

# I U P A C

Advancing Worldwide Chemistry

Biennial Report 2004–2005



# International Union of Pure and Applied Chemistry

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The **International Union of Pure and Applied Chemistry (IUPAC)** is a non-governmental organization of member countries that encompass more than 85% of the world's chemical sciences and industries. IUPAC was formed in 1919 by chemists from industry and academia. For more than eight decades, the Union has succeeded in fostering worldwide communications in the chemical sciences and in uniting academic, industrial, and public sector chemistry in a common language. IUPAC addresses international issues in the chemical sciences and provides leadership in standardizing chemical nomenclature and terminology, analytical methods, and atomic weights and other critically evaluated data. IUPAC has been proactive in establishing a wide range of conferences and projects designed to promote and stimulate modern developments in chemistry, and to assist in aspects of chemical education and the public understanding of chemistry. IUPAC facilitates and encourages international agreements and the coordination of numerous activities carried out by national and regional chemistry organizations. It also contributes to the work of the International Council for Science (ICSU) in promoting science and its values, including freedom in the conduct of science, equitable access to scientific data and information, and facilitation of science education and capacity building, in all regions of the world.

This report lists IUPAC's six long-range goals and provides illustrations of actions taken during the last two years toward meeting those goals. The Union's work is done almost entirely by approximately 1000 volunteer scientists from many countries who serve on IUPAC's committees, subcommittees, and task groups. IUPAC's scientific work is conducted largely under a formal project system, in which proposals from chemists worldwide are peer-reviewed and, if meritorious, are approved and supported.

IUPAC receives its core financial support from national subscriptions paid by its National Adhering Organizations—primarily national chemical societies or national academies of science. Additional income is derived from investments of its endowment and reserve funds, from publications, and from grants for specific projects. Nearly half of the budget of approximately USD 1.5 million in 2005 went to the operating expenses of IUPAC's Divisions and Committees and commitments for peer-reviewed projects, primarily travel costs for volunteers who comprise committees and project task groups. The other half covered the costs of governance, communications, and a small Secretariat staff.

IUPAC will provide leadership as a worldwide scientific organization that objectively addresses global issues involving the chemical sciences.

Important global issues are addressed by the Committee on Chemical Research Applied to World Needs (CHEMRAWN). The CHEMRAWN series of conferences has allowed IUPAC to address issues that transcend pure science and have important socio-political aspects. Over the past quarter of a century, 12 CHEMRAWN conferences have brought together experts in science and technology, including industrial leaders, government policymakers, academic scientists, and members of the general public. Together they have explored, discussed, and debated how chemistry, chemical research, and chemical resources can help meet major human needs or solve major problems.

Each CHEMRAWN conference focuses on an issue of global significance. Examples include food security, mitigation of greenhouse gases, sources of cleaner energy, chemistry as a tool for sustainable development, pollution prevention through the redesign of chemical processes, and adequacy of supply of pure water and sanitation.

This last area was the focus of CHEMRAWN XV, which was held in Paris, France, in June 2004. The attendees gathered from five continents and considered the latest developments in chemistry and chemical engineering designed to meet the varied industrial and municipal demands for water supplies. The required quality varies from situation to situation. For example, computer chip manufacture requires ultrapure water containing less than a few parts per trillion of impurities, while people in poor countries are often forced to drink untreated water from sources also used for washing.

The conference identified three main areas for development. (i) Separation science makes use of coagulants, flocculants, and dispersants to enable the recycling of wastewater. While innovative chemistry is generating more effective membranes, it is also important that they are biodegradable and environmentally benign. Cheaper desalination processes remain a goal for the future. (ii) Disinfection science is becoming more effective, as disinfecting agents are increasingly being used in combination with ultraviolet light irradiation. Once again, all by-products must be biodegradable. (iii) Analytical science plays an essential role in providing the most advanced techniques to monitor and track pollutants. Computational techniques are also used to control the flow of water and effluent and thereby minimize usage and waste.

The major challenge remains the provision of safe drinking water in many parts of the world. For example, there is a serious problem of arsenic contamination of water supplies in Bangladesh, where it affects 60 million people. This issue was discussed in a special session at the Paris meeting, and IUPAC is currently engaged in a project with the World Health Organization (WHO) to address this problem with the provision of inexpensive family drinking water purification units. The project aims to produce a scientifically sound report that will inform and advise non-specialists on key aspects of arsenic remediation technologies, while also providing a simple and practical guide similar to the WHO guide for infectious agents in water.

Along with the Bangladesh Academy of Sciences, the U.S. National Science Foundation, the Bangladesh Arsenic Mitigation Water Supply Project, the Arsenic Policy Support Unit, and the Bangladesh Chemical Society, IUPAC sponsored the Bangladesh Workshop on Origins and Remediation of Groundwater Contamination by Arsenic. The meeting was held at the Atomic Energy Centre in Dhaka in December 2005. Objectives of the meeting included the



following: (i) develop a better understanding of how arsenic gets into water; (ii) focus on the need to identify one or two optimum remediation techniques that can be scaled up; and (iii) communicate the need to safely dispose of the materials used to remove arsenic. Conclusions from the workshop indicated that more assessment, communications, research, and action are necessary to improve the dangerous situation.

The CHEMRAWN Committee held a workshop in Arusha, Tanzania, in August 2004 to articulate chemical issues in the drive for sustainable agriculture in sub-Saharan Africa and to gather relevant information and support for a future CHEMRAWN conference on this theme.

IUPAC continues to collaborate with the Organization for Prohibition of Chemical Weapons (OPCW) on scientific and technical developments that might impact the Chemical Weapons Convention, which went into effect in 1997 and has now been ratified by 179 countries. Because of the continuing worldwide threat of chemical weapons, IUPAC was called upon by OPCW to play an expert, independent, and international role in assessing the situation. A workshop held in Bergen, Norway, in July 2002 explored advances in relevant chemical synthetic methods involving micro-reactors, chemical processing, and analytical methodology. A report on that conference (*Pure Appl. Chem.* 74(12), 2323-2352, (2002)) was provided as a briefing for OPCW and States Parties. It highlighted the need for continuing education for chemists and the general public about the Convention on Chemical Weapons and its attempts to contain the destructive potential of our science. The Committee on Chemistry Education (CCE) is charged with the oversight of educational aspects of IUPAC activities and discussed this issue at its meeting in Istanbul in August 2004. The situation is delicate; there is a fine line between educating in favor of prohibition and accidentally educating for propagation. A Task Group

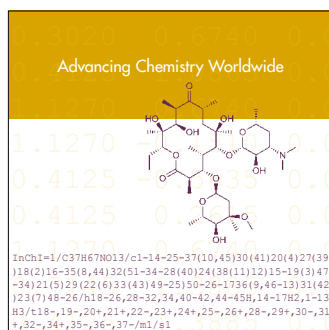


*Conferees at Malta II, held in November 2005, included (standing, l to r) Sultan Abu-Orabi, Mona Al Huseiny, Hassan Moawad Abd El Al, Azam Irajizad, and (seated, l to r) Nadia Kandile, Ann Nalley, Miriam Waldman, and Zafra Lerman.*

was established and has maintained close contact with OPCW, with IUPAC being represented at the meeting of States signatories in The Hague in January 2005. A joint meeting of IUPAC and OPCW, on the CWC and the role of chemists, was held in Oxford (UK) from 9-12 July 2005. Two recommendations from the meeting were as follows: (i) chemists need to develop their own codes of conduct and (ii) educational materials should be developed that describe the CWC and the obligations it places on the member states that are signatories. Participants in the meeting felt that it was important to place the CWC in the context of the beneficial uses and misuses of chemicals, as well as to raise awareness of multiple uses of the same substances.

Another global issue addressed by IUPAC is the development of chemistry in a cooperative way in the Middle East. In collaboration with the American Chemical Society, the Royal Society of Chemistry, and the Gesellschaft Deutscher Chemiker, IUPAC sponsored the second conference on Research and Education in the Middle East, held in Malta in November 2005 (Malta II), which built on the initial conference (Malta I) in December 2003. The conference brought together 80 participants, 56 of whom were from Middle Eastern countries, and provided neutral ground for discussions on shared challenges in environment, materials, science, medicinal chemistry, nanotechnology, energy, and education.

IUPAC will facilitate the advancement of research in the chemical sciences through the tools that it provides for international standardization and scientific discussion.



IUPAC is recognized as the final authority on the names of elements. In 2003, a joint working party of IUPAC and the International Union of Pure and Applied Physics confirmed the discovery of element 111 by the collaboration of Hofmann *et al.* from the Gesellschaft für Schwerionenforschung mbH (GSI) in Darmstadt, Germany (*Pure Appl. Chem.* 75(12), 1601-1611 (2003)). The discoverers proposed the name *roentgenium* (Rg) because element 111 was synthesized exactly 100 years after Roentgen's discovery of X-rays. The IUPAC Inorganic Chemistry Division recommended acceptance of this proposal, and after the periods of expert examination and public scrutiny, the name was officially approved at the 80th meeting of the IUPAC Bureau in Bled, Slovenia, in October 2004. The IUPAC Council, at its meeting in Ottawa in 2003, had delegated the authority to approve the name to the Bureau, in order to avoid delay.

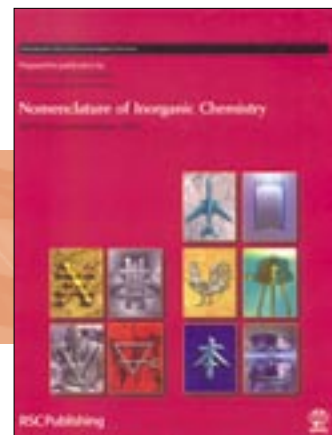
At its meeting in Beijing, China, in August 2005, the Commission on Isotopic Abundances and Atomic Weights released changes to the standard atomic weights of 16 chemical elements: aluminium, bismuth, caesium, cobalt, gold, lanthanum, manganese, neodymium, phosphorus, platinum, samarium, scandium, sodium, tantalum, terbium, and thorium. The new values will be published in a new Table of Standard Atomic Weights, which will soon be published in IUPAC's official journal, *Pure and Applied Chemistry*.

Recommendations for systematic molecular nomenclature have long been a priority for IUPAC. With the development of electronic communication and computer programs to relate names and molecular structures, IUPAC, in collaboration with the U.S. National Institute of Standards and Technology, began in 2000 a project to devise an algorithm that would provide a unique electronic signature for each molecule related to its structure. The project task group completed an algorithm called InChI, the IUPAC International Chemical Identifier, that provides a unique molecular label for all organic, inorganic, and organometallic compounds. InChI also guarantees that the same identifier is generated regardless of the order of data input, as it expresses a chemical structure in terms of layers of information (connectivity, tautomeric, isotopic, stereochemical, and electronic). The algorithm has been incorporated into Chemical Markup Language (CML), and a full public version (InChI 1.0) was released in 2005 for use by software developers and database compilers. The focus is now on promoting the use of InChI throughout the chemical community. Applications include finding compounds in the chemical literature via text-based search engines such as Google, communicating between databases, transmission of substance identity, maintaining a chemical inventory, and purchasing chemicals from suppliers.

IUPAC sponsored 75 conferences during the biennium, ranging from the flagship IUPAC Congress and large international meetings on particular areas of chemistry to smaller symposia and workshops on specific topics. The 40th IUPAC Congress, which was held in Beijing, China, in August 2005, was centered







around the theme of “Innovation in Chemistry.” Co-sponsored and organized by the Chinese Chemical Society and the Institute of Chemistry of the Chinese Academy of Sciences, it attracted approximately 1100 participants from around the world, with large representations from China and other Asian countries. The General Assembly overlapped with the Congress, and 411 registered participants from 52 countries took part in a busy schedule of committee meetings and events. Highlights of the gathering included a compelling World Chemistry Leadership Meeting that focused on “Chemistry in Asia,” a joint meeting of three committees to discuss IUPAC’s role in furthering the public understanding of chemistry, and an inspiring Safety Training Workshop featuring presentations by recent trainees.

Other well-established series of conferences were held during the biennium in many parts of the world, including the following:

- International Conference on Biodiversity and Natural Products: Chemistry and Medical Applications (Delhi, India, January 2004)
- UNESCO School and IUPAC Conference on Macromolecules (Mauritius, April 2004)
- International Symposium on Biomolecular Chemistry (Sheffield, United Kingdom, July 2004)
- International Symposium on Macromolecules (Paris, France, July 2004)
- International Symposium Solubility Phenomena (Aveiro, Portugal, July 2004)
- IUPAC Symposium on Photochemistry (Granada, Spain, July 2004)
- International Conference on Chemical Education (Istanbul, Turkey, August 2004)
- International Conference on Chemical Thermodynamics (Beijing, China, August 2004)
- International Conference on Organic Synthesis (Nagoya, Japan, August 2004)
- IUPAC Conference on Heteroatom Chemistry (Shanghai, China, August 2004)
- IUPAC Conference on Physical Organic Chemistry (Shanghai, China, August 2004)
- International Symposium on Novel Aromatic Compounds (St. John’s, Newfoundland, Canada, August 2005)
- International Biotechnology Symposium (Santiago, Chile, October 2004)
- International Polymer Conference (Fukuoka, Japan, July 2005)
- International Symposium on Organometallic Chemistry Directed Towards Organic Synthesis (Geneva, Switzerland, July 2005)
- International Symposium on Plasma Chemistry (Toronto, Canada, August 2005)
- IUPAC New Directions in Chemistry Workshop on Advanced Materials (Stellenbosch, South Africa, September 2005)

IUPAC continues to be a leader not only in nomenclature, but also in the compilation and critical evaluation of chemical data. Seven books were published during this biennium: *Physicochemical Kinetics and Transport at Biointerfaces*, *Chemical Thermodynamics for Industry*, *Analog-based Drug Discovery*, *Green Chemistry in Latin America*, *Green Chemistry in Russia*, and *Measurement of the Thermodynamic Properties of Multiple Phases*. A major achievement is the latest update of *Nomenclature of Inorganic Chemistry—IUPAC Recommendations 2005*. A further volume in the *Solubility Data Series* was published in 2005 and focuses on the solubility of hydrocarbons in water and seawater.

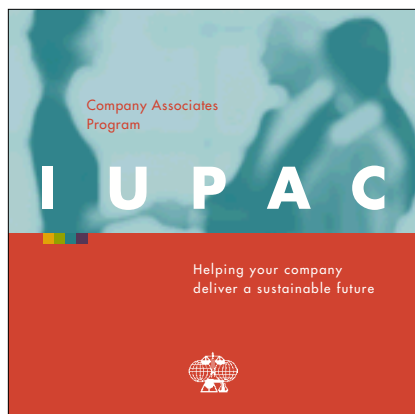
During the last two years, IUPAC projects have led to eight Recommendations and 27 Technical Reports published in *Pure and Applied Chemistry*. Abstracts and full-text versions of these recommendations and technical reports are available through *PAC* online at no cost.

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

From IUPAC's inception, the inclusion of the word "Applied" in its title has signaled a strong tie to the chemical industry. IUPAC long has had a formal program of Company Associates (for listing of Company Associates, see page 13) and a Committee on Chemistry and Industry (COCI), which concentrates its efforts on programs and issues pertinent to industrial interests and concerns. Many of the benefits accruing to industry from IUPAC activities are indirect. For example, the conferences described earlier in this report explore new developments in a wide range of chemical sciences and are well-attended by industrial, as well as academic, chemists. Likewise, the global issues discussed previously are of crucial importance to industry. Thus, IUPAC's efforts to provide a sound and unbiased evaluation of current science can have an impact on industrial processes and products in many countries.

During this biennium, there has been considerable emphasis on strengthening industry links through the expansion of the Company Associates program. COCI has developed a strategy to explain more cogently the significant benefits for Company Associates, as well as for the National Adhering Organizations in their respective countries. A new brochure has been distributed to publicize the program more vigorously. The COCI/IUPAC global perspective enables the capacity for companies to share best international practice, which is of particular benefit to emerging industries. It

is also critical for the worldwide standardization of industrial procedures and attitudes.



2003 fellows Jane B. Nyakang'o (UNIDO Kenya National Cleaner Production Centre) and Ana Luisa Arocena (CEMPRE Uruguay) visit the BP Chemicals Technology Center in Naperville, Illinois, USA.

COCI has continued its highly successful safety training program and workshops. The IUPAC-UNESCO-UNIDO Safety Training Program (STP) allows experts from developing countries to learn about safety and environmental protective measures by visiting and working in plants of IUPAC Company Associates in the developed world. Each scientist or engineer accepted into the program typically spends one to three weeks in training. The Safety Training Program was the focus of a workshop at the 2005 IUPAC General Assembly and Congress in Beijing, at which all eight Fellows from 2000-2004 presented papers and brainstormed improvements to the STP. COCI has also worked with the Committee on Chemistry Education (CCE) to add an industry perspective to the overarching IUPAC initiatives to foster public understanding and appreciation of chemistry.



COCI also provides a forum for dialog with trade associations and national bodies. IUPAC has initiated a pilot program to offer a one-year complimentary Company Associate membership to those companies that sponsor IUPAC conferences. Such a sponsorship commitment makes a significant contribution to IUPAC work in one form; follow-up contact is an acknowledgment of that support and provides an opening for long-term collaboration.

The IUPAC-Richter Prize in Medicinal Chemistry has been established by a generous gift from the Chemical Works of Gedeon Richter, Ltd. (Budapest, Hungary) to acknowledge the key role that medicinal chemistry plays in improving human health. By establishing this prize jointly with IUPAC, Richter wishes to contribute to the international recognition of the role of research in medicinal chemistry, publicize the company's commitment to medicinal chemistry research, and further promote IUPAC activities. The prize of USD 10 000 will be awarded to an internationally recognized scientist, preferably a medicinal chemist, whose activities or published accounts have made an outstanding contribution to the practice of medicinal chemistry or have led to an outstanding example of new drug discovery. The prize will be awarded biennially by a selection committee appointed by the Subcommittee on Medicinal Chemistry and Drug Development of the IUPAC Chemistry and Human Health Division. The first prize will be awarded in 2006. For more than 100 years, Gedeon Richter Ltd has carried out research, development, manufacture, and marketing of approximately 100 pharmaceutical products.

Many IUPAC projects have direct relevance to industrial products and processes, as well as to the enhancement of basic research. Many, but by no means all, involve polymer characterization. Another example is the monograph on *Analog-based Drug Discovery*, which is of importance to the pharmaceutical industry. Through COCI, a greater attempt is being made to identify the industrial implications of the full range of IUPAC projects.

**IUPAC and Gedeon Richter, Ltd. Announce the 2006 IUPAC-Richter Prize in Medicinal Chemistry**  
Call for Nominations

The IUPAC-Richter Prize is to be awarded to an internationally recognized scientist, preferably a medicinal chemist, whose activities or published accounts have made an outstanding contribution to the practice of medicinal chemistry or to an outstanding example of new drug discovery.

The prize has been established by a generous gift from the **Chemical Works of Gedeon Richter, Ltd.** (Budapest, Hungary) to acknowledge the key role that medicinal chemistry plays in improving human health.

Application is by **NOMINATION** only with one person needing to serve in that capacity, although a total of five (5) individuals should be listed as referees overall. The package should contain a complete resume, a professional autobiography of not more than two pages, and a one-page summary of what the individual considers to be his/her activities, accomplishments and/or publications that have had the most significant impact upon the field of Medicinal Chemistry. The material will be confidentially forwarded to an independent selection committee appointed by the IUPAC Subcommittee on Medicinal Chemistry and Drug Development.

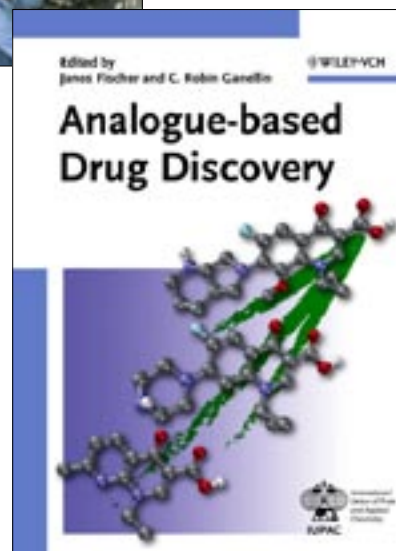
The first IUPAC-Richter Prize will be presented in 2006 during the XXth International Symposium on Medicinal Chemistry, 29 Aug-2 Sept 2006, in Istanbul, Turkey, where the recipient will also give a 45-minute plenary lecture on the subject of his/her research.

**Prize USD 10 000**  
**Deadline: 31 March 2006**

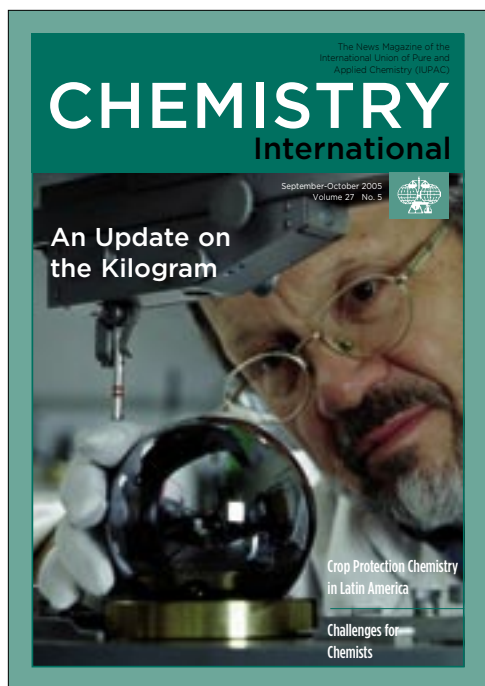
For further information please visit [www.iupac.org/news/richter\\_prize.html](http://www.iupac.org/news/richter_prize.html) or contact Professor C. Robin Ganellin, Chairman of the IUPAC Subcommittee on Medicinal Chemistry and Drug Development, by e-mail at [c.r.ganellin@ucl.ac.uk](mailto:c.r.ganellin@ucl.ac.uk).

**ISMC 2006**  
29 Aug-2 Sept 2006  
Istanbul, Turkey  
The XXth International Symposium on Medicinal Chemistry is being organized by the Turkish Association of Pharmaceutical and Medicinal Chemistry under the auspices of the European Federation for Medicinal Chemistry. [www.ismc-2006.org](http://www.ismc-2006.org)

Nomination materials should be submitted by **31 March 2006** to:  
**IUPAC Secretariat**  
by e-mail to: [secretariat@iupac.org](mailto:secretariat@iupac.org)  
telephone: +1 (919) 485 8700  
fax: +1 (919) 485 8706



IUPAC will foster communication among individual chemists and scientific organizations, with special emphasis on the needs of chemists in developing countries.



IUPAC's constituency consists of the entire world of chemistry, both organizational and individual. Official contacts are maintained with the National Adhering Organizations, but there is also need for contact with national chemical societies, industrial companies, and individual chemists. Such widespread contact requires both web-based and conventional forms of communication.

The IUPAC web site serves as a major vehicle for worldwide communication. News from and about IUPAC, full listings of current and completed projects, detailed committee membership information, publications, and conference calendars are updated regularly. In addition, links to national chemical web sites, Company Associates, and Associated Organizations provide a facile means for chemists to remain aware of a wide range of international activities. The electronic newsletter continues to inform its recipients (about

9 000) of updates made on the web. In addition, the e-press newsletter disseminates information on current and recent IUPAC activities to scientific magazines and journals. The bimonthly IUPAC news magazine, *Chemistry International*, is distributed in print form to chemists in nearly 90 countries and is also available online. It serves as a major means of publicity and communication, and current issues are distributed at IUPAC conferences. With each new issue, *Chemistry International* continues to become a more attractive, vibrant, informative, and popular publication.

A new series, titled "Emerging Issues in Developing Countries," has been established in *Chemistry International*. The Analytical Chemistry Division initiated this feature to inform readers, explore new ideas, and promote discussion on themes related to developing countries and emerging analytical communities. The series provides a forum for views and discussion on how IUPAC can foster communication in developing countries.

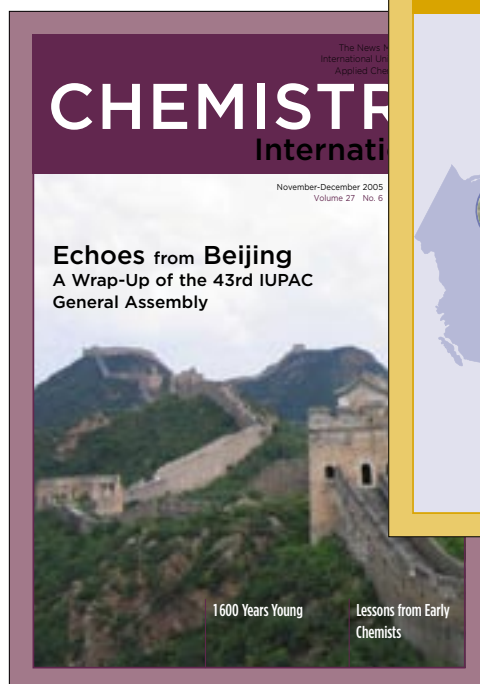
IUPAC has formal and informal ties to international organizations that impinge on every aspect of individual and commercial society. IUPAC has moved to strengthen its ties with the International Council for Science (ICSU) and to play a greater role in its activities, because it is important that the promotion of chemistry goes hand-in-hand with the wider promotion of science. An active nomination program has culminated in the incoming IUPAC president being elected to the ICSU Executive Board.



For a number of years, IUPAC has enjoyed a fruitful co-operation with UNESCO, particularly in the field of chemical education. A strengthening of the collaboration has been discussed, and in December 2005 the two parties signed a “Memorandum on co-operation in chemical sciences,” with particular focus on cooperative activities on capacity building and information sharing in Africa.

The project system, through its task groups, provides close contact points for individual chemists. Wider contact is provided through the numerous IUPAC-sponsored conferences held throughout the world. At its meeting in August 2005, the Council approved a major change to the guidelines to ensure that IUPAC conferences would be held *only* in countries that have National Adhering Organizations. The opportunity to host a major international IUPAC-sponsored conference is a considerable economic benefit to any country, and the new policy will enhance the value of full NAO membership of IUPAC.

Meanwhile, in an effort to encourage conferences in scientifically emerging countries, IUPAC continues to provide modest financial support. These funds are typically used to subsidize attendance by young scientists or to include eminent scientists, designated as IUPAC lecturers, in the conference program. If such financial support is awarded, the above rule requiring full NAO membership is waived. Thus, there is some incentive for scientifically emerging countries to get involved with IUPAC, even before becoming full NAO members. The Council also approved a change to former practice, establishing a time limit of four years for Associated National Adhering Organization membership. After such a period, a country is encouraged to become a full NAO member.



IUPAC will utilize its global perspective and network to contribute to the enhancement of chemistry education, the career development of young chemical scientists, and the public appreciation of chemistry.

IUPAC recognizes particular responsibilities to encourage and support young scientists throughout the world. Since the year 2000, the IUPAC Prize for Young Chemists has been awarded annually for the best Ph.D. theses in the chemical sciences in the previous year. The IUPAC Prize for Young Chemists is the only international program designed to provide public and financially remunerative recognition to chemists at such early stages of their careers. Over six years, 26 awards have been made in a highly competitive program; each award provides USD 1000 and travel expenses to present a poster and receive the award at an IUPAC Congress. In Beijing in 2005, eight young scientists (four each from 2004 and 2005) received awards for innovative research in wide-ranging areas, such as non-covalent interactions, enzymatic reactions, prebiotic catalysis, nanoscale science including nanofibers and metal oxide nanostructures, DNA-templated synthesis, and “confused” porphyrins. An additional four applicants in 2004 and in 2005 were awarded Honorable Mentions, in recognition of the extremely high quality of the competition.

In 2003, IUPAC received from the Samsung General Chemicals Company (now the Samsung Total Petrochemical Co Ltd) of South Korea, an endowment of USD 125 000, to stimulate polymer education and research around the world. The Polymer Division will use the interest on this endowment in the following ways: (i) a Samsung-IUPAC Young Polymer Scientist award of USD 2000 will be made every second year to a scientist under the age of 40, to enable participation in the forthcoming IUPAC World Polymer Congress



*Timothy Deming (center), recipient of the 2004 Samsung-IUPAC Young Polymer Scientist Award, poses with (from left) Won Lee, director, Samsung Total Petrochemical Research Center; Robert F.T. Stepto, president, IUPAC Polymer Division; Jung-Il, vice president, IUPAC Polymer Division; and Jean-Pierre Vairon, chairman, Organizing Committee of WPC 2004.*



*Young Ambassadors for Chemistry assemble pieces of a DNA model built from candies.*

(the first award was made to Timothy Deming in July 2004); (ii) travel grants will be made available for support of students from economically disadvantaged countries (15 awards of USD 200 were made for the 2004 World Polymer Congress); (iii) an amount of USD 2000 will be made available to organizers of World Polymer Congresses to defray plenary lecturer costs; and (iv) support will be provided for education-related projects. The first IUPAC-Samsung Education Prize of USD 5000 was awarded to Professor Pavel Kratochvil for the postgraduate course in polymer science, which has been held since 1966 at the Institute of Macromolecular Chemistry at the Academy of Sciences of the Czech Republic in Prague. This course has attracted a worldwide reputation for its high standards and effective training of students in polymer science.

The Committee on Chemistry Education partnered with Science Across the World (SAW) in 2003 to facilitate the flow of ideas between chemistry and society through the Young Ambassadors for Chemistry (YAC) project. The aims are to train teachers and provide resources to develop the communication skills of young people and teach them to be young ambassadors for chemistry. In November



2004, two workshops were hosted by the Chemical Society located in Taipei, China. They focused on two SAW publications, *Chemistry in our Lives* and *Talking about Genetics around the World*, which were translated into Chinese for the occasion. Subsequent YAC events were held in 2005 in Argentina and Russia.

IUPAC provides travel support to assist approximately 70 young scientists, especially from developing countries, to participate in its biennial Congress. In 2005, IUPAC joined with the organizers of the Beijing Congress to support travel for young chemical scientists from around the world. Each scientist presented a poster or lecture and participated in the full range of Congress sessions.

The advent of the IUPAC Poster Prizes program in 2004 provides National Adhering Organizations and eligible IUPAC-sponsored conferences with a strategic tool to encourage participation of young chemists in conferences. The Poster Prizes recognize outstanding poster presentations at IUPAC Congresses, IUPAC Division/Standing Committee-sponsored conferences, and designated national meetings. Each NAO may select one conference per year at which to award IUPAC Poster Prizes. Usually two prizes are awarded at each conference, and in 2004 there were 17 recipients at conferences in Portugal, Japan, Turkey, Poland, South Africa, China, and Pakistan. The program is gathering momentum—in addition to the almost 30 eligible IUPAC conferences, national conferences in 11 countries awarded prizes in 2005. The prize selections are made by the conference organizers, and each winner receives a certificate signed by the IUPAC president, a copy of the IUPAC Gold Book (*Compendium of Chemical Terminology*), and a two-year subscription to *Chemistry International*.

IUPAC also continues to benefit from the generosity of Georg Thieme Verlag, through the award of the Thieme-IUPAC Prize for a synthetic organic chemist

under the age of 40. The award is made as a special feature of the biennial International Conference on Organic Synthesis; the most recent conference was held in Nagoya in 2004, and the award was presented to John F. Hartwig (Yale, USA).

The Younger European Chemists' Conference was initiated in 2001 to increase European students' and Ph.D. candidates' interest in science and technology, in the face of the declining number of chemistry graduates in many European countries. IUPAC was present at the conferences held in 2004 (Torino, Italy) and 2005 (Brno, Czech Republic), and at the 2005 conference, an IUPAC lecture was delivered by Professor Gerald Pattenden on "The Excitement of Natural Products and Their Biometric Synthesis." Following these conferences, several young chemists volunteered to become involved in IUPAC activities.



Poster presentations and discussions constitute the backbone of the Younger European Chemists' conferences. IUPAC President Leiv K. Sydnes discusses photochemical problems with Elena Tulyakova from M V Lomonosov Moscow State University in Russia.

Eight young scientists were recognized with the 2004 and 2005 IUPAC Prize for Young Chemists at the Opening Ceremony of the IUPAC Congress in Beijing, China.



IUPAC will broaden its national membership base and will seek the maximum feasible diversity in membership of IUPAC bodies in terms of geography, gender, and age.

At the organizational level, IUPAC communicates with its National Adhering Organizations and continually strives to bring additional countries into the fold. The previous IUPAC membership of 45 National Adhering Organizations has been increased by four after the Beijing Council meeting approved National Adhering Organization status for the Caribbean Academy of Sciences–Jamaica Chapter, Jordanian Chemical Society, National Academy of Sciences of Ukraine, and National Academy of Sciences of Belarus. Although member countries generate about 85 % of the world's chemical output, there are several countries with a substantial chemistry enterprise that are not yet members of the Union. The current Associate National Adhering Organizations will be vigorously encouraged to move to National Adhering Organization status in the future.

Members of IUPAC's governing bodies and various committees are selected primarily on the basis of needed expertise, but special efforts are made to assure diversity in terms of geography, gender, and age. At the Division level, elections are held for Titular Members, and once this group is established, Associate Members are added to cover further areas of expertise. Finally, the National Representatives are chosen deliberately to add members from countries not otherwise included. The purpose of the election process and the committee structure is to seek maximum inclusion and communication, rather than narrow national representation. In this way, even smaller chemical countries can become fully involved in the work of IUPAC.

Various programs have been put in place by NAOs to interest mid-career younger chemists in IUPAC work, and to arrange for their participation as observers in committee meetings during the General Assembly. In 2003, IUPAC provided support to bring another group of seven young scientists, each from a different member country, to the General Assembly. Based on this success, Young Observers were invited

again to participate in the 2005 General Assembly in Beijing. IUPAC, together with the Canadian, USA, and UK National Adhering Organizations, selected 24 chemists, with varied backgrounds and interests, from nine countries: Brazil, Canada, Chile, France, India, Russia, Turkey, UK, and the USA. The participation of these Young Observers added vitality and a valuable perspective to the committee work in which they participated.

IUPAC reaches out to individual chemists and other organizations in order to enhance its global impact. More than 30 international scientific organizations have applied for and been granted the status of IUPAC Associated Organizations. These organizations range from regional chemistry federations to societies dedicated to a specific sub-discipline of chemistry.

At the individual chemist level, IUPAC has direct contact with about 4500 interested scientists in over 70 countries through its Affiliate Member Program. Formed in 1983, this program permits individual chemists—directly or through their national chemical societies—to express interest in IUPAC's work and to remain informed of IUPAC activities. Each Affiliate Member receives the bimonthly news magazine *Chemistry International*, along with other communications from the IUPAC Secretariat.

The IUPAC Fellows Program, established in 1997, offers Fellow status to individuals who have completed service on IUPAC bodies. Currently there are more than 1000 IUPAC Fellows. These scientists receive *Chemistry International* and are invited to participate in two-way communication with IUPAC bodies on important issues to which IUPAC might make a significant contribution.

Because proposals for projects are sought globally, members of task groups that carry out projects may come from anywhere, even countries not currently associated with IUPAC, thus broadening the global



reach of IUPAC. Likewise, information on the Union that is disseminated at IUPAC-sponsored conferences serves to acquaint a wider circle of chemists with IUPAC's work and to encourage their participation.



*Young Observers from nine different countries participated in the IUPAC General Assembly in Beijing, China, in August 2005.*

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### International Organization

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## Mission

IUPAC is a non-governmental organization of member countries that encompass more than 85% of the world's chemical sciences and industries. IUPAC addresses international issues in the chemical sciences utilizing expert volunteers from its member countries. IUPAC provides leadership, facilitation, and encouragement of chemistry and promotes the norms, values, standards, and ethics of science and the free exchange of scientific information. Scientists have unimpeded access to IUPAC activities and reports. In fulfilling this mission, IUPAC effectively contributes to the worldwide understanding and application of the chemical sciences, to the betterment of the human condition.

## National Adhering Organizations

Asociación Química Argentina ( <i>Argentina</i> )	Consiglio Nazionale delle Ricerche ( <i>Italy</i> )
Australian Academy of Science ( <i>Australia</i> )	Caribbean Academy of Sciences - Jamaica Chapter ( <i>Jamaica</i> )
Österreichische Akademie der Wissenschaften ( <i>Austria</i> )	Science Council of Japan ( <i>Japan</i> )
Bangladesh Chemical Society ( <i>Bangladesh</i> )	Jordanian Chemical Society ( <i>Jordan</i> )
National Academy of Sciences of Belarus ( <i>Belarus</i> )	Korean Chemical Society ( <i>Korea</i> )
The Royal Academies for the Sciences and Arts of Belgium ( <i>Belgium</i> )	Kuwait Chemical Society ( <i>Kuwait</i> )
Brazilian Chemistry Committee for IUPAC ( <i>Brazil</i> )	Koninklijke Nederlandse Chemische Vereniging ( <i>Netherlands</i> )
Bulgarian Academy of Sciences ( <i>Bulgaria</i> )	Royal Society of New Zealand ( <i>New Zealand</i> )
National Research Council of Canada ( <i>Canada</i> )	Norsk Kjemisk Selskap ( <i>Norway</i> )
Sociedad Chilena de Química ( <i>Chile</i> )	Chemical Society of Pakistan ( <i>Pakistan</i> )
Chinese Chemical Society ( <i>China</i> )	Polska Akademia Nauk ( <i>Poland</i> )
Chemical Society located in Taipei ( <i>China</i> )	Sociedade Portuguesa de Química ( <i>Portugal</i> )
Croatian Chemical Society ( <i>Croatia</i> )	Colegio de Químicos de Puerto Rico ( <i>Puerto Rico</i> )
Czech National Committee for Chemistry ( <i>Czech Republic</i> )	Russian Academy of Sciences ( <i>Russia</i> )
Det Kongelige Danske Videnskabernes Selskab ( <i>Denmark</i> )	Union of Yugoslav Chemical Societies ( <i>Serbia and Montenegro</i> )
National Committee for IUPAC ( <i>Egypt</i> )	Slovak Chemical Society ( <i>Slovakia</i> )
Suomen Kemian Seura-Kemiska Sällskapet ( <i>Finland</i> )	Slovenian Chemical Society ( <i>Slovenia</i> )
Comité National Français de la Chimie ( <i>France</i> )	National Research Foundation ( <i>South Africa</i> )
Deutscher Zentralausschuss für Chemie ( <i>Germany</i> )	Ministerio de Ciencia y Tecnología ( <i>Spain</i> )
Association of Greek Chemists ( <i>Greece</i> )	Svenska Nationalkommittén för Kemi ( <i>Sweden</i> )
Hungarian Academy of Sciences ( <i>Hungary</i> )	Schweizerische Chemische Gesellschaft ( <i>Switzerland</i> )
Indian National Science Academy ( <i>India</i> )	Türkiye Kimya Derneği ( <i>Turkey</i> )
Royal Irish Academy ( <i>Ireland</i> )	National Academy of Sciences of Ukraine ( <i>Ukraine</i> )
Israel Academy of Sciences and Humanities ( <i>Israel</i> )	Royal Society of Chemistry ( <i>United Kingdom</i> )
	National Academy of Sciences ( <i>USA</i> )



## IUPAC Secretariat

P.O. Box 13757 Research Triangle Park, NC 27709-3757 USA  
 Tel: +1 (919) 485 8700 Fax: +1 (919) 485 8706 E-mail: [secretariat@iupac.org](mailto:secretariat@iupac.org) [www.iupac.org](http://www.iupac.org)