively solicited from NAOs, national chemical societies, regional federations, international specialty societies (primarily IUPAC Associated Organizations), and IUPAC Fellows. Simply sending out a call for projects is unlikely to be successful, as indicated by the general lack of response to simi-

lar invitations for Pool Projects over the last six years. A continuing effort from Division Committees is needed, with carefully planned follow-up action by the Secretariat. Moreover, vague ideas for potential projects are not sufficient. There must be adequate development of the concept, evaluation of its feasibility for IUPAC and realistic cost estimates. The Division Committees are ultimately responsible for most of this work, but considerable help from the Secretariat will be required.

IUPAC should continue to sponsor various levels of projects. Some may be of sufficient importance and urgency that significant resources should be committed, while others may be more along the lines of many current projects—often initiated by one or a few people, who are prepared to do all the work with little IUPAC support. In fact, in some instances the formal endorsement by IUPAC may be sufficient to attract other local sources of funds for individuals. However, each project should pass quality checks, as discussed below, and responsibility for conduct of each project should clearly be vested in an individual or a well defined Task Group.

Personnel to carry out projects

In some instances the current procedure by which the proponent of a project is usually charged with pursuing it may be sufficient and desirable. In other instances someone or some organization may make a compelling argument that IUPAC should undertake a project but with no suggestion as to who would be both capable and willing to carry out the volunteer work. The relevant Division Committee, with the active assistance of the Secretariat, must be able to identify suitable individuals with requisite expertise. Databases provided by journal editors and NAOs and developed from sources such as citation indices will undoubtedly prove to be valuable. Use of electronic communication tools, especially the Internet, should be beneficial.

Another aspect that deserves some guidelines is the geographic representation on a particular task group. For the current Commissions, the paramount requirement is expertise in the field, but considerable efforts are made to insure reasonable geographic balance. The SDIC believes that each Task Group should be treated on its own merits. For some projects it may be desirable to have the Task Group rather localized in order to prepare a document quickly and at minimum cost. In such cases, there should be a geographically broad review of the initial document and ultimate stamp of approval by a group viewed as representative (perhaps a Commission or the Division Committee). For other projects, it may be politically important at the beginning to have a Task Group balanced in several ways, including geography. In any event, there should be guidelines to insure that capable chemists from 'distant' places are included as appropriate.

Project development and management

The SDIC envisions that projects will be developed by the relevant Division Committee and that the Task Groups responsible for projects will report directly to that Committee. The elimination of the extra level of management currently supplied by a Commission is a key advantage of our proposal. However, the Division Committee must recognize the increased responsibilities and be prepared to accept them. The members of the Committee, individually and collectively, should be expected to provide active support to the Division President. The SDIC believes that the Secretariat must be able to offer substantial assistance to Division Committees and Officers in recruiting individuals to work on some projects, and the Secretariat must assist in the management of projects. The SDIC recognizes that these responsibilities will require an enhancement of the professional staff of the Secretariat but does not believe that the essentially volunteer character of IUPAC should change. Likewise, the traditional size and budget of the Secretariat need not increase if the staff at the new site is developed to provide professional assistance, in addition to administrative support.

Evaluation of projects

Current policies require that proposed projects be subject to 'outside evaluation' before approval by a Commission and by the Division President. In some instances rigorous critiques are obtained, analogous to those given by a referee of a journal article, while in other instances only a cursory analysis is undertaken. Past practice has often limited the description of a new project to a short paragraph, which is often inadequate for critical review by someone outside IUPAC. Since the 'priority' accorded a project has little or no relation to funding, there has been little incentive to improve either the project description or the rigor of evaluation.

The SDIC believes that a system for evaluating proposals prior to approval is essential. It must be seen within IUPAC as fair and must be viewed outside IUPAC as rigorous. Moreover, at some time after completion of a project there should be systematic evaluation of the accomplishments.

Prospective evaluation

A prospective evaluation has two purposes. First, it should weed out any proposal that IUPAC does not want to endorse—for example, something that is irrelevant to IUPAC's mission; that might be embarrassing to the Union; or that might be widely perceived as being undertaken solely to give credibility to an individual's 'pet project'. Although there may be few such projects proposed, it is important to the Union's reputation that

the review system impose some check point for such eventualities.

The second purpose of prospective evaluation is to allocate the Union's resources in an optimum way. In setting up procedures, IUPAC should be careful not to impose burdensome requirements. There should be considerable flexibility tied to the level of resources required. For example, an essentially one-person project (the product of which would ultimately be reviewed and approved broadly) might make few demands on IUPAC resources and require relatively little justification. A project that is funded within a Division's budget must be justified there but not at higher levels. A project that is proposed for central funding (the successor to 'pool projects') should have adequate justification for this purpose. A project that requires outside resources (UNESCO, ICSU, industry, etc.) may require more detailed justification. For all types of projects the totality of IUPAC resources should be considered, including Secretariat support and publication requirements, as well as direct costs for the project. It is likely that the principal direct costs will continue to be for travel and subsistence; however, even with the voluntary contribution of time by Task Group members there may be instances where modest expenditures for specific purposes, such as data evaluation or purchase of reagents, might be warranted.

The Bureau should develop general criteria to guide reviewers and establish detailed procedures for prospective evaluation at the Division level and centrally. The SDIC believes that the criteria should include the following:

- Inherent scientific quality of the project
- Anticipated impact on some aspect of the chemical sciences or interdisciplinary activities
- Relation to IUPAC's goals and strategic thrusts
- Provision for publication of results and widespread dissemination
- Cost/benefit ratio

Retrospective evaluation

Retrospective review and evaluation of individual projects has generally not been done at the IUPAC level, but some Commissions or Divisions do look at outcomes in a serious way. *The SDIC believes that the Bureau should set criteria for either a central evaluation or a mandated Division evaluation of the impact of a project and of the outcome relative to what was anticipated.* The nature and time frame for such an evaluation must be decided on a case by case basis, but must involve consultation widely with the relevant scientific community. Where applicable, quantitative assessments, such as literature citations or adoption of nomenclature by major journals, should be employed. Over a period of years, such retrospective evaluations can provide useful guidance on the selection of future projects. In addition, the retrospective review may be valuable in identifying material that can be used for public relations purposes and for future fund-raising.

Role of the Secretariat

Successful implementation of most of the recommendations by the SDIC will require more active assistance by the Secretariat in the management of Divisional activities than has been true in the past. The Secretariat must provide staff support to Task Groups, particularly those conducting projects with an urgent completion date. This support need not consume a large amount of time for any individual project but can be of critical importance in providing to a Task Group of volunteers the management discipline that can come only from full-time paid staff.

Collectively, for the projects within all Divisions' programs, this responsibility will consume significant staff time. Fortunately, this additional obligation is consistent with the Executive Director's desire to change the emphasis of the Secretariat's duties by utilizing computer and electronic communication technologies to minimize staff time and costs in carrying out administrative aspects of the work. The staff resources thus freed can be used for more professional activities, including assistance to the Divisions. In addition, the Secretariat should over time acquire information on potential sources of funds from industry and from international governmental and non-governmental organizations that might be available to help support certain IUPAC projects.

Financial considerations

The SDIC is well aware that financial support of the Union through subscriptions by NAOs is likely to expand, at most, by amounts to cover inflationary increases. Our recommendations are aimed at improving the setting of priorities and the management of activities to ensure cost-effective operations of the Union's programs. The Strategic Plan should be viewed as providing a rational approach to dealing with the many aspects of chemistry to which IUPAC can and does contribute, rather than a call to undertake large, new programs. The significant changes recommended in the organization and management of activities within the Divisions will be accomplished within the current budgetary framework.

The large savings that will result from removing support of regular meetings of Commissions will be redistributed, largely to support specific projects, with some funds used to solicit advice and plan projects and others perhaps needed for improved management. *The SDIC*

recommends that the Treasurer and Finance Committee analyze the budgetary implications of the SDIC's recommendations and propose to the Bureau a plan for redistributing projected savings in future General Assembly budgets beginning with the 2002–2003 biennium. Provision should be made to provide adequate funds to each Division, while retaining a central pool of funds that can be awarded competitively for interdivisional projects or for projects beyond the scope of an individual Division's resources.

Currently TMs are distributed from a central pool for approved 'pool projects,' with financial support related only to the number of TMs. Under the new policy, the central pool will consist of money, rather than TMs. If these funds are to be used effectively, there must be a mechanism for preparing and reviewing applications and for making decisions in a manner that fully utilizes the scientific expertise of the Division Officers but permits decisions to be made by an impartial body. *After consultation with Division Presidents, the IUPAC Officers should propose to the Bureau a mechanism for reviewing applications for project funding and allocation of resources.* Guidelines should also be developed for securing outside funding to prevent apparent conflicts of interest and to maintain the Union's independent character.

Summary of recommendations on organization and management of scientific activities

The SDIC recommends an integrated program, with a defined time frame, to convert from the present Division/Commission structure to one that is more dynamic and under which approved projects will be carried out by short-term Task Groups that report directly to the Division Committees. Principal features of this proposal are as follows:

A. Division Committee

1 The Division Committee is to become the focus of scientific work in the Division and has the overall responsibility itself for initiating, developing and managing the work of the Division. The Committee should solicit ideas for projects from NAOs, national chemical societies, regional federations, international specialty societies (primarily IUPAC Associated Organizations), IUPAC Fellows, and participants at relevant IUPAC symposia and other meetings.

2 Division Committees, with the active assistance of the Secretariat, must be able to identify suitable individuals with requisite expertise to carry out projects. Overall, but not necessarily for each project, individuals will be recruited world-wide.

3 The Bureau will develop a system for prospective and retrospective evaluation of projects, with general criteria to guide reviewers.

4 In order to strengthen the role and mandate of Division Committees, the Bureau will establish uniform nomination policies and procedures for the Members and Officers of all Division Committees, to govern the 1999 election process. These procedures will include the following points:

(a) Each Division President will appoint a nominating committee of five members, consisting of no more than two Members of the Division Committee and three others chosen for breadth, with the overall membership approved by the Executive Committee.

(b) Each Division will insure that the nomination of candidates for Division Officers is conducted in a thoughtful way, with adequate consultation within the Committee and with the President of IUPAC.

(c) The Bureau will give Divisions authority to suspend the application of all Division Rules that are in conflict with the Bylaws or with the new policy enunciated by the Bureau. Within existing Statutes and Bylaws, the Bureau will provide maximum flexibility to Divisions in adjusting the size and composition of the Division Committee and Commissions.

5 The Bureau will establish a policy for appointment of National Representatives to Division Committees and for their participation in the work of the Divisions.

6 The Bureau and Executive Committee will give special attention to the application of the above recommendations within the current Sectional structure of the Division of Chemistry and Human Health.

B. Commissions

7 The Bureau will endorse the termination of *all* existing Commissions by the end of 2001 and recommend that Council take this action at the General Assembly in 1999. Any new Commissions formed must strictly adhere to the requirements of Bylaw 4.301 and have a definite termination date.

8 The Divisions will be encouraged to accelerate the timetable given above for reduction in Commission size and reallocation of financial resources to support of specific projects. The Treasurer and the Bureau will provide the maximum flexibility in allocation of money and Titular Members.

C. Secretariat

9 The Secretariat will provide professional staff assistance to Division Committees and Task Groups to facilitate the development, conduct and management of projects and the recruitment of individuals for Task Groups.

D. Funding

10 The Bureau will approve a policy of providing IUPAC funds for support of approved projects and other specific activities, not support of Titular Members *per se*. The Bureau will endorse suitable amendment of Bylaw 4.307.

11 The recommended changes are to be implemented within existing budget levels provided by NAO subscriptions (adjusted only for inflation). The large savings that will result from removing support of routine meetings of Commissions will be redistributed among scientific programs to fund specific projects and to finance necessary meetings of reconstituted Commissions and other planning and advisory groups.

12 Budgets will be adjusted to provide adequate funds to each Division and to retain a central pool of funds that can be awarded competitively for interdivisional projects or for projects beyond the scope of an individual Division's resources. The Bureau will establish mechanisms for reviewing applications for project funding and allocation of resources, both within Divisions and centrally.

Summary of formal actions required

Strategic Plan:
The Executive Committee has approved the Strategic Plan for 1998–99 and has authorized its use to guide program development during the current biennium. The Plan has been distributed widely within IUPAC and among the NAOs, and has been publicized outside the Union. Proposed actions for implementation of the Plan and for updating it biennially will be presented by the IUPAC Officers separately from this report.

Organization and management of scientific activities
If the EC accepts the recommendations of the SDIC in April, 1998, implementation will require a series of actions that may be summarized as follows:

April–September 1998: The EC should ensure that the report by the SDIC, together with its own views and proposals for implementation, is widely distributed within IUPAC and among the NAOs with a request for comments, identification of potential problems, and suggestions for improvements. During this period, written communications and informal dialogue among IUPAC Officers, Division Presidents and Commission Officers should be encouraged.

September 1998: The Bureau will be asked to approve a policy that (i) vests in Division Committees responsibility for selection of and management of scientific projects, (ii) defines the composition of Division Committees and procedures for selection of Division Committees and Division Officers, (iii) establishes criteria for approval of projects, and (iv) calls for a phasing out of all current Commissions.

October 1998: NAOs should be advised of the new policies and asked for comments and/or suggestions for modification of the policies. NAOs should be advised of changes in Bylaws that will be requested in 1999.

October 1998–August 1999: Division Officers and Division Committees, in consultation with their Commission Officers, should develop plans for making the transition to a project-based system no later than 2001, with some aspects phased in if desired in 1999. IUPAC Officers and the Secretariat should provide any required assistance and cooperate in modifying procedures whenever possible to facilitate the Divisions' efforts.

August 1999: Council will be asked to modify Bylaw 4.307 as described in the report. Council will be asked to terminate all existing Commissions, effective 31 December 2001.

Concluding statement

The SDIC recommends that the EC approve this program, request comments from IUPAC bodies and the Union's National Adhering Organizations, and submit the proposal (modified in detail if needed as a result of comments received) to the Bureau for action. The Bureau will be asked to endorse this program in September 1998 and set in motion the steps outlined above.

Appendix 1. Membership of the SDIC

	IUPAC Position
Prof. Joshua Jortner (Chairman) Tel Aviv University Israel	Vice-President, 1996–97 President, 1998–99
Dr Edwin D. Becker National Institutes of Health USA	Secretary General, 1996–99
Prof. Heindirk tom Dieck Gesellschaft Deutscher Chemiker Germany	
Prof. Mostafa El-Sayed Georgia Institute of Technology USA	
Prof. Robert Gilbert University of Sydney Australia	Macromolecular Division: Vice-President, 1996–97 President, 1998–99
Dr Alan Hayes ICI (Retired) UK	Chairman, CHEMRAWN Committee, 1996–97 Vice-President, 1998–99
Prof. Upendra K. Pandit University of Amsterdam Netherlands	Organic Chemistry Division: Vice-President, 1996–97 President, 1998–99

Prof. Pieter Steyn — Elected Member
University of Potchefstroom — of Bureau, 1996–99
South Africa

Prof. Leiv K. Sydnes — Elected Member
University of Bergen — of Bureau, 1994–2001
Norway

Prof. Andrea Vasella
ETH
Switzerland

Dr John W. Jost (staff support) — Executive Director
IUPAC Secretariat

Appendix 2. Initially suggested goals and mission statements

IUPAC goals [from Vice-President's Critical Assessment—Prof. Joshua Jortner]

These goals rest on the statutory objectives and should define the missions of IUPAC.

1 Serving as an international, nongovernmental, scientific, authoritative and objective advisory body for global issues related to pure and applied chemistry.
2 Contributing to the advancement, coordination and collaboration of world-wide academic and industrial research in chemistry.
3 Providing effective channels of communication in the international chemistry community.
4 Promoting the service of chemistry to society and to the international community.
5 Contributing to education in chemistry on all levels.
6 Encouraging young chemists in developed and developing countries.
7 Advancing the service of chemistry to developing countries.
8 Broadening the geographical base of the Union
9 Addressing globally important issues of chemistry.
10 Advancing the public understanding of science in the special context of chemistry.
11 Serving as the 'voice of chemistry'.
12 Enhancing the visibility of the activities of the Union for the sake of the discipline.
13 Maintaining the norms, values, standards and ethics of science.

Although not explicitly incorporated in the bylaws, issues 10–13 are central for the international chemistry community and for the impact of science on society.

The Goals of IUPAC, an Ethically Based International Scientific Union [excerpted from paper by Prof. Pieter Steyn]

Inwardly directed Goals (traditional goals)

1 Serving as the leading (or representative) international, authoritative and objective advisory body for globally important issues related to the practice of pure and applied chemistry.
2 Contributing to the advancement, co-ordination and collaboration of world-wide academic and industrial research in chemistry.
3 Facilitating effective channels of communication in the international chemistry and scientific community.

Outwardly directed Goals (Service to the Society at Large)

1 Promoting universal access to the benefits of chemistry through formal, non-formal and informal education.
2 Contributing to the advancement of education in all aspects of chemistry in terms of quality and appropriateness.
3 Promoting chemical industry in its contribution to sustainable development, wealth creation, and the improvement of the quality of life. [Wealth creation may be omitted].

IUPAC Mission and strategic thrusts [excerpted from paper by Prof. Upendra Pandit]

IUPAC Mission: To advance and contribute to all international aspects of chemistry and to serve the interests of the international chemical community in the 21st century

Strategic thrusts:

IUPAC in the service of man

1.1 Respond to the evolving developments in Chemistry, especially with reference to interdisciplinary areas
1.2 Foster the positive image of chemistry as the 'MOLECULAR BASIS OF HUMAN WELFARE IN THE 21st CENTURY'
1.3 Initiate activities in areas of global concern where Chemistry can help to provide visible solutions on a short to medium time-scale basis [environment, ecology, bio-diversity, international aspects of health care, etc.]
1.4 Develop Programs directed to the specific needs of technically less-developed countries

IUPAC in the service of chemists

2.1 Establishment of international chemical standards, terms, codification and nomenclature—where it can be done effectively by the IUPAC
2.2 Development of Forums and Channels for Exchange of information on 'Educational Methods'

2.3 Coordination of Technical Training (setting-up an International data-bank on available training positions and applicants, e.g. on postdocs)

2.4 Facilitate International Industrial Partnerships (databank on 'effective' academic, industrial and other laboratories which can do contract-work on specific projects)

2.5 Establish an IUPAC Information Centre to which chemists, affiliates and non-affiliates alike, can address their enquiries

2.6 Establish 'Name' Awards, Lectures and Fellowships for young chemists

The contribution of IUPAC in these areas is warranted on the basis of its Global Position, International Recognition and Available Expertise.

Appendix 3. Organization and management of IUPAC's scientific work

During the last few years there has been intensive study, discussion and debate within the Union on what was first termed 'restructuring' but later broadened to the more general 'Scientific Policy of the Union.' A number of proposals have been advanced, some have been adopted, some have been rejected outright and others have been declined for the present but might be introduced at a future date. Concurrently, during the last year, there have been increased efforts to address the overall mission and strategy of the Union, partially with advice from leading chemists outside IUPAC. These broader ideas have been focused in Vice-President Jortner's Critical Assessment (VPCA), which presents recommendations for establishing overall Goals and for expanding the scope and emphasis of IUPAC's scientific work. The present document complements the VPCA in addressing questions of organization and management of the scientific work.

Within the last two years, three of our seven Divisions have been or are being restructured to create Divisions of (i) Chemistry and the Environment, (ii) Chemistry and Human Health and (iii) Macromolecular Chemistry and Materials [name subject to modification]. Although further restructuring at the Division level is certainly possible, it has been decided as a result of discussions within the last year that the remaining four Divisions will in the near future retain their traditional scope of Physical, Inorganic, Organic and Analytical Chemistry. However, at the level of the Division Presidents and the Executive Committee, there is a strong consensus that additional flexibility is needed to tackle projects within a specific and limited time frame and to address problems that cross traditional boundaries within chemistry and between chemistry and other disciplines.

Some historical perspective

Most of the scientific work of the Union emanates from Commissions, augmented in many instances by Division Subcommittees, Working Parties and Task Forces. Over the years IUPAC has established a network of Commissions (currently numbering 37). Occasionally a new Commission is formed, sometimes there is a change in the name and/or terms of reference of a Commission and (quite infrequently) a Commission is abolished. Overall, there has evolved an organization that has the virtue of stability but the shortcomings of a static structure. Yet, the Statutes and Bylaws anticipate a more dynamic composition of Commissions. Statute 10.4 states: 'Each Division and Section may include such Commissions as are approved by the Council', while Bylaw 4.301 prescribes a detailed procedure for analyzing the need for a new Commission, including a report to Council. B 4.301 concludes: 'This report, if favourable to the creation of a new body [Commission], shall contain an indication *as to the probable duration of the life of the new body* and an estimate of its annual cost.' [Emphasis added] Bylaw 4.302 states: 'At each General Assembly, the Council shall in the light of the Division or Section President's report and on the recommendation of the Bureau decide *whether or not to continue each Commission*.' [Emphasis added]

In spite of the flexibility built into the Statutes and Bylaws, the structure has been largely static. As long ago as 1955, President Tiselius observed that '…many of our Commissions do very fine work and have justified their existence beyond any doubt…Perhaps it would be practical to introduce a distinction between standing Commissions and Commissions set up for a definite, limited task. The second type should be limited in their mandate to, for example, two years (that is to say, between two Conferences of the Union), and should be given opportunities to meet within this period. Their task would, of course, be entirely different from that of a standing Commission which involves maintaining a more or less continuous survey of a given field and taking action whenever necessary.' Yet, such limited lifetime Commissions have been formed only once—as an interim measure to postpone or avoid the creation of more permanent Commissions—and few Commissions have been abolished. In 1973, President Bénard pointed out why this is the case: 'It is easy to obtain general approval for the creation of new bodies, but it is difficult to decide to abandon existing ones. The reason for this is that it takes far more courage to say 'no' than to say 'yes', particularly when the consequences involve our friends.' He went on to say: 'An institution which does not have the strength to renew itself is an institution condemned at length to sterility.'

The current concerns on restructuring stem from 1981, when President Zollinger made the first real 'critical assessment' of IUPAC projects. According to his analysis, the problems seemed to stem from '(1) inefficiency and too long duration of a relatively large number of projects; (2) insufficient use of our traditional means to solve problems in a changing world; (3) the involvement of too small a circle of chemists in IUPAC work—a reporter in Davos even called this circle a 'charmed circle'.' Sixteen years after Zollinger's appraisal, and after a series of initiatives to correct these perceived deficiencies, we have many more projects than Zollinger had to contend with, the traditional means are not working well, and we still have a 'charmed circle.'

Let's be clear: Even with these shortcomings, IUPAC Commissions have done and continue to do outstanding work for the international chemical community. Our challenge is to insure that such high quality work continues but that the projects undertaken are widely regarded as relevant to today's world and are completed in a time frame consistent with the fast pace of modern research and industrial development. We must reach out to a broad international community of chemists to help define the needs on which IUPAC projects are based and to recruit the most talented chemists worldwide to work on these projects. As evidenced by the quotes from 1955, 1973 and 1981, it has not been possible to achieve the dynamism needed within our present structure and mode of operation. *We need to convert from a primarily static Commission structure to one that is largely based on time-limited Commissions formed to carry out specific, well defined tasks.*

Philosophical basis for a new organization

Under this concept, the IUPAC organization would continue to consist of Council, Bureau, Standing Committees and Divisions (including Division Committees). However, the norm would be that Commissions should not be regarded as part of the 'regular' organization but rather as the temporary working groups that carry out specific projects developed by the Division Committees with the help of the Governance and the Secretariat. There may be areas in which continuity is needed, such as organization of a regular series of symposia. Such activities might now be carried out by a Commission, but a continuing Subcommittee of the Division Committee could take over such functions.

Divisions should regard the entire world-wide chemical community as the resource for both ideas and for volunteers to carry out projects, not the 'charmed circle' of IUPAC insiders. Likewise, ideas for projects should come from the world-wide community. Just how to generate such ideas, develop projects and seek out people able and willing to work on the projects is, of course, the key to success or failure. I am convinced that ideas for useful work usually originate in a 'bottoms-up' manner, not as directed from 'top-down'. In fact, the establishment of the pool TMs was to permit the undertaking of such 'top-down' projects generated outside the mainstream of Commission activity, but after several years there are very few such projects. If we implement the type of structure envisioned here, but without a good mechanism to identify and develop projects—and to secure the services of experts on the Commissions—we will kill the useful work that is now being done. A great deal of thought and planning is needed to insure that IUPAC can develop the processes to do this without the large cadre of long-term members of Commissions. I do not pretend to have the answers, but I think that the following steps would be desirable:

- Insure through the nomination process that the members of the Division Committees are people with a broad outlook in their discipline. This will help in generating ideas and in finding good people to work on Commissions.
- Include on Division Committees (wherever possible) editors of major journals, who have databases of potential project referees and Commission members. Also, editors may be more aware than the average chemist of areas in which IUPAC work on standardization, terminology, etc. is really needed.
- Establish close relations between the professional staff of the Secretariat and national chemical societies and NAOs to identify potential workers.
- Use IUPAC-sponsored symposia more effectively to advertise IUPAC activities and to solicit ideas for projects through brainstorming sessions at such symposia. The Secretariat should play a stronger role than it now does in the arrangements for symposia, and a staff member could attend to note what ideas are generated.
- Ask Division Committees to organize planning meetings of carefully chosen people to evaluate the need for a Commission in a given field or to define a project and suggest Commission members.
- Insure that a real refereeing system is in place for projects proposed by members of Division Committees or members of any existing Commission.

Under this concept, each Commission would have a defined task with a defined product and a defined time in which to carry out the project, along with a budget, expressed in dollars, not Titular Members. It would be expected that the members of a Commission which has completed its task will consider their current active involvement in IUPAC to be over until they are asked to serve on a new Commission. Clearly, some people who distinguish themselves on such projects may also be

asked to serve on Division Committees or in some other capacity, but there should be no general expectation of a long-term active involvement. However, creation of an IUPAC Fellows Program [as will be proposed to Council in Geneva] would, over the course of time, insure that anyone who has ever worked on any IUPAC activity or project would have the opportunity to remain in touch with current activities and to make suggestions for new projects and Commission members.

Proposed course of action

The first step, completed at the Executive Committee in Jerusalem, was to discuss the ideas articulated here and to integrate those with proposals from individual Divisions and with aspects of the VPCA. The EC endorsed the *concept* of an organization based primarily on time-limited Commissions but recognized that implementation will be dependent on solving a number of problems, some of which are given above.

The EC also endorsed in principle the recommendations in the VPCA to establish clear Goals for IUPAC but, again, recognized that further thought and discussion are needed to refine the Goals. The EC concluded that a broad-based committee would be needed to develop the necessary strategic thrusts and to consider their implementation in terms of the structure and guidelines for scientific activity. The EC therefore authorized the formation of a Strategy Development and Implementation Committee (SDIC), to report back to the EC in April 1998. From the findings and recommendations of the SDIC, the EC expects to formulate specific proposals for approval by the Bureau in September 1998 and for necessary action by Council in 1999.

The examination of these issues by the SDIC and the possible implementation of broad changes in goals, structure and operation of IUPAC and its constituent parts should not negate actions currently underway in and between several Divisions to effect a number of specific structural and functional changes during 1997.

Edwin D. Becker,
Secretary General

Appendix 4. Selected bylaws

B4.1 Division and Section Committees

B4.101 Each Division or Section shall be administered by a Division or Section Committee which shall be the organ of liaison between the Bureau on the one hand and the various bodies constituting the Division or Section on the other hand.

B4.102 The Titular Members and Associate Members of a Division or Section Committee and of Commissions within a Division or Section shall together form the Membership of the Division or Section.

B4.103 The Titular Members of each Division or Section Committee shall be elected by the Membership of the Division or Section according to its rules and shall not exceed 10 Titular Members, unless otherwise determined by the Bureau. The term of service of a Titular Member shall be not more than four consecutive years, but shall cease on election as an officer. The Vice-President and the President of a Division or Section shall not hold these respective offices for more than four consecutive years; the Secretary of a Division or Section shall serve for four consecutive years and be eligible for reelection up to a maximum of a further four years. Exceptional circumstances must be established and special permission of the Bureau granted for Titular Membership of the same or more than one Division or Section Committee beyond a total of 12 years whether the Titular Memberships are consecutive or not.

Subject to this provision the immediate Past-President of the Division or Section shall be one of the Titular Members of the Division or Section Committee for a period of two years. In addition to these Titular Members the President, Vice-President, Secretary General, and Treasurer of the Union shall be ex officio Members of all Division and Section Committees.

Additionally a Division or Section Committee may elect Associate members, who shall have full voting rights. The number of Associate members shall not exceed six. The term of service of an Associate Member shall be two years, with the possibility of reelection consecutively for two more years only.

A newly elected Titular Member or Associate Member of a Division or Section Committee shall assume office only after approval by the Bureau or Executive Committee. The Adhering organization with which the Titular Member or Associate member is connected shall be notified of the appointment.

B4.104 The Division or Section Committee shall elect from among its existing and, subject to confirmation, new Titular Members a President, a Vice-President designated as President-Elect, and a Secretary. These elections shall be subject to approval by the Council.

B4.105 The Division or Section Committee may form a Division or Section Executive Committee, consisting of the President, the Vice-President designated as President-Elect, and the Secretary of the Division or Section, to carry out the necessary administrative

duties between meetings of the Division or Section Committee.

B4.106 The functions of the Division or Section Committee shall be:

B4.1061 to propose to the Council through the Bureau the establishment of Commissions to be attached to it and to appoint the membership and the initial officers of these, the appointments having to be approved by the Council;

B4.1062 to propose to the Council through the Bureau the dissolution of existing Commissions when required;

B4.1063 to supervise the work of its Commissions and other bodies;

B4.1064 to plan and organize scientific meetings and other activities which are deemed useful in furthering the objects of the Division or Section;

B4.1065 to prepare a budget for the Division or Section in accordance with a procedure to be prescribed by the Treasurer, for consideration and approval by the Bureau and the Council;

B4.1066 to advise the Bureau for recommendation to the Council on scientific matters.

B4.107 The Division or Section Committee shall meet at least every two years, during a General Assembly.

B4.108 Decisions of the Division or Section Committee must receive the approval of the Bureau when they would have financial consequences involving the budget of the Union. In addition, in order to ensure the fullest coordination between the activities of all the Divisions and Sections the Secretary General at the Secretariat shall be informed of all other decisions taken by the Division and Section Committee.

B4.109 At a General Assembly the Division or Section President shall report to the Council on the activities of the Division or Section since the last General Assembly. In a year in which a General Assembly is not held the Division or Section President shall present to the Division or Section Committee and to the Bureau a written report on the activities of the Division or Section since the last General Assembly.

B4.110 Each Division and Section shall make provision for the conduct of the work of its Commissions and other bodies. Such provision, which must receive the approval of the Bureau, may be incorporated in Divisional or Sectional rules.

B4.3 Commissions

B4.301 On the recommendation of a Division or Section Committee, through the Bureau, the Council may create a Commission of the Division or Section. Each Commission shall have as its object the study of topics of international scientific or technical significance requiring agreement, regulation, standardization, or codification in some aspect of pure or applied chemistry. The terms of reference of a new Commission shall be clearly described and approved by the Council. If a Division or Section Committee wishes to create a Commission, it must apply to the Bureau for the appointment of an ad hoc committee of three persons which shall study the question and then report back to the Bureau. This report, if favourable to the creation of a new body, shall contain an indication as to the probable duration of the life of the new body and an estimate of its annual cost.

B4.302 At each General Assembly, the Council shall in the light of the Division or Section President's report and on the recommendation of the Bureau decide whether or not to continue each Commission.

B4.305 (in part) Besides the Membership of a Commission the following may attend Commission meetings:

(i) National Representatives nominated by the various Adhering organizations and approved by the Commission. A Commission may coopt not more than one such representative from an Adhering organization, but such representation shall not be permitted if the Commission already has a Titular or Associate Member from that Organization, unless exceptional circumstances are established and special permission granted by the Bureau. Such representation shall lapse at the conclusion of the next General Assembly unless the person is renominated by his Adhering organization and reapproved by the Commission. Reappointment of National Representatives beyond a total of 12 years service, whether these are consecutive or not, requires that special circumstances should be established by the Adhering organization.

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.

Committee on Project Evaluation Criteria

The Executive Committee (EC) has endorsed the integrated program and time frame proposed by the Strategy Development and Implementation Committee (SDIC) for improvement in the organization and management of the Union's scientific activities. As proposed by the SDIC, several aspects of this program must be developed in more detail in order that the EC can present for Bureau approval in September 1998 a comprehensive plan for implementing the program.

The EC has appointed an *ad hoc* Committee on Project Evaluation Criteria (CPEC) to advise the EC and the Bureau on criteria for the evaluation of project proposals; on mechanisms for approval of such proposals and allocation of resources; and on criteria for retrospective assessment of the outcomes of projects.

The CPEC membership is comprised of Elected Members of the Bureau and Division Officers, whose collective experience will insure that the perspectives and needs of the Divisions are addressed along with the requirements of a project-based system. Membership of the CPEC follows:

Prof. Gus Somsen (chairman) Elected Member of Bureau.
Prof. John Corish President, Inorganic Chemistry Division.
Prof. Folke Ingman President, Analytical Chemistry Division.
Prof. Werner Klein Vice-President, Div. of Chemistry and the Environment.
Dr Edwin Przybylowicz Elected Member of Bureau.
Prof. Pieter Steyn Elected Member of Bureau.
Dr John W. Jost (staff support) Executive Director, IUPAC.

The CPEC is charged as follows:

1 Recommend procedures and assessment criteria, as outlined in the SDIC report, for evaluation of project proposals by IUPAC and non-IUPAC reviewers
- at the Division level
- centrally within IUPAC
- for external funding.

2 Recommend a mechanism for reviewing applications for central funding of projects and allocation of resources, within the guidelines proposed in the SDIC report.

3 Recommend criteria and procedures for retrospective evaluation of projects to assess their success and impact, along lines proposed in the report by the SDIC.

4 Provide a report to the EC encompassing the above recommendations by 15 August 1998.

History of chemistry in the Czech Republic

Chemistry International **inaugerates in this issue a new series of articles describing the history and status of Chemistry in the member countries of the Union.**

Our first article describes the History and Current Status of Chemistry in the Czech Republic

What is now the Czech Republic is in an area that was occupied by the West-Slav Czech tribes (Samo Empire, AD 623–658). The Premyslides dynasty originated among these tribes. The beginnings of the Czech state extend back to the period of the reign of the first Czech Prince Bořivoj at the castle site Budeč in the Prague Basin (by 891). The nucleus of the Czech state was fixed during the reign of Prince Wenceslas (924–935). The Premyslides of the House of Slavnik were able to centralize the whole territory of Bohemia in the 10th century. Beginning in the first half of the 11th century, further regions were annexed, and during the 13th century, the basis of the feudal political formation was created as the Counties of the Czech Crown.

The Czech King and Holy Roman Emperor Charles IV of the House Luxembourg (1316–1372), made the royal seat Praha the largest town of Central Europe and founded the oldest university in Central Europe. Many outstanding scholars were affiliated with the Charles University. The great progress of natural philosophy in the Czech Kingdom occurred during the second half of the 16th century when Rudolph II (1552–1612), who was both Czech King and Holy Roman Emperor (1576–1611), supported alchemy, astrology and arts, as well as inviting many learned men to work at court, e.g. the astronomers Tycho de Brahe and Johannes Kepler (from 1600 to 1611). One of the great men in the history of Czech civilization was Jan Amos Komensky (1592–

Medieval College, the Carolinum.

1670), who created the fundamentals of modern pedagogy and who occupies a prominent position in the world history of teaching for his work in methods of cognition and knowledge.

A change-over from hand manufacture to machine production was in progress in Bohemia during the 18th century when the pre-scientific stage of chemistry (iatrochemistry, pflogiston theory) was transformed step by step into science. In 1707, the Professional School of Engineering was opened in Praha; this School became, in 1803, the Polytechnic Institute from which the Czech Technical School in Praha arose in 1863 (the Czech Technical University at Praha from 1920 onwards). Another school, the Private School of the Arts, Humanities and Social Sciences was active in the period 1770–1775 and, in 1784, changed its title to the Czech Society of Science. This Society was then, in 1790, re-named the Royal Czech Learned Society which, as the only Czech learned society, published the results of Czech scientific research into the 19th century. In 1871, the Czech Chemical Society was established, the Society for Chemical Industry followed in 1892; lastly, the two Societies merged into the Czech Society for Science and Industry (1906). The Czech Academy of Science and Art was founded in 1890 (originally the Czech Academy of Emperor Francis Joseph). In 1895, the Czech Technical Foundation, an association of Czech engineers, was established in Praha with the aim of issuing technical literature in the Czech language and supporting its formation. (For the development of industry in the 18th and 19th centuries, see below.)

The Czech contributions to the development of chemistry were, from the first half of 19th century to the first half of the 20th century, made predominantly in universities. There, research was carried out in departments chaired by outstanding Czech professors of chemistry. Some notable examples are: Bohuslav Brauner (1855–1935), a disciple of R.W. Bunsen and H.E. Roscoe and Mendeleev's friend. Brauner was a pioneer of the periodic system of elements. He determined the atomic weights of 26 elements, including the lanthanides La, Ce, Pr, Nd and Sm and the actinides Th and U. He also proposed oxygen as the basis of relative atomic weights (1888). Emil Votocek (1872–1950), founding father of the Czech scientific school of organic chemistry, was the author of many original studies in the field of the chemistry of saccharides. Votocek´s successor was Rudolf Lukeš (1897–1960) who was in scientific contact with L. Ruzicka (1887–1976, Nobel Prize in 1939, honorary doctor's degree from Charles University in 1948) and V. Prelog (1906–1998, a graduate of the Czech Technical University at Praha, Nobel Prize in 1975), professors at the technical college in Zurich. Jaroslav Heyrovský (1890–1967) discovered the use of a dropping mercury electrode for electrolysis (1922). He was awarded the Nobel Prize for discovering the polarographic method and its use in analytical chemistry (1959). František Šorm (1913–1980), headed a research group that became famous for the synthesis of natural compounds, mainly terpenes and biologically active components of plants. Otto Wichterle (*1913), the author of excellent textbooks of inorganic and organic chemistry and inventor of the soft contact lens; his research group discovered rapid casting polymerization of lactams.

There were 22 schools of the university type in Czechoslovakia in 1949, 36 schools in 1982, and 41 schools in 1987. In the Czech Republic, there were 18

The Institute of Macromolecular Chemistry.

those schools in 1991 out of which six schools either were specialized in the education of chemistry or included faculties for teaching in chemistry—Charles University (Praha), Masaryk University (Brno), Palacky University (Olomouc), Institute of Chemical Technology at Prague, University Pardubice (Pardubice), and Technical University Brno (Brno).

In 1952, the Czechoslovak Academy of Sciences was established (the Academy of Sciences of the Czech Republic at present), and the centre of fundamental research in all branches of science was shifted to its scientific institutes (totalling 64), among them are the Institute of Inorganic Chemistry (Praha), Jaroslav Heyrovsky Institute of Physical Chemistry (Praha), Institute of Organic Chemistry and Bio-chemistry (Praha), Institute of Macromolecular Chemistry (Praha), Institute of Analytical Chemistry (Brno), and Institute of Chemical Process Fundamentals (Praha). All the laboratories of the Academy were equipped with the most modern instruments, and their research results, published in scientific periodicals or delivered as lectures at international meetings, have been recognized worldwide, e.g. the studies of R. Zahradník in the field of quantum chemistry, and the papers of A. Holy on the syntheses of nucleic acids and on the chemistry of antimetabolites.

An early symptom of the industrial revolution in Bohemia was the Industrial Exposition arranged in Praha in 1791 as the first of that type in Europe. The first chemical plant had been put into operation in Lukavec as early as 1630. During the following two hundred years, it produced sulfur bloom and rolls, Czech sulfuric acid (vitriol, oleum), vitriol of copper, vitriol of iron, ochre of iron, muriatic acid, nitric acid, and English sulfuric˘acid (chamber acid). From 1800, there were Starck Works in Bohemia (Kraslice, Hromnice, Vranov, Kazncjov), which produced, in addition to the chemicals produced by Lukaˇvec, alum, Glauber's salt, and citric acid. In 1801, the first sugar-beet factory was opened in Bohemia (Horovice). The first establishment for chemical production in Praha (muriatic acid, nitric acid, Glauber salt) dates from 1815. The production of soda by the Leblanc process existed in Hrušov (1851). In 1856–57, two significant chemical concerns were founded in Bohemia—the Chemical Factory Carl Rademacher & Co. (Praha—Karlín) and, the Syndicate for Chemical and Metallurgical Production (Ústí nad Labem). During the latter part of the 19th century and the first part of the 20th century, mˇaˇny chemical works arose, e.g. of dynamite (Roztoky u Prahy, 1868), ammonia and ammonium salts (Praha—Zizkov, 1869), fertilizers and chemicals (Kolín, 1871), lacquers and tin salt (Praha, 1894), zinc paints (Retenice, 1895), carbide (Libkovice, 1899), and paints (Letovice, 1910).

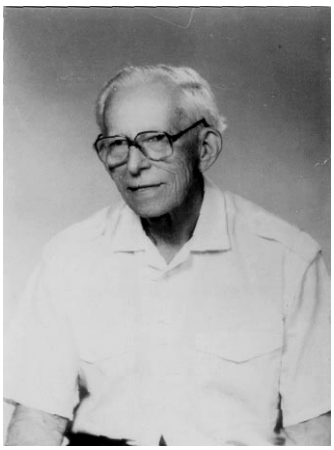
After the First World War, industry formed the main part of the national product in Czechoslovakia; its industrial production was the seventh highest in the world. After a stagnation during the Second World War, through 1982, production advanced roughly 13-fold on average. Some examples of production increases in specific products (in thousands tons) are, from 1937 through 1982: plastics 1/957, synthetic fibres 4/180, paper 246/928, refined sugar 667/894, and cement 1273/10 325.

Prague Congress Centre.

In the Czech Republic (area ≈ 79 000 km^2, population ≈ 10 000 000), 41% of the population was active in industry. This was 66.7% of the national income in 1983. In 1991, there were 223 industrial wo˝rks, among them 31 works for the production of chemical and rubber materials (e.g. Barum—Otrokovice, Kaucuk—Kralupy nad Vlt., Chemical Works—Sokolov, Chemopetrol—Litvínov, Fatra—Napajedla, Gumotex—Breclav, Lachema—Brno, Moravian˘ Chemical Works—Ostrava, North-Czech Chemical Works—Lovosice, Opt˝imit—Odry, Silon—Planá nad Luz, Spolana Neratovice, Synthesia—Semtín, Technoplast—Chropync). In addition, the Ministry of Health coordinated 10 production establishments (e.g. Galena—Komárov u Opavy, Research Institute of Antibiotics and Biotransformations—Roztoky u Prahy, and Research Institute of Pharmacy and Biochemistry—Praha). The economic results of chemistry was affected also by the activity of the institutes of applied research (16, e.g. Research Institute of Inorganic Chemistry—Ústí nad Labem, Research Institute of Organic Syntheses—Rybitví, and Institute for Research, Production and Application of Radio-isotopes—Praha) and design institutions (23, e.g., Chemoprojekt—Praha). All those works and establishments turned into joint-stock companies after the split of the Czech and Slovak Federal Republic and the formation of the Czech Republic at the beginning of 1993. The chemical turnover for the Czech Republic in 1993 was 2.47×10^9 USD (according to CEFIC figures).

Czechoslovakia has been a member of the International Union of Pure and Applied Chemistry (IUPAC)

since 1920, shortly after its foundation. The representatives of Czechoslovakia have always been significant participants in Union activity. Some of the well known Czech personalities were members of Bureau of IUPAC: E Votocek (Vice-President of IUPAC, 1922–1925), O. Tomicek (1947–1951), O. Wichterle (1961–1971, Member of the Executive Committee 1965–1969, one of founders and the first President of the Macromolecular Division, 1967–1971), V. Herout (1969–1977), and A. Vlcek (1979–1987, Member of the Executive Committee 1985–1987). Out of many other active Czech members of IUPAC we should also mention B. Brauner, who was a founder-member and later the Chairman of the IUPAC Commission on Chemical Elements (1921), and P. Kratochvíl who was the Chairman of the Commission on Macromolecular Nomenclature for six years (1985–1991). At the present time, the Czech Republic is represented by the Czech National Committee for Chemistry as well as by 10 elected members and 15 nominated national representatives on IUPAC Standing Committees and Division bodies. There are a number of institutions in the Czech Republic (e.g. the Czech Commission on Nomeclature of Organic Chemistry, the Czech Commission on Macromolecular Nomenclature, and J.M. Marci Spectroscopic Society) that translate IUPAC documents and publish them in the national chemical journal Chemické Listy, as well as the National Centre of IUPAC for the Czech Republic that distributes IUPAC documents on nomenclature and terminology (in English and Czech). The IUPAC General Assembly and the IUPAC Congress were held in Prague in 1967; since that year, 55 meetings in the series of Prague Meetings on Macromolecules (Microsymposia and Discussion Conferences on Macromolecules, under the auspices of IUPAC) have been organized in Prague. The IUPAC International Symposia on Macromolecules were held in Prague in 1957, 1965 and 1992.



O. Wichterle

P. Cefelín,
Associate Member of the Macromolecular Division Committee of IUPAC and Secretary of the Czech National Committee for Chemistry

Recent reports

Characterisation of finite length composites: Part IV—structural studies on injection moulded composites (Technical Report)

Synopsis: The microstructure of discontinuous fiber composites can be articulated by many parameters. In this collaborative study as part of series of parallel projects under the IUPAC Working Party IV.2.1 on Structure and Properties of Commercial Polymers, various laboratories have carried out measurements. Their results and observations are summarised in this paper. In this family of materials, the microstructure should be described by at least three parameters, namely fiber orientation distribution, fiber length distribution and fiber content.

It is shown in this work that there is a profound influence of the processing history on the microstructure for these composite materials, and that there is a considerable challenge in measuring the macro-, meso and microstructural aspects.

Introduction

The materials under investigation in this study are injection moulding engineering plastics which have been prepared by pultrusion compounding. It is now well established that this family of materials can produce significantly longer fibers in the moulded artefact than by traditional extrusion compounded means. This margin may reach as much as an order of magnitude higher aspect ratio, but depends upon the fiber/matrix system and the manner in which subsequent processing takes place. An optimum number average l/D ratio for extru-

sion compounded (short) fiber composites would be 100 to 200, but in the case of pultrusion compounded (long) fiber compounds) can reach values in excess of 1000; this very much depends on the processing geometry, flow path and mould cavity design, and actual magnitudes of attainable fibers lengths are always relative to the severity of processing. In some cases, individual residual fibers of the original length (l_0) have been observed in long fiber moulded parts. The conventional injection moulding process is used with effectively similar conditions for both feedstock variants; this forming process offering a limited range of processing variables for altering the microstructure-properties relationship.

Producing components composed of longer fiber reinforced composites provides interesting new challenges for characterisation, and changes in fiber length and orientation are more pronounced. The influence of the flow path and shear history has a profound effect upon the resultant microstructure and hence the ultimate properties. The rheological characterisation of these materials with an insight into the flow induced morphological changes is described elsewhere.

In moulded panel components, the extent of in-plane anisotropy arising from the injection moulding process can be moderated by the methods reported by Allan and Bevis, In their novel process development, once the melt is injected into the mould in the normal way, it is pulsed in order to align polymer chains and fibers by shearing the fluid material remaining in the mould cavity by actuating pistons, typically these operate in the direction of mould-fill. Their process is known as the multiple live-feed process.

The microstructure of injection mouldings is extremely complex. It is challenging to attempt to characterise the fiber and molecular orientation of both conventional and multiple live-feed injection moulded samples. It is often convenient to visualise the microstructures attained by the simple model of through thickness skin/core/skin layers, and for this study it was our intention to produce some variations by influencing the flow and hence the processing conditions which dictate the resultant 'structure'. If a wide range of moulding conditions are used, and the resultant moulded parts are truly 'structures' then there is an implication that each structure requires experimental characterisation of its morphology before any description of the overall mechanical properties and the material properties is possible.

In order to gain this understanding, a move towards a quantitative microstructural characterisation is necessary. This paper is part of a series from the work carried out by IUPAC Working Party IV.2.1 and focuses on the microstructural issues observed by the contributors. In principle, this involves a measurement of fiber length distribution, fiber content and the fiber orientation function.

In exploring the relationship property-structure-processing and rheology we intend to conduct the work with both traditional and multiple live-feed mouldings. Moreover, the materials will have two different fiber systems (glass and carbon, Kevlar® is omitted) and two different matrix materials (polyamide 6,6 and polypropylene). This paper forms part of a series concerned with these materials which describes the mechanical properties, processing routes and flow characteristics of this family of materials. Moreover, the microstructural data in this study is used to model the stiffness in Paper V which follows on in this series of papers.

The following laboratories have contributed to this project under the umbrella of an 'AC working party (Working Party IV.2.1) and this hopefully adds value to the contribution of this work:

Laboratory 1 ICI Materials (D.R. Moore, R.S. Bailey, G. v Bradsky, R.S. Prediger). Laboratory 2 Shell Research Arnhern, (A. Cervenka).
Laboratory 3 Rhone-Poulene, (Y. Giraud).
Laboratory 4 Huls AG, (H. Motz).
Laboratory 5 National Research Council Canada, (T. Vu-Khanli).
Laboratory 6 Brunel University, (M.J. Bevis, P.S. Allan).
Laboratory 7 BP Chemicals, (M.J. Cawood, A. Gray, with contributions from the A. Duckett at the IRC, Leeds University).
Laboratory 8 Institut für Technische und Makromoleclare Chemie, Hamburg (H.G. Zachmann, G. v Krosigk).

This report was prepared for publication by: G.J. von Bradsky, R.S. Bailey[1], A.J. Cervenka, H.G. Zachmann and P.S. Allan ([1]ICI Technology, PO Box 90, Wilton, Middlesbrough, Cleveland TS90 8JE, UK), for the Working Party on Structure and Properties of Commercial Polymers, of the Commission on Polymer Characterisation and Properties, Macromolecular Division. The full details are to be found in Pure Appl. Chem. *1997,* ***69****, 2523–2539.*

Characterisation of finite length composites: Part VI—Rheological studies of materials based on the polypropylene matrix (Technical Report)

Synopsis: A range of rheological and morphological techniques, contributed by nine laboratories, are used to characterise the flow behaviour in a model long fiber reinforced thermoplastic system. It is concluded that in capillary rheometry, the pressure drop fluctuations that typify the flow arise from two mechanisms, that of local fiber fraction inhomogeneity passing through the die,

and the instability of the vortices in the die entry region which w6rsen as shear rate is increased. It is clear that the test geometry is significant in both capillary and torsional measurements. Yield stresses of 3.5 Pa (5 mm fiber length) and 7 Pa (10 mm fibres) have been evaluated.

Introduction

The materials under study are commercially available as pultrusion compounded injection moulding compounds and are known as long fiber reinforced thermoplastics. These materials offer an increased precursor fiber length over their conventional extrusion compounded counterparts. The granular feedstock for these materials is highly anisotropic with bundles of fibres aligned along the granule axis. After flow through nozzle, runner and gates in an injection moulding machine, the fibres become more uniformly dispersed in the mould cavity. The fibres are oriented more randomly in the moulded part, to the extent that controlled pyrolysis of the matrix polymer in a component may leave the shape retained by the residual fiber skeleton intact. The rheology in the mould cavity, therefore, differs from that of the feedstock. Some aspects of the rheology of this class of mouldable thermoplastic fiber composite have been reported by Gibson, and Gibson, Corscadden & McClelland using an instrumented moulding machine nozzle; fiber bundles are still observed in polymer taken from the nozzle region in spite of the preshearing history. It is now a requirement for materials selection that an understanding of both high shear rate and in-cavity rheology is established for design practices. This places a requirement for at least a reproducible flow curve to be available, which can be fitted by a simple curve fit for injection mould filling simulation software.

Converging flow in the entry into a die or gate is expected to be particularly important with high Trouton ratios of about 100 reported for a long fiber moulding compound by Gibson, and Gibson & Williamson. For long glass fiber in a nylon matrix Gibson has shown that the entry pressure drop through a moulding machine nozzle has a minimum at less than an included angle of 40°. This appears to be most pronounced at high flow rates, with the pressure drop almost independent of entry angle at lower flow rates. Corscadden has reported an increase in entry pressure drop with entry angle between 60° and 140° for long glass fiber in polypropylene using a ram extruder, with a maximum at about 120°, and with a minimum at less than 40° using an injection moulding rheometer at 5000 s^{-1} shear rate. Some effect of the die diameter has been found with dough moulding compound (DMC) materials, but the effect of convergence ratio from the feed barrel diameter is unknown. All reported data are in a mixed shear and stretching flow regime at high shear rates. These observations relate to an imposed die taper entry configuration and this may differ from the natural die entry angle which the material follows in a 180° entry angle.

The extreme anisotropy of the feedstock provides the opportunity to measure along the fiber and transverse components in a defined geometry of flow such as a parallel plate rotational rheometer. With both steady shear and dynamic modes available, this provides a more fundamental characterisation and may allow rules for combining various sources of data for this type of material to be explored.

Since these compounds are used exclusively for injection moulding of engineering components, the type of flow which is characterised in this study is likely to be afflicted with pressure fluctuations and granule memory effects on a level which will not be as dramatic in commercial operations when the material will be plasticised on melting.

In commercial applications, materials are employed with a fiber loading (in weight %) from 30 to 60%. The fiber characteristics always dominate the mechanical properties. The influence of processing techniques and microstructure on the mechanical properties are addressed in the parallel study of this working party. The microstructural characterisation of these materials has been addressed for this family of materials for fiber length, orientation and dispersion by previous workers, however there has been little investigation into the passage of these materials through convergent flow.

Fiber length attrition is reported to be brought about predominantly by the screw preplasticisation in the injection moulding machine. Secondary attrition processes do occur at high shear rates which are of less significance.

Fiber orientation and dispersion play a far greater role in the flow characterisation. There is no clear picture of the mechanisms of how these fiber composites pass through flow constrictions with minimal fiber attrition which is evident from the dramatic melt fracture which occurs on elastic recovery of the fibres during die exit.

The determination of fiber orientation for these has been approached by a number of workers using image analysis and image processing from polished sections taken through moulded components and flow channels. In a section through the composite, intersected fibres appear as ellipses which are light against a darker matrix background. These fields of view are converted into binary images by image processing. The orientation of the fibres can be determined from the angle of the major and minor axis of the ellipse relative to fixed reference axes in three dimensional space. It is customary to set the predominant flow direction as the X-axis in simple geometries. In mould filling studies, in a rigid fiber system, the fibres tend to be aligned by shear forces on

entering a die and misaligned (relative to the flow direction) upon divergence. This gives rise to the classical 'fountain flow' mechanism, associated with the advancing flow front in mould cavities.

The active participants in this collaboration are identified in the text as follows:

Laboratory

1. BASF Aktiengesefischaft, LudwigsWen, Germany.
2. Solvay Central Lab., Bruxelles, Belgium.
3. ICI Materials, Wilton, UK.
4. Shell Chemical Research Centre, Louvain-la-Neuve, Belgium.
5. DuPont de Nemours & Co., Engineering Technical Lab, Wilmington, USA.
6. Hoechst Celanese, Summit, USA.
7. Technical University of Denmark, Lyngby, Denmark.
8. National Research Council Canada, Quebec, Canada.
9. Hoechst AG, Kunststoff-Forschung, Frankfurt, Germany.
10. University of Karlsruhe, Germany.

This report was prepared for publication by: R.S. Bailey[1] and D.J. Groves ([1]ICI Technology, PO Box 90, Wilton, Middlesbrough, Cleveland TS90 8JE, UK), for the Working Party on Structure and Properties of Commercial Polymers, of the Commission on Polymer Characterisation and Properties, Macromolecular Division. The full details are to be found in Pure Appl. Chem. *1997,* ***69****, 2541–2565.*

Studies on biodegradable poly(hexano-6-lactone) fibers 1. Structure and properties of drawn poly(hexano-6-lactone) fibers (Technical Report)

Synopsis: Using high molecular weight (M_n = 80 000) Poly(hexano-6-lactone) (PCL*), tough and high tenacity PCL monofilaments with various draw ratios (undrawn to 9 times drawn) were prepared by melt-spinning. The relationship between microstructure and properties of the PCL fibers is described in this current IUPAC Technical Report. Analysis of microstructure of the drawn PCL fibers by wide-angle X-ray diffraction revealed typical c-axis orientation with an increase in crystallinity. It was also supported by sonic velocity measurements. The thermal, mechanical, and dynamic mechanical properties of the PCL fibers were affected significantly by draw ratio. DSC thermograms showed that the melting temperature and the enthalpy of fusion increased with draw ratio. The temperature dependence curves of dynamic viscoelasticity showed that the temperature at *tan* δ peak of α dispersion corresponding to the glass transition temperature shifted toward higher temperature and the peak value of *tan* δ decreased with draw ratio. The dynamic storage modulus and the sonic modulus increased with draw ratio. These results are due to the increase in crystallinity and molecular orientation with drawing, and are responsible for an increase in tensile tenacity as well as knot tenacity of the PCL fibers.

The name 'ε-caprolactone' is commonly used rather than the IUPAC nomenclature 'hexano-6-lactone'; hence the abbreviation PCL, based on the former, is used throughout this Technical Report.

This report was prepared for publication by: Masatsugu Mochizuki[1], Kazuo Nakayama[2], Renyuan Qian[3], Bing-Zheng Jiang[4], Matsuo Hirami[1], Toshio Hayashi[5], Toshiro Masuda[6] and Akio Nakarnia[7] ([1]Research and Development Center, Unitika Ltd., 23, Uji-Kozakura, Uji, Kyoto 611, Japan; [2]National Institute of Materials and Chemical Research, Tsukuba, Ibaraki 305, Japan; [3]Institute of Chemistry, Academia Sinica, Beijing 100080, China; [4]Changchun Institute of Applied Chemistry, Acadernia Sinica, Changchun, Jifin, China; [5]Research Institute for Advanced Science and Technology, Osaka Prefecture University, Sakai, Osaka 593, Japan; [6]Department of Material Chemistry, Kyoto University, Yoshida, Sakyou-ku, Kyoto 606-01, Japan; [7]4-1-5 Midoridai, Kawanishi, Hyogo 666-01, Japan) for the Working Party on Structure and Properties of Commercial Polymers, of the Commission on Polymer Characterisation and Properties, Macromolecular Division. The full details are to be found in Pure Appl. Chem. *1997,* ***69****, 2567–2575.*

Properties and units in the clinical laboratory sciences: Part III. Elements (of properties) and their code values (Technical Report) (IUPAC–IFCC 1997)

Synopsis: We have prepared a coding scheme for the elements (concepts) in the subject field 'clinical laboratory sciences'. The scheme uses code values taken from international coding schemes that provide code values for the elements in the various subspecialties which are represented in the subject field. The coding scheme for elements is accessible on Internet from the C-NPU Home page address: http://inet.uni-c.dk/home/ifcc_iupac_enpu

Preface

The present document is the third part of a series on properties observed in the clinical laboratory sciences initiated in 1987.

The series will comprise the five general parts (I–IV and XI) and a series of special parts:

I Syntax and semantic rules

II Kinds-of-property
III Elements (of properties) and their code values
IV Properties and their code values
V Properties and units in Thrombosis and Haemostasis
VI Properties and units in IOC prohibited Drugs
VII Properties and units in Inborn Errors of Metabolism
VIII Properties and units in Clinical Bacteriology
IX Properties and units in Trace elements
X Properties and units in General Clinical Chemistry
XI Coding systems—structure and guidelines
XII Properties and units in Clinical Pharmacology and Toxicology
XIII Properties and units in Reproduction and Fertility
XV WWW databases
XVI Properties and units in Clinical Allergology

The size and complexity of part III, IV and XV is such that they will be presented in electronic format. The overall aim is access by electronic media of: 'Compendium of terminology and nomenclature of properties in clinical laboratory sciences'. 'Glossary of terms in quantities and units in clinical chemistry'. 'Properties and units in the clinical laboratory sciences'.

Definitions

code value: result of Applying a coding scheme to an element in a coded set.

coding scheme: collection of rules that maps the elements of one set on to the elements of a second set.

international coding scheme identifier, ISCI: identifier assigned to uniquely identify a registered coding scheme for use in information interchange.

Subject field: section of human knowledge, the borderlines of which are defined from a purpose-related point of view.

NOTE—In terminology science and its practical applications, the subject field is determined through the establishment of systems of concepts.

Term list: collection of terms to be subjected to further terminology work.

Introduction

Authoritative coding schemes in the health care domain are much needed for the electronic exchange of information on assays across language and cultural barriers.

In the clinical laboratory sciences there is a tradition for systematic expression of laboratory examination and the number of examinations performed is considerable, that is 5 to 10 per inhabitant per year.

To facilitate data exchange, a coding scheme for terms indicating properties has been prepared (part IV of this series). The elements (words, concepts, building blocks) of these terms for properties are listed as a term list in the present document in the form of a coding scheme comprising:

1. An international coding scheme identifier, and a code value representing a concept.
2. The linguistic expression of the concept in English and in some other language.

The listings are given both in code value order and in alphabetic order. The size of the listings is considerable, and they are therefore accessible on Internet only. This also facilitates updating.

This report was prepared for publication by: I. Bruunshuus[1], Wilhelm Frederiksen[2], H. Olesen[1] and I. Ibsen[1] ([1]Dept. of Clinical Pharmacology Q 76.4.2, Copenhagen University Hospital (Rigshospitalet), Copenhagen, Denmark; [2]Dept. of Clinical Microbiology, Statens Serum Institute, Copenhagen, Denmark. Please forward comments to: *H. Olesen, Dept. Clin. Pharmacol. Q 76.4.2, Copenhagen University Hospital (Rigshospitalet), 20 Tagensvej, DK-2200 Copenhagen, Denmark. Fax: +45 35 45 27 45; email: qukb7642@inet.uni-c.dk or iibsen@rh.dk), for the Commission on Nomenclature, Properties and Units (C-NPU), Clinical Chemistry Section, Chemistry and Human Health Division (Technical Report), and the Committee of Nomenclature, Properties and Units (C-NPU), Scientific Division, from the International Federation of Clinical Chemistry (Recommendation 1997). The full details are to be found in* Pure Appl. Chem. *1997, **69**, 2577–2582.*

Properties and units in the clinical laboratory sciences: Part IV. Properties and their code values (Technical Report) (IUPAC–IFCC 1997)

Synopsis: To facilitate and to assure correct electronic transmission of request and report on clinical laboratory properties over cultural and linguistic barriers, a systematic nomenclature has been prepared for a series of laboratory specialities.

Each defined property has been given a unique code value preceded by the coding scheme identifier: NPU.

The NPU code value and its adhering code value string for each term allow expression of the concept according to local script, idiom or conventions.

The coding scheme is accessible on Internet from C-NPU Home page address http://inet.uni-c.dk/home/ifcc_iupac_cnpu.

Scope

The coding scheme prepared is intended as a repository of code values and terms of properties to be used in the transfer of information on such properties through

computing and telecommunication equipment used in the health services.

Preface

The document is the fourth part of a series on properties measured in the clinical laboratory sciences initiated in 1987.

The series will comprise the five general parts (I–IV and XI) and a series of special parts:

I Syntax and semantic rules
II Kinds-of-property
III Elements (of properties) and their code values
IV Properties and their code values
V Properties and units in Thrombosis and Haemostasis
VI Properties and units in IOC prohibited Drugs
VII Properties and units in Inborn Errors of Metabolism
VIII Properties and units in Clinical Bacteriology
IX Properties and units in Trace elements
X Properties and units in General Clinical Chemistry
XI Coding systems—Structure and guidelines
XII Properties and units in Clinical Pharmacology and Toxicology
XIII Properties and units in Reproduction and Fertility
XV WWW databases
XVI Properties and units in Clinical Allergology

The size and complexity of part III and IV is such that their lists will be presented in electronic format only.

The overall aim is access by electronic media of:

'Compendium of terminology and nomenclature of properties in clinical laboratory sciences'.

'Glossary of terms in quantities and units in clinical chemistry'.

'Properties and units in the clinical laboratory sciences' (the present series of documents).

Introduction

The variety of properties observed in the domain of the Clinical Laboratory Sciences is well over 5000. The number of properties observed is 5 to 10 per inhabitant per year in industrialised countries.

An increasing part of the billions of requests and reports is transmitted by electronic means, mostly by code values from a local coding scheme.

The expression of the meaning of a code value is according to local habit, rules and conventions. This often is not readily transformed to coded sets from other coding schemes.

To facilitate inter region electronic communication, the European standard ENV 1614:1995 has presented a system of concepts based on for a systematic nomenclature to function as a bridge between local dialects.

Based on this system of concepts and on the European standard ENV 12435:1996, that deals with the presentation of results, terms have been elaborated and codified for communication between clinical laboratory information systems and other health information systems.

A basic document for further description and clarification is 'Compendium of terminology and nomenclature of properties in the clinical laboratory sciences', while details of the syntax and semantic rules are given in.

This report was prepared for publication by: H. Olesen[1], D. Kenny[2], I. Bruunshuus[1], I. Ibsen[1], K. Jorgensen[3], R. Dybkaer[4], X. Fuentes-Arderiu[5], G. Hill[6], P. Soares De Araujo[7] and C. McDonald[8] ([1]Dept. of Clinical Pharmacology Q 76.4.2, Copenhagen University Hospital (Rigshospitalet), Copenhagen, Denmark; [2]Dept. of Clinical Biochemistry, Our Lady's Hospital for Sick Children, Dublin 12, Ireland; [3]Retired. Formerly Dept. of Clinical Biochemistry KB 3.01.1, Copenhagen University Hospital (Rigshospitalet), Copenhagen, Denmark; [4]Dept. of Standardisation in Laboratory Medicine, Kommunehospitalet Copenhagen, Denmark; [5]Dept. of Clinical Biochemistry, Ciutat Sanitària i Universitària de Bellvitge, Barcelona, Spain; [6]Dept. of Clinical Chemistry, Hospital for Sick Children, Toronto, Canada; [7]Dept. of Biochemistry, IQUSP, São Paulo, Brazil; [8]Regenstrief Inst. for Health Care, Indiana University School of Med., Indianapolis, Indiana, USA. Please forward comments to: *H. Olesen, Dept. Clin. Pharmacol. Q 76.4.2, Copenhagen University Hospital (Rigshospitalet), 20 Tagensvej, DK-2200 Copenhagen, Denmark. Fax: +45 35 45 27 45; e-mail: qukb7642@inet.uni-c.dk or iibsen@rh.dk.)* *for the Commission on Nomenclature, Properties and Units (C-NPU), Clinical Chemistry Section of the Chemistry and Human Health Division, (Technical Report 1997), and the Committee of Nomenclature, Properties and Units (C-NPU), Scientific Division, from the International Federation of Clinical Chemistry (Recommendation 1997).* *The full details are to be found in* Pure Appl. Chem. *1997, **69**, 2583–2591.*

Properties and units in the clinical laboratory sciences: Part IX. Properties and units in trace elements (Technical Report) (IUPAC–IFCC 1997)

Synopsis: This document is the first Technical report-recommendation on the presentation of trace elements and their values in clinical laboratory sciences from International Federation of Clinical Chemistry and International Union of Pure and Applied Chemistry. It forms part of the ongoing effort to standardise requests and reporting of laboratory data for transmission across cultural and linguistic domains, without attempting to standardise the routine language used by clinicians and laboratory practitioners.

Other documents deal with syntax, kinds-of-property,

and properties and units used in other areas of clinical laboratory sciences.

The document is accessible on Internet from C-NPU Home page address: http://inet.uni-c.dk/home/ifcc_iupac_cnpu/

Preface

This document is the result of cooperation between the Commission on Toxicology of the International Union of Pure and Applied Chemistry (IUPAC) and the Committee/Commission on Nomenclature. Properties and Units of the International Federation of Clinical Chemistry (IFCC) and IUPAC.

The document is the ninth part (IX) of a series on properties examined in the clinical laboratory sciences, initiated in 1987.

The series will comprise:

I Syntax and semantic rules
II Kinds-of-property
III Elements (of properties) and their code values
IV Properties and their code values
V Properties and units in Thrombosis and Haemostasis
VI Properties and units in IOC prohibited Drugs
VII Properties and units in Inborn Errors of Metabolism
VIII Properties and units in Clinical Bacteriology
IX Properties and units in Trace elements
X Properties and units in General Clinical Chemistry
XI Coding systems—structure and guidelines
XII Properties and units in Clinical Pharmacology and Toxicology
XIII Properties and units in Reproduction and Fertility
XV WWW databases
XVI Properties and units in Clinical Allergology

Foreword and scope

Basic research in biology and medicine and innovations in laboratory methodology have greatly increased the range of properties available to medical practitioners to help them in decisions on diagnosis, treatment and prevention of disease.

The plethora is now such that the individual physician has insight in or understanding of only a limited number of properties offered to him from the various clinical laboratory specialities.

In the laboratory, local terms (jargon) may be well understood among colleagues, but they are not appropriate for communication with the outside world. Likewise, a laboratory and its local community of users, such as hospital or community physicians, may use a 'local dialect' of the language of clinical laboratory sciences which is well understood by all concerned, but when the communication possibilities are wider, even transnational, risks of serious misunderstanding arise.

In addition, the terminology used by one laboratory speciality may vary even within the speciality, and may be incomprehensible to another speciality. This is a minor inconvenience to the laboratory specialities, each one essentially operating within its own area of activity. However, for the user this is highly unsatisfactory and also may hinder treatment of the patient.

It is therefore essential to promote clear, unambiguous, meaningful and fully informative communication. Also, coherence of statements made within and between medical specialities, and uniformity in structure of presentation are to be striven for. This will facilitate transfer of information across cultural, alphabetic and language areas.

The purpose of this document is to Apply the IUPAC–IFCC recommended syntax structures for request and report, providing formats and terms of properties examined in the domain of Trace Elements, in order to facilitate unequivocal written or electronic communication between health care professionals.

The list of properties shown in this document is not exhaustive; it is a collection of realistic examples.

This report was prepared for publication by: R. Cornelis[1], X. Fuentes-Arderju[2], I. Bruunshuus[3] and D. Templeton[4] ([1]Laboratory of Analytical Chemistry, Institute for Nuclear Sciences, Universiteit Gent, Gent, Belgium; [2]Department of Clinical Biochemistry, Ciutat Sanitària i Universitària de Bellvitge, L'hospitalet de Llobregat, Barcelona, Spain; [3]Department of Clinical Pharmacology Q 7642, National University Hospital (Rigshospitalet), Copenhagen, Denmark; [4]Department of Clinical Biochemistry, Banting Institute, Faculty of Medicine, University of Toronto, Canada; Please forward comments to: *R. Cornelis, Laboratory for Analytical Chen-fistry, Instituut Nucleaire Wetenschappen, Universiteit Gent, Proeftuinstraat 86, B-9000 Gent, Belgium. Fax: +32 9 264 66 99; email: rita.cornelis@rug.ac.be), for the Commission on Nomenclature, Properties and Units (C-NPU), Commission on Toxicology (C-TOX) of the Clinical Chemistry Division (Technical Report 1997), and the Committee of Nomenclature, Properties and Units (C-NPU), Scientific Division, from the International Federation of Clinical Chemistry (Recommendation 1997). The full details are to be found in* Pure Appl. Chem. *1997, **69**, 2593–2606.*

Properties and units in the clinical laboratory sciences: Part XI. Coding systems—structure and guidelines (Technical Report) (IUPAC–IFCC 1997)

Synopsis: In ENV1614:1995 the system of concepts for properties in the clinical laboratory sciences has been elaborated and in part 1 of this series the syntax and semantic rules are presented.

The present document deals with the procedures for assembling the elements of a term for a property into a string of code values representing the intensional definition of a property. This is done by use of semantic links that ensure the correct localisation of the elements according to the syntax rules.

Further some special features needed as extensions to the general structure are presented.

Preface

The present document is the eleventh part (XI) of a series on properties examined in the clinical laboratory sciences, initiated in 1987.

The series will comprise the five general parts (I–IV and XI) and a series of special parts (in various stages of appearance in various media):

I Syntax and semantic rules
II Kinds-of-property
III Elements (of properties) and their code values
IV Properties and their code values
V Properties and units in Thrombosis and Haemostasis
VI Properties and units in IOC prohibited drugs
VII Properties and units in Inborn Errors of Metabolism
VIII Properties and units in Clinical Bacteriology
IX Properties and units in Trace Elements
X Properties and units in General Clinical Chemistry
XI Coding systems—structure and guidelines (*this document*)
XII Properties and units in Clinical Pharmacology and Toxicology
XIII Properties and units in Reproduction and Fertility
XV WWW databases
XVI Properties and units in Clinical Allergology

The size and complexity of part III, IV and XV are such that their lists will be presented in electronic format only. The overall aim is access by electronic media of: 'Compendium of terminology and nomenclature of properties in clinical laboratory sciences'. 'Glossary of terms in quantities and units in clinical chemistry'. 'Properties and units in the clinical laboratory sciences'.

Foreword and scope

The hardware and software facilities for electronic storage, transfer and handling of data are such that multipurpose databases can be made accessible at low cost without geographic restriction. The versatile and flexible underlying structures allow for ease of access and retrieval of data and gives presentation formats fully comparable to printed counterparts. Because of ease of use and because of the wider distribution of the information, misinterpretation is more likely to occur than in oral or written presentation for more restricted and culturally more homogeneous audiences. This necessitates some harmonisation/standardisation of data on transfer, while allowing local expression forms at sender and receiver ends. This in particular applies when specific concepts are to be expressed in different languages and different scripts.

This document is part of an ongoing international effort to agree on some sort of 'standardisation' of the transmission of 'laboratory results'. It centres on the description of two coding schemes developed for that purpose and gives guidelines and rules for their use.

The two coding schemes pertain to:

1. Coding scheme 1: code values for elements (of properties)
2. Coding scheme 2: code values for properties and their units

Introduction

In the clinical laboratory sciences, much effort has been given to the presentation of the outcome of analytibil efforts. Thus a report from a laboratory may be presented as an equation:

Property = Result

The general rules for the left side of this equation are given in ENV1614:1995 and for the right side in ENV12435:1996.

Further details on formats for request and report are dealt with in the documents on syntax and semantic rules, and kinds-of-property and an extensive survey is in 'Compendium of terminology and nomenclature of properties in clinical laboratory sciences'.

These recommendations, standards and conventions as listed have been followed systematically in the coding schemes developed.

Although the formats apply to the majority of properties examined, some extensions and special features are needed in the daily routine application.

In the following a description of the coding schemes for properties and their elements are presented, with emphasis on special features, as are some guidelines for their use.

This report was prepared for publication by: H. Olesen[1], D. Kenny[2], R. Dybkær[3], I. Ibsen[1], I. Bruunshuus[1], X. Fuentes-Arderiu[4], G. Hill[5], P. Soares De Araujo[6] and C. Mcdonald[7] ([1]Dept. of Clinical Pharmacology Q 76.4.2, Copenhagen University Hospital (Rigshospitalet), Copenhagen, Denmark; [2]Dept. of Clinical Biochemistry, Our Lady's Hospital for Sick Children, Dublin 12, Ireland; [3]Dept. of Standardisation in Laboratory Medicine, Kommunehospitalet Copenhagen, Denmark; [4]Dept. of Clinical Biochemistry, Ciutat Sanitària i Universitaria de Bellvitge, Barcelona, Spain; [5]Dept. of Clinical Chemistry, Hospital for Sick Children, Toronto, Canada; [6]Dept. of Biochemistry, IQUSP, São Paulo, Brazil; [7]Regenstnef Inst. for Health Care, Indiana University School of Med.,

Indianapolis, Indiana, USA. Please forward comments to: *H. Olesen, Dept. Clin. Pharmacol. Q 76.4.2, Copenhagen University Hospital (Rigshospitalet), 20 Tagensvej, DK-2200 Copenhagen, Denmark. Fax: +45 35 45 27 45; email: ifcc-iupac-cnpu@inet.uni-e.dk or iibsen@rh.dk), for the Commission on Nomenclature, Properties and Units (C-NPU), Clinical Chemistry Section, of the Chemistry and Human Health Division (Technical Report 1997), and the Committee of Nomenclature, Properties and Units (C-NPU), Scientific Division, from the International Federation of Clinical Chemistry (Recommendation 1997). The full details are to be found in* Pure Appl. Chem. *1997, **69**, 2607–2620.*

Properties and units in the clinical laboratory sciences: Part XIII. Properties and units in reproduction and fertility (Technical Report) (IUPAC–IFCC 1997)

Synopsis: This document is the first technical report—recommendation on the presentation of properties in reproduction and fertility and their values in clinical laboratory sciences from The International Society of Andrology, International Federation of Clinical Chemistry and International Union of Pure and Applied Chemistry. It forms part of the ongoing effort to standardise requests and reporting of laboratory data for transmission across cultural and linguistic domains, without attempting to standardise the routine language used by clinicians and laboratory practitioners.

The document is accessible on Internet from C-NPU Home page address: http://inet.uni-c.dk/home/ifcc_iupac_cnpu

Preface

This document is the result of cooperation between the International Society of Andrology and the Committee/Commission on Nomenclature, Properties and Units of the International Federation of Clinical Chemistry (IFCC) and the International Union of Pure and Applied Chemistry (IUPAC).

The present document is the thirteenth part (XIII) of a series on properties observed in the clinical laboratory sciences, initiated in 1987.

The series will comprise the five general parts (I–IV and Xl) and a series of special parts:

I Syntax and semantic rules
II Kinds-of-property
III Elements (of properties) and their code values
IV Properties and their code values
V Properties and units in Thrombosis and Haemostasis
VI Properties and units in IOC prohibited Drugs
VII Properties and units in Inborn Errors of Metabolism
VIII Properties and units in Clinical Bacteriology
IX Properties and units in Trace Elements
X Properties and units in General Clinical Chemistry
XI Coding systems—structure and guidelines
XII Properties and units in Clinical Pharmacology and Toxicology
XIII Properties and units in Reproduction and Fertility
XV WWW databases
XVI Properties and units in Clinical Allergology

Foreword and scope

Basic research in biology and medicine and innovations in laboratory methodology have greatly increased the range of properties available to medical practitioners to help them in decisions on diagnosis, treatment and prevention of disease.

The plethora is now such that the individual doctor has insight in or understanding of only a limited number of properties offered to him from the various clinical laboratory specialities.

In the laboratory, local terms (jargon) may be well understood among colleagues, but they are not appropriate for communication with the outside world. Likewise, a laboratory and its local community of users, such as hospital or community physicians, may use a 'local dialect' of the language of clinical laboratory sciences which is well understood by all concerned, but when the communication possibilities are wider, even transnational, risks of serious misunderstanding arise.

In addition, the terminology used by one laboratory speciality may vary even within the speciality, and may be incomprehensible to another speciality. This is a minor inconvenience to the laboratory specialities, each one essentially operating within its own area of activity. However, for the user this is highly unsatisfactory and also it may hinder treatment of the patient.

It is therefore essential to promote clear, unambiguous, meaningful and fully informative communication. Also coherence of statements made within and between medical specialities, and uniformity in structure of presentation is to be strived for. This will facilitate transfer of information over cultural, alphabetic and language areas.

The purpose of this document is to apply the IUPAC–IFCC recommended syntax structures for request and report, providing formats and names of properties observed in the domain of Reproduction and Fertility, in order to facilitate unequivocal written or electronic communication between health care professionals.

The list of properties shown in this document is not exhaustive.

The main background document is the WHO laboratory manual for the examination of human semen and sperm-cervical mucus interaction.

This report was prepared for publication by: H. Olesen[1], A. Giwercman[2], D. M. de Kretser[3], D. Mortimer[4], H. Oshima[5] and P. Troen[6] ([1]Department of Clinical Pharmacology Q 7642, Copenhagen University Hospital (Rigshospitalet), Copenhagen, Denmark [2]Department of Growth and Reproduction JMC 5064, Copenhagen University Hospital (Rigshospitalet), Copenhagen, Denmark; [3]Institute of Reproduction and Development, Clayton, Victoria, Australia; [4]Sydney Andrology, Sydney WF, Sydney, Australia; [5]Department of Urology, Tokyo Medical and Dental University, Tokyo, Japan; [6]University of Pittsburgh Medical Center, Pittsburgh, USA.

Please forward comments to: *H. Olesen, Dept. Clin. Pharmacol. Q 76.4.2, Copenhagen University Hospital. Tagensvej 20, DK-2200 Copenhagen, Denmark),* *for the Commission on Nomenclature, Properties and Units (C-NPU), Clinical Chemistry Section, of the Chemistry and Human Health Division (Technical Report 1997), the International Society of Andrology (Recommendation 1997) and the Committee of Nomenclature, Properties and Units (C-NPU), Scientific Division, from the International Federation of Clinical Chemistry (Recommendation 1997). The full details are to be found in* Pure Appl. Chem. *1997,* ***69****, 2621–2638.*

News

Committee on Science and Technology in Developing Countries (COSTED)

The following are extracts from the minutes of the 25th COSTED Executive Committee meeting, Irbid-Amman, Jordan, 25–27 February 1997.

Chairman's opening remarks

The Chairman greeted the host country dignitaries and acknowledged the generous support by Yarmouk University in hosting the meetings and facilitating the preparations for the meeting. He recalled the warm opening remarks of Prof. Kamal and congratulated Dr Owais for the excellent arrangements. He placed on record deep appreciation for the services of the outgoing members of the Executive Committee, Prof. M.G.K. Menon, Prof. R.R. Daniel, Prof. R.D. Keynes, Dr D.A. Bekoe, Dr D. Ouazar, Dr I. Head, Dr H. Leutner, Dr D. Norse and Dr T. Freyvogel. He welcomed the attending new EXCOM members, Prof. M. Addy, Dr E.M. Krieger, Dr D.M. Polter, Dr Alain Ruellan. He noted that Prof. K. Gulamov, Dr Su Jilan, O. Kitani, Prof. C.N.R. Rao and Mr V. Zharov expressed regret at their inability to participate. The Chairman also thanked ICSU for continued support, co-operation and the opportunity provided for a COSTED presentation at the 25th ICSU General Assembly. The co-sponsorship and sustained support of UNESCO was graterully acknowledged. The contribution and continuing support by the National Members of COSTED–IBN was also warmly acknowledged. The Chairman also underscored the challenging goals ror COSTED—exemplified by the extraordinary range of themes on the agenda—and urged everyone to combine vision and pragmatism in the work.

Scientific secretary's report

A substantive report was made by the Scientific Secretary consisting of two parts, (i) a formal report on the activities of the Central Secretariat during 1996 and (ii) proposals on future need based activities in three broad areas, (a) Capacity Building in Science, (b) Technology Management and (c) Intellectual Property Rights. The report was very well received. The ensuing discussions endorsed the proposed activities as highly relevant. The committee recognised that technology management and IPR are highly important and relevant to the COSTED mandate. These areas have not been adequately addressed in developing countries nor have they been publicised at the national level. It was noted that COSTED–IBN has had a successful history of co-operation in basic sciences and it is timely to include technology aspects in its programmes. In view of the heterogeneous nature of developing countries, priorities in technology development and R&D need to be carefully identified as well as factors influencing co-operation in technology development. In summary, the committee was highly supportive of the new initiative to strengthen the T in COSTED as R&D in technology is perceived to contribute not merely to economic growth but to ensure sustainable economic growth. The Scientific Secretary proposed an activity for a capacity building programme in technology management in co-operation with the United States International University, San Deigo. The proposal was warmly received. It was recommended that the programme begin at the Asian level and be extended as rapidly as resources permit to other regions.

Agenda item 11.7—regional secretaries' reports

The following presentations were made on the regional COSTED–IBN activities.

COSTED Western and Central Africa	Dr Addy
COSTED Asia	Ravichandran for Thyagarajan
COSTED–IBN Latin America	Prof. Allende
COSTED–IBN Arab Region	Dr Owais
African Biosciences Networks	Dr Ba
COSTED–IBN Southern & Central Africa	Dr Mokhele
AONBS	Dr Tanticharoen

The committee congratulated the COSTED–IBN Latin American Region for presenting an excellent example in successful networking as well as external fund raising for the networks. In general, the committee recognised the increased vibrancy and outreach of COSTED–IBN activities and expressed optimistic views about the progress made so far. The reports also indicated the heterogenity of the different regions of the developing countries, the distinct nature of successful activities in each region and their integral benefits to COSTED–IBN as a whole. Dr Allende stressed the need for COSTED–IBN to transcend ICSU and UNESCO and truly represent the science and technology activities as perceived by the regions. Dr Owais highlighted the need for sensitisation of policy makers in the Arab region to be of primary importance and urgency. Dr Ba in presenting the ABN report made a case for soliciting additional funds to ensure greater effectiveness and success of the ABN activities which have been recently curtailed due to paucity of funds. Dr. Tanticharoen offered to host short-term training courses and split PhD Sandwich courses (less than 12 months) at the NCGEB, Bangkok and invited COSTED–IBN to take advantage of the same.

The report or the Arab Regional Co-ordinating Committee Meeting held at Yarmouk University just prior to the ExCom meeting will be circulated in due course.

Following are highlights of the report of the Planning Session for COSTED in Africa presented by Dr Mokhele.

- Strengthen existing networks
- Themes selected for networks should address research from basic, applied and incorporate commercialisation of research results
- Communication infrastructure essential for networks to function
- COSTED–IBN should better exploit capacity found in the broader ICSU and *vice versa*
- A number of themes for networks were suggested (e.g. remote sensing, structural engineering analysis)
- COSTED must project what *competitive advantages* as an ICSU committee it has to offer
- COSTED's role in Science and Society
- Strengthen COSTED Regional secretariats.

Plans for COSTED in Africa (1997–2000); wherever possible, specific goals will be set for each year and progress will be reported in terms of these benchmarks.

1 Expand Natural Products Research Co-operation in Africa (NAPRECA) in West Southern Africa
   - 3 countries in each region networked by the next EXCOM meeting

2 Expand Biological Nitrogen Fixation Network

3 Establish network of researchers in Remote Sensing in 3 years

4 Enhance activities of network on structural engineering analysis.

5 Expansion of COSTED National Membership: All current ICSU National Members in Africa should join COSTED by next EXCOM. A vigorous campaign should be mounted.

6 Increase in number of National Academies of Science (Mokhele/Hassan: TWAS General Conference in Rio, September 1997)

7 Co-ordination of the activities of COSTED–IBN Secretariats in Africa and between these and the Central COSTED office in Madras

8 Strengthen the capacity of the Secretariats to play efflective co-ordinating and facilitating role

At the end of the reporting session considerable discussion of the role, mission and philosophy of COSTED–IBN followed. Members expressed wide ranging views which included the need for a panoramic view of the organisation not influenced by regional insights. Recognising the diversity of the regional situations it was recommended that in future the Central Secretariat's report needs to present a collage of a central coherent programme without imposing uniformity on the specific actions in the regions. Members recognised that the uniqueness of COSTED–IBN was based on the fact that COSTED–IBN's link to ICSU is well structured and so is the regional outreach of COSTED–IBN in the developing countries. This is a distinct advantage in ensuring the effective fulfilment of the objectives with which the organisation was set up. COSTED–IBN is free to concentrate on applied sciences as found appropriate since the ICSU Unions focus to a great extent on basic sciences. The EXCOM urged COSTED-IBN to strengthen co-operation with the ICSU Unions and Committees and enhance its visibility so as to attract a greater role as an advisory body to the ICSU family in matters relating to science and technology for development. COSTED–IBN was requested to help increase ICSU membership in Africa and recommend the representation of new and young scientists from the developing regions to ICSU. Members desired that a report from COSTED-IBN feature on the agenda of the TWAS General Committee meeting in September 1997 as is being done in the United Nations meeting of the Commission

for Sustainable Development, in New York.

The idea that COSTED–IBN should strive to function as a match maker between activities and funds was warmly received by institutions. It was recommended that COSTED–IBN adopt a two-pronged approach: by fostering networks to strengthen scientific activities and by fostering partnerships to strengthen technical and industrial collaboration in developing countries. The need for information on the centres of excellence to facilitate training of scientists between the regions was stressed. It was proposed that the regional secretariats prepare a diagram of their structures which could he integrated by the Central Secretariat to present an overall structure of the organisation.

ISCU Assessment Report *vis-á-vis* COSTED–IBN

A suggestive input from Mme Julia Marton-Lefevre was discussed extensively. Views ranged from, preference for non-governmental new members, potential role of COSTED–IBN and ICSU to play a high level advisory role in influencing governments for greater support for science and technology, appropriateness of a review mechanism for ICSU and 'sunset' provision for programmes. The following consensus emerged regarding the Assessment Report.

1 ICSU should, as a priority help build the capacity of groups of scientists in the developing countries to form national academics or societies which could become National Scientific Members of ICSU. COSTED–IBN should be given the mandate, funds and assistance to undertake this on behalf of ICSU.

2 COSTED–IBN should contact present National Scientific Members of ICSU in developing countries and assist them to fulfill their roles as Members of ICSU better.

3 COSTED–IBN should organise high level meetings of scientists and policy makers, making the case—for the role of science in the development process and organise appropriate follow-up actions to this.

4 The ICSU Secretariat should be expanded to include a development officer from ICSU to help fund raising and membership drive.

5 The COSTED–IBN Regional Secretaries should be encouraged to set up regional scientific networks and link these to the appropriate International Scientific Unions and Committees.

New regional netwoks

Biodiversity networks

It was generally agreed that Biodiversity Networks in developing countries are extremely important. However, recognising that there are major global efforts already afoot in this area, COSTED–IBN should strive to

1 gather data on existing efforts in biodiversity in various regions to unearth local capacities and bottlenecks

2 identify the priorities and needs as perceived by the regions

3 facilitate the plugging in/hooking on of regional initiatives in biodiversity to important programmes like DIVERSITAS.

4 promote exchange of ideas and policy options for the South

Energy networks

The Committee endorsed in principle the proposal for an energy network proposed by the Scientific Research Council of Jamaica. It was noted that this was essentially an information exchange network. Mme Marton-Lefevre brought to the attention of EXCOM that ICSU has been anxious in the past few years to attempt a meaningful initiative in this area and she encouraged COSTED–IBN to explore this possibility. The Chairman asked the Scientific Secretary to examine the feasibility of an energy network for developing countries. Such networks in special programmatic areas could eventually be either expanded or disbanded as found appropriate.

CSC—COSTED–IBN collaboration: Project CREN

The proposal was presented by the Scientific Secretary who pointed out that COSTED–IBN collaboration in this initiative is solicited in view of CREN expanding beyond the Commonwealth Countries. The EXCOM approved the proposal in principle and members offered a number of suggestions for co-operation. These ranged from working in partnership with other ICSU bodies in this area, IUPAC/CHEMRAWN, IUGS (waste disposal) China CAST (Cleaner production) ISSS (training). The Scientific Secretary was requested to pursue COSTED–IBN collaboration with CREN in the light of the above suggestions.

Brain storming session on general issues

1. Concept of networking in COSTED–IBN

Stimulating discussions led to the following broad ideas on the concept of networking in COSTED–IBN.

Definition of Network: Organised manner of linking scientists, technologists and scientific and technical institutions and bodies in a continuous manner for a common objective.

Advantages:

- provides scope for the birth of new networks
- acts as a tool for access to information at national, regional and international levels.

- facilitates exchange of experience, research methodology and formulation of joint strategies for common problems.
- provides directionality for efforts based on collective expertise
- facilitates pooling of resources
- facilitates grass root level participation and contribution
- presents a collective voice and therefore a better credibility in fund raising and efflective implementation.

Disadvantages:
- local disparities may sometimes hinder networking
- success depends on the motivation, participation and response of the networking partners
- sustainance of the network depends on the correct identification of objectives and priorities and periodic review of the same

Action:
- Each regional secretariat to prepare a working draft on the regional experience in networking in all areas of science.
- The central secretariat to integrate the drafts and come up with a paper highlighting the successes and failures of the regional networks and the factors influencing them (e.g. political, financial, psychological, etc.)
- based on this study, the regional and central secretariats to formulate a strategy for a concerted action plan for regional networking in new areas under the COSTED umbrella.
- to address two important prerequisites for networking: (i) strengthening the secretariat through access to electronic communication, (ii) getting access to services and resources for dissemination.

2. The Mission of COSTED

It was unanimously felt that the objectives of COSTED–IBN as defined in the constitution are comprehensive and broad enough. The purpose of the brainstorming session was to arrive at a definition or action to operationalise these objectives. In this context, views expressed were strongly in favour of strengthening the linkages between S and T as well as between T and economic development. ICSU has upheld the voice for science all along. However, the ICSU assessment report considers applied areas of science and the development process to be of high priority in the future. Thus COSTED–IBN must take into account the emerging trends and priorities in global S&T. It was pointed out that COSTED–IBN will increasingly be called upon to play an advisory role on science for policy and policy for science and this should be amply reflected in the attempt to define the goals. Based on the above discussions. a draft of COSTED's key objectives prepared by Dr Allende was revised as follows:

1 to strengthen, organise and integrate the scientific communities of the developing regions of the world.

2 to stimulate and facilitate the participation of the scientists and scientific institutions of the developing countries in the activities of international science and technology.

3 to generate programmes and projects that increase the scientific and technological capacity of developing countries to address problems relevant to their cultural and socio-economic development and or international scope.

4 to provide advice on science and technology policies to governments and other concerned Institutions in the developing world.

New books

COSTED has announced the availability of the following books.

Concepts in biotechnology. Editors: D. Balasubramanian, C.F.A. Bryce, K. Dharmalingam, J. Green & Kunthala Jayararnan. Published by Universities Press (India) Limited 3-5-820, Hyderguda, Hyderabad 500 029, A.P. India. Distributed by Orient Longman Limited. Contact the nearest Orient Longiman Office or mail your order to Orient Longman Limited, 3-6-272 Himayatnagar, Hyderabad 500 029, A.P., Tel.: (040) 240294, 240305, 240306, 240391, fax: (040) 240393,
E-mail: info@orienth.globemail.com
ed.co@orientlongman.sprintrpg.ems.vsnl.net.in

This textbook is the outcome of a COSTED–IBN project on curriculum development in biotechnology for undergraduate study, especially for students in developing countries. It is designed to provide a strong base in this emerging, interdisciplinary area which holds great promise for economic development.

The early chapters review the structure and function of biological molecules and living cells, and the way in which cellular structure and function is controlled by the genetic makeup of the cell. The diverse technologies associated with the application of living systems in select areas—such as health care, agriculture, animal systems, bioprocess technologies—are then described. Finally, the impact of biotechnology on the environment, and ethical and social implications of this technology are discussed.
- A model textbook in Biotechnology for undergraduate and postgraduate students.
- Covers the fundamental principles and concepts which form the basis for the subject.
- Illustrates their applications in select areas such as

health care, agriculture, animal systems, bioprocess technologies and the environment.
- Provides an insight into the impact of biotechnology on international competition, trade, societies in developing countries, their economy, way of life and social structure.
- Numerous assignments and self assessment exercises designed to reinforce key concepts.
- Every chapter has a Further Reading List.
- The glossary of technical terms further enhances the usefulness of the book

Contents

The Editors

Prof. D. Balasubramanian, Director, Centre for Cellular and Molecular Biology, Hyderabad, India.

Prof. C.F.A. Bryce, Dean, Faculty of Science, and Head, Department of Biological Sciences, Napier University, Edinburgh, Scotland.

Prof. K. Dharmalingawn, Head and Coordinator, School of Biotechnobgy, Madurai Kamaraj University, Madurai, India.

Dr J. Green, School of Biolechnology, Napier University, Edinburgh, Scotland.

Prof. Kunthale Jayaranm, Head, Centre for Biotechnology, Anna University, Madras, India.

Regional Land Cover Changes Sustainable Agriculture and their Interactions with Global Change (with focus on South Asian countries). Editor Veena Ravichandran. Foreword: Dr Rodney Nichols, President and CEO of New York Academy of Science & Chairman, COSTED. 440 pp. Price: Rs450/US$13. Postage within India: Rs.33, outside India: US$4. Contact: COSTED International Secretariat, 24 Gandhi Mandapam Rd, Chennai-600025, India.

This book brings forth the Proceedings of the International Workshop held in Chennai, India, between 16 and 19 December 1996, organised by the Committee on Science and Technology in Developing countries (COSTED) and funded by the European Commission. This is the outcome of COSTED's efforts to bring to the attention of the governments and the policy makers the prevailing trend towards cornmodity-centered land use planning leading to considerable land diversion, erosion, removal of forest canopies contributing to global changes.

The book focuses on the heavily populated Southern Asian Region where there is an urgent need to address food security through sustainable agricultural practices against this scenario. The workshop brought together 60 senior experts, government officials, policy makers and NGOs from the European Union and the Southern Asian region in the field of agriculture, land use policy and global issues.

The proceedings of the workshop brings forth the research needs and institutional capacities, regional issues, global scenario technological advances opportunities for management cooperation, networking, concerted actions and delivery systems role of government, public policies, world trade agreenients,

The book provides a wealth of information on the most recent scenario in land use and sustainable agriculture for the South Asian region. The suggested readership for this book is:
- Academicians & Researchers
- Social Scientists
- Scientific Advisors to the Govt.
- Policy makers
- NGOs
- Technologists

A valuable reference for South Asian region University and research libraries. The Proceedings also includes a list of participants which enables the reader to contact the concerned person for further information on the relevant subject.

Contents

News of interest to our members

Prof. John G. Topliss will receive the 1998 ACS Division of Medicinal Chemistry Award at the 26th National Medicinal Chemistry Symposium at Virginia Commonwealth University, Richmond, on 14 June. Prof. Topliss is a Titular Member of the Medicinal Chemistry Section Committee.

Prof. Daryle Busch, Secretary of the Inorganic Chemistry Division, has been nominated as one of two candidates for President-Elect of the American Chemical Society.

The European Physical Society, Section of Macromolecular Physics, will hold a European Conference on Macromolecular Physics: Morphology and Micromechanics of Polymers, Merseburg, Germany, 27 September to 1 October 1998. Further information can be obtained by writing to EPS'98, Martin Luther University of Halle-Wittenberg, Department of Materials Science, D-06099 Halle/S., Germany. Tel.: +49 3461 46 27 45; fax: +49 3461 46 25 35; E-mail: eps98@werkstoff.uni-halle.de/werkstoff/aww/eps/eps01.htm

Provisional Recommendations

Definitions of terms for diffusion in the solid state

Synopsis

This document provides definitions of terms and processes which are used in describing the migration of host and foreign species through solid materials. Both the phenomenological theory of diffusion and the detailed atomistic mechanisms by which atom transport occurs are treated. Also included are the various types of gradients such as electrical, chemical, thermal and mechanical, which provide the driving forces for diffusion.

Comments by 1 October 1998, to Prof. R. Metselaar, Laboratory of Solid State Chemistry and Materials Science, Technische Universiteit Eindhoven, Postbus 513, 5600 MB Eindhoven, Netherlands. Tel.: +31 40 2473122, fax: +31 40 2445619, e-mail: tgtvrm@chem.tue.nl

Conference Calendar

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

1998

Organic synthesis

28 June–2 July 1998
12th International Conference on Organic Synthesis (12-ICOS), Venice, Italy.
Prof. F. Nicotra, Departement of Industrial and Organic Chemistry, Univeristy of Milano, Via Venezian 21, I-20133 Milano, Italy. Tel.: +39 2 236 7613, fax: +39 2 236 4369, e-mail: nicotra@imiucca.csi.unimi.it

Heteroatom chemistry

5–11 July 1998
Fifth International Conference on Heteroatom Chemistry, London, Ontario, Canada.
Prof. Kim M. Baines, Department of Chemistry, University of Western Ontario, London, Ontario N6A 5B7, Canada. Tel.: +1 519 661 2166, fax: 519 661 3022, e-mail: kbaines2@julian.uwo.ca

Chemistry in Africa

6–10 July 1998
7th International Conference on Chemistry in Africa, Durban, South Africa.
Prof. T.M. Letcher, Department of Chemistry & Applied Chemistry, University of Natal, Durban 4041, South Africa. Tel.: +27 31 260 1395, fax: +27 31 260 3091, e-mail: 7icca@che.und.ac.za

Macromolecules

13–17 July 1998
37th International Symposium on Macromolecules (MACRO '98), Gold Coast, Australia.
Prof. R.G. Gilbert, Chemistry School, Sydney University, NSW

2006, Australia. Tel.: +612 9351 3366, fax: +612 9351 3329, e-mail: gilbert@chem.usyd.edu.au

Photochemistry

19–24 July 1998
XVII IUPAC Symposium on Photochemistry, Sitges, Spain.
Prof. Josep Font, Departament de Quimica, Universitàt Autonoma de Barcelona, Bellaterra, 08193 Barcelona, Spain. Tel.: +34 3 581 1255, fax: +34 3 581 1265, e-mail: PHOTOIUPAC98@cc.uab.es

Polymeric materials

20–23 July 1998
18th Discussion Conference on Macromolecules: Mechanical Behaviour of Polymeric Materials, Prague, Czech Republic.
P.M.M. Secretariat, Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic, Heyrovského nám. 2, 162 06 Prague 6, Czech Republic. Tel.: +420 2 360341, fax: +420 2 367981, e-mail: sympo@imc.cas.cz

Chemical thermodynamics

26 July–1 August 1998
15th International Conference on Chemical Thermodynamics, Porto, Portugal.
Prof. Manuel A.V. Ribeiro da Silva, Department of Chemistry, Faculty of Science, Rua do Campo Alegre, 687, 4150 Porto, Portugal. Tel.: +351 2 6082821, fax: +351 2 2008628, e-mail: risilva@fc.up.pt

Novel aromatic compounds

2–7 August 1998
9th International Symposium on Novel Aromatic Compounds (ISNA-9), Hong Kong.
Prof. Henry N.C. Wong, Department of Chemistry, The Chinese University of Hong Kong, Shatin, New Territories, Hong Kong. Tel.: +852 2609 6344, fax: +852 2603 5057, e-mail: hncwong@cuhk.edu.hk

Pesticide chemistry

2–7 August 1998
9th International Congress on Pesticide Chemistry, London, UK.
Dr John F. Gibson, Scientific Secretary, The Royal Society of Chemistry, Burlington House, London W1V 0BN, Tel.: +44 171 437 8656, fax: +44 171 734 1227.

Solubility phenomena

5–8 August 1998
8th International Symposium on Solubility Phenomena, Niigata 950-2181, Japan.
Prof. Kiyoshi Sawada, General Secretary, Faculty of Science, Niigata University, Niigata 950-21 81, Japan. Fax: +81 25 262 6265, e-mail: issp@sc.niigata-u.ac.jp

Chemical education

9–14 August 1998
15th International Conference on Chemical Education: Chemistry and Global Environmental Change, Cairo, Egypt.
Prof. Saad S.M. Hassan, Department of Chemistry, Faculty of Science, Ain Shams University, Cairo, Egypt. Tel.: 202 483 1836, fax: +202 284 2123, e-mail: iupac15@asunet.shams.eun.eg

Carbohydrate symposium

9–14 August 1998
19th International Carbohydrate Symposium, San Diego, CA, USA.
Prof. David A. Brant, ICS 98 Symposium Secretariat, Department of Chemistry, University of California, Irvine, CA 92697-2025, USA. Tel.: +1 714 824 8976, fax: +1 714 824 1372, e-mail: ics98@uci.edu

Physical organic chemistry

16–21 August 1998
14th International Conference on Physical Organic Chemistry, Florianopolis, Brazil.
Prof. Eduardo Humeres, Department of Chemistry, Universidade Federal de Santa Catarina, Campus Universitario-Trindade, 88040-900 Florianopolis, Brazil. Tel.: +55 48 231 9219, fax: +55 48 231 9711, e-mail: humeres@mbox1.ufsc.br

Coordination chemistry

31 August–4 September 1998
33rd International Conference on Co-ordination Chemistry, Florence, Italy.
Prof. Ivano Bertini, Chairman, University of Florence, 33rd ICCC Secretariat, Department of Chemistry, Florence 50121, Italy. Tel.: +39 55 2757 549, fax: +39 55 2757 555, e-mail: ICCC@rics1.lrm.fi.cnr.it

Medicinal Chemistry

6–10 September 1998
XVth International Symposium on Medicinal Chemistry, Edinburgh, Scotland, UK.
Dr J.F. Gibson, The Royal Society of Chemistry, Burlington House, London, W1V 0BN, UK. Tel.: +44 171 437 8656/440 3321, fax: +44 171 734 1227.

Electrochemistry

13–18 September 1998
49th Annual Meeting of the International Society of Electrochemistry, Kitakyushu, Japan.
Prof. Rika Hagiwara. Department of Fundamental Energy Science, Graduate School of Energy Science, Kyoto University, Sakyo-ku, Kyoto 606, Japan. Tel.: +81 75 753 5822, fax: +81 75 753 5906, e-mail: ise@g-chem.nucleng.kyoto-u.ac.jp

Chemistry of germanium, tin and lead

20–25 September 1998
9th International Conference on the Coordination and Organometallic Chemistry of Germanium, Tin & Lead (ICCOC GTL-9), Melbourne, Australia.

Prof. Dainis Dakternieks, School of Biological & Chemical Sciences, Deakin University, Geelong 3217, Australia. Tel.: +61 3 52 271318, fax: +61 3 52 271040, email: dainis@deakin.edu.au

Supramolecular science and technology

27 September–3 October 1998
1st International Conference on Supramolecular Science & Technology, Zakopane, Poland.
Prof. Marek Pietraszkiewicz, Chairman, Institute of Physical Chemistry, ul. Kaspazaka 44/52, 01-224 Warsaw, Poland. Tel.: +48 22 632 3221 (ext. 3226), fax: +48 39 12 0238, e-mail: pietrasz@ichf.edu.pl

Chemistry of natural products

11–16 October 1998
21st IUPAC symposium on the Chemistry of Natural Products, Beijing, China.
Prof. Xiaotian Liang, Chairman, Prof. Xibai Qiu, Secretary, c/o Chinese Chemical Society, PO Box 2709, Bejing 100080, China. Tel./fax: +86 10 625 68157, e-mail: qiuxb@infoc3.icas.ac.cn

Excitonic processes in condensed matter

2–5 November 1998
Third International Conference on Excitonic Processes in Condensed Matter, Boston, MA, USA.
Prof. William M. Yen, Department of Physics and Astronomy, University of Georgia, Athens, GA 30602-2451, USA. Tel.: +1 706 542 2491, fax: +1 706 542 2492, e-mail: wyen@hal.physast.uga.edu

1999

Functional dyes

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

CHEMRAWN

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

Biodiversity and Bioresoures

27 June–1 July 1999
2nd International Conference on Biodiversity and Bioresources—Conservation and Utilization, Belo Horizonte, Minas Gerais, Brazil.
Prof. Alaide Braga de Oliveira, Faculdade de Farmacia—UFMG, Av. Olegario Maciel 2360, 30.180-112 Belo Horizonte, Brazil. Fax: +55 31 337 9076, e-mail: fernao@dedalus.lcc.ufmg.br

Polymerization methods

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

Organo-metallic Chemistry

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

Carotenoids

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

Rheology of polymer systems

19–22 July 1999
19th Discussion Conference on the Rheology of Polymer Systems, Prague, Czech Republic.
Dr Jaromir Lukas, Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic, Heyovskeho na. 2, 162 06

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Praha 6, Czech Republic. Tel.: +420 2 360341, fax: +420 2 367981, e-mail: sympo@imc.cas.cz

Ionic polymerization

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

Analytical science

25–30 July 1999
Analytical Science into the Next Millennium (SAC 99), Dublin, Ireland.
Prof. Malcolm R. Smyth, Faculty of Science, Dublin City University, Dublin 9, Ireland. Tel.: +353 1 704 5308, fax: +353 1 704 5503, e-mail: smythm@dcu.ie

Solution chemistry

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

IUPAC General Assembly

6–13 August 1999
Berlin, Germany.
IUPAC Secretariat, Tel.: +1 919 485 8700, fax: +1 919 485 8706, e-mail: secretariat@iupac.org

IUPAC Congress

14–19 August 1999
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

Macromolecule–metal complexes

6–10 September 1999
8th International Symposium on Macromolecule–Metal Complexes (MMC–VIII) Tokyo, Japan.
Prof. Eishun Tsuchida, Waseda University, Tokyo 169-50, Japan. Tel.: +81 3 5286 3120, fax: +81 3 3209 5522, email: w169988@mn.waseda.ac.jp

2000

Bio-organic chemistry

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

High temperature materials chemistry

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

Macromolecules

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

Organic Synthesis

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

Chemical Thermodynamics

6–11 August 2000
16th IUPAC Conference on Chemical Thermodynamics, Halifax, Nova Scotia, Canada.
Dr Peter G. Kusalik, Department of Chemistry, Dalhousie University, Halifax, Nova Scotia B3H 4J3, Canada. Tel.: +1 902 494 3627, Fax: +1 902 494 1310. e-mail: kusalik@is.dal.ca

Natural products

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

Biotechnology

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