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Art and Science
Looking in the Same Direction

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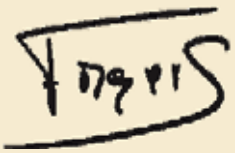
From the Editor

Just a few tantalizing words were enough to catch my attention. In a conference report published in *CI,* January 2005, Prof. Heinz Gamsjäger wrote that participants of the 11th International Symposium on Solubility Phenomena (ISSP) enjoyed an art exhibit called "Solubility: Art and Science" at the University of Aveiro in Portugal. The exhibit featured the works of invited artists, art teachers, and postgraduate students from the university, and was held simultaneously during the conference in July 2004. What a tease, I thought, to mention the exhibit without showing any of the works of art. I immediately contacted the conference organizers and asked them how we could use *CI* to expand the reach of the exhibit to all IUPAC members. After all, bridging the worlds of art and science seems possible, and more so for a conference series whose motto is "Similia similibus solvuntur" ("Like dissolves like"). I was quickly rewarded by my inquiry and received the exhibit catalogue and a CD presenting various pieces exhibited in Aveiro. At first glance, I was convinced that one way or another, this fascinating exhibit should be shared with you, and this issue has finally come. See pages 4-8.

The exhibit showed various painting techniques and different approaches to working with soluble materials. "Like dissolves like" is probably one of the most important and basic rules of chemistry that painters have to learn. Perhaps more than scientific insight, artists' intuition leads them to work with and apply that rule, and the results presented to us are simply delightful to enjoy.

In addition to reproducing a few original pieces displayed at the exhibit, authors Maria Clara F. Magalhães (professor at the Department of Chemistry and organizer of the 11th ISSP) and Rosa Maria Oliveira (professor at the Department of Communication and Art and coordinator of the exhibit) present reflections on what art and chemistry have in common. They also discuss mutual sources of inspiration in creating new art forms and other innovations.

As Prof. Oliveira wrote in the catalogue introduction, "Throughout history there are few moments when artists and scientists have worked together; however, there are many points where they converge in their creativity." If conferences could more regularly be the occasion for such convergence, they could facilitate interaction and foster communication between scientists and artists, thereby sparking creative minds in both worlds.



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Cover composition by Linda Graham, Purple Zante, Inc. The collage is made of paintings, drawings, serigraphs, and holographs presented at the exhibit Solubility: Art and Science, *Aveira, Portugal, July 2004.*

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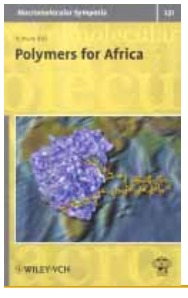

Encouraging Involvement Among Chemists

by David StC. Black

Since its inception in 1919, IUPAC has undergone constant change in order to maintain and increase its relevance to the international chemistry community. It has achieved an excellent reputation for its efforts related to the detailed infrastructure of the world of chemistry through its work in nomenclature, symbols, terminology, and standards and through its sponsorship of various conferences and publications. These activities remain at the core of IUPAC's mission, and they rely on the voluntary work of many scientists who are experts in their respective fields. Indeed, the current project system involves the efforts of approximately 1 000 expert chemists drawn from the entire international arena. Although the value and importance of the outcomes of the projects and related activities are understood and valued by chemists directly involved in IUPAC work, they are not always appreciated by the wider chemistry community. In today's climate, in which the general community, especially in Western countries, does not seem to hold chemistry in as high regard as it once did, it is incumbent upon IUPAC to publicize the benefits of chemistry to our quality of life—and the centrality of chemistry to life itself. The main goal of IUPAC must be to promote chemistry in the widest possible sense. The more important IUPAC can become in the day-to-day operations of the chemistry community, the greater its opportunities will be for promoting the importance of chemistry to the world at large. So how can we increase the number of individual chemists involved in IUPAC activities?

The project system is, of course, open to all chemists worldwide, including those from countries that do not have a National Adhering Organization (NAO) or even an Associate National Adhering Organization (ANAO). But despite the very few restrictions on participation, almost all projects are initiated through the various Divisions and Standing Committees, and it continues to be difficult to encourage chemists not previously involved in IUPAC work to participate. Attempts are made at some IUPAC conferences to generate enthusiasm among wider audiences, but success has so far been limited.

Another way to increase participation in IUPAC is through the Affiliate Membership Program (AMP), which was launched in 1986 with the express purpose of encouraging involvement among chemists throughout the world. A second aim of AMP was to disseminate information about IUPAC activities to a much wider audience. Affiliate membership provides some quite tangible benefits. Members receive bimonthly copies of *Chemistry International* (*CI*), which provides information about IUPAC programs and their operation, general news about developments in international chemistry, and discussion articles on contemporary issues in science. A diary of IUPAC-sponsored conferences is also regularly included, as are interesting reports presented at these conferences. Readers of *CI* are also kept up to date on current projects and on provisional recommendations or draft technical reports seeking general comment prior to approval. One of the most important characteristics of *CI* is that it is a magazine for and by members, and their opinions, suggestions, letters, and articles are always welcome. Certainly *CI* has become a much more interesting, inclusive, and attractive publication in recent years. Although individual copies can routinely be found in the satchels of IUPAC conference attendees, a regular subscription is highly desirable. A year's subscription to *CI* is also provided as part of the IUPAC Poster Prizes. *CI* is used as a mechanism for publicity, discussion, and stimulation, and it is produced in a reasonably cost-neutral manner, rather than for profit. It is more important than ever that *CI's* circulation be as wide as possible, and increasing affiliate membership is one way to achieve this goal.

Affiliate members are entitled to a 10 percent discount on registration fees for many IUPAC-sponsored conferences. The savings for just one conference far outweigh the cost of membership (USD 20, plus a small NAO handling fee). A discount of 25 percent on all IUPAC publications is also available to affiliate members. Such publications include *Pure and Applied Chemistry*, IUPAC nomenclature

books and compendia of data, and reports of many IUPAC-sponsored conferences.

One of the special features of the AMP is that it is essentially managed by NAOs, who are in immediate contact with chemists in their own countries. National chemical societies that act as NAOs sometimes include IUPAC affiliate membership as an option when members pay their dues. Automatically offering IUPAC affiliate membership to all national chemical society members in exchange for an appropriate minor increase in membership dues may be worth considering. The very real benefits of affiliate membership would far exceed the small increase in cost—and the regular arrival of *CI* in addition to the usual publications of the national chemical society should be a significant added attraction for members.

Essentially, it is the prerogative of the individual NAO to promote and use the AMP as they wish. Various NAOs might see different opportunities for the application of the program in their respective countries. In cases in which the NAO is a separate organization from the national chemical society, it could liaise with the chemical society to implement an effective AMP. Regardless of the details of operation, all NAOs and national chemical societies should consider this excellent opportunity to expand the horizons of their members. Such a broadened outlook would enrich members' expertise and possibly encourage them to more fully and actively participate in the international chemistry community. It would also bring added value to membership in a country's national chemical society, and thus support ongoing efforts to retain membership. Finally, a significant increase in affiliate membership would greatly enhance IUPAC's ability to speak with an authoritative, inclusive, and respected contemporary voice for chemistry in the world community.

IUPAC Secretary General David StC. Black <d.black@unsw.edu.au> has been involved in IUPAC since 1994 as a committee member of the Division of Organic and Biomolecular Chemistry, and served as Division vice president during 2002–2003. He has served as secretary general since 2004.

Art and Science

Looking in the Same Direction

*Drawing by **Isabel Seruca***

by Maria Clara F. Magalhães and Rosa Maria Oliveira

The present cultural convergence of art, science, and technology provides ample opportunity for artists and scientists to examine how these various areas of knowledge influence one another. We live in a time characterized by cross-disciplinary interaction, and those in the arts and sciences must develop new approaches to face the challenge of working together. If successful in meeting this challenge, innovators in these fields will be able to create exciting new art forms and achieve creative and useful technological innovations.

Relationship Between Art and Science

From prehistoric times to the Renaissance, there was little distinction drawn between art and science—both were viewed as important aspects of culture, driven by creativity. The Renaissance, however, initiated an era of specialization during which art and science began to move in different directions, intersecting only occasionally. Until recently it has been taken for granted that art and science have followed different paths, characterized by different languages and world views, making communication between participants in these two human pursuits nearly impossible.

In today's world, however, some artists have begun to study and employ the concepts, tools, and contexts of scientific and technological research, and advances in technology increasingly allow the artist to operate outside the conventions of traditional practice. We believe that during the 21st century, this trend will continue to evolve and become more widespread, leading to new techniques and materials and new aesthetic perspectives that will be used to convey artists' unique conceptual experiences of the world.[1]

Chemistry's Role in Art

Even as far back as the stone age, the ancient relationship between art and chemistry can be perceived in early humans' recognition and exploitation of differences in the properties of natural dyes and pigments in terms of color, transparency, and texture, and in the use of water and fire in the transformation of these materials. Throughout history, the discovery of new minerals and other materials has led to new aesthetic possibilities. In modern times, chemistry—as the science of the properties of materials, and of their transformations—has continued to serve as a source of inspiration for art. And artistic pursuits in turn influence work in chemistry. Jewelry-making and sculpture lead to the development of new alloys, and the visual arts and architecture motivate research into new materials with unique chemical compositions, structures, particle sizes and shapes, and stability in reaction to light and weather.

Science also enables us to deepen our knowledge of artistic masterpieces by using a plethora of analytical techniques to investigate the composition of the materials used, their origins, and the artist's technique, as well as ultimately helping to determine the authenticity of the pieces themselves.

Our reflections concerning the links between chemistry and art arose from the exhibition *Solubility: Art and Science*, presented at the 11th International Symposium on Solubility Phenomena Including Related Equilibrium Processes, held in Aveiro, Portugal, in July 2004. This discussion touches on several different connections between chemistry and art, including art and chemistry as mutual sources of inspiration, the properties (specifically solubility) of materials, and some of the associated techniques used in creating works of art.

Art and Chemistry as Mutual Sources of Inspiration

Pursuits in both the arts and sciences are strongly influenced by the emotions of the individuals who undertake them, as well as by numerous social and aesthetic influences. Creativity is one of the common drives of all human beings, and we must not forget its importance in scientific work and in the evolution of modern society in general. For example, Nobel Prize winners Roald Hoffman[2] and Jean-Marie Lehn[3] call attention to the importance of creativity in chemistry, particularly in the synthesis of new molecules and materials, with wholly new properties, that have not previously existed on earth, as a most obvious expression of the similarity of approaches to chemistry and art. Like artists, chemists combine existing elements in previously unknown ways to create something entirely new. And like art, science seeks to bridge previously disparate areas of knowledge, allowing scientists to look at materials in new and different ways, and to make unexpected associations that lead to new discoveries. In science, as in art, it is necessary to tap into imagination and creativity in order to rise above accepted knowledge and practice to create new mod-

els and theories that can stimulate or accommodate new knowledge.

Scientists work within their own epoch, and sometimes it takes an outside influence to allow mental barriers to be broken down. One example is the discovery of a whole family of carbon allotropes named fullerenes, in which the carbon atoms are arranged in spherical or ellipsoidal structures. Harold Kroto made this discovery after recognizing the structural significance of the geodesic domes built by twentieth-century architect R. Buckminster Fuller.

Science in general, and chemistry in particular, can also be a source of inspiration for artists. In literature, the beautiful passages on the subject of water in James Joyce's *Ulysses* merit particular attention. The confluence of science and art can also be enjoyed in the books *Chemistry Imagined, Reflections on Science* (Smithsonian Institution Press, Washington and London, 1993), by Roald Hoffman and Vivian Torrence, and *Crossing Over, Where Art and Science Meet* (Three Rivers Press, New York, 2000), by Stephen Jay Gould and Rosamond Wolff Purcell. These two very different works were produced by very different scientific and artistic personalities who nevertheless share a passion for their work and an ability to make science clear, stimulating, and highly enjoyable to the general public.

Fig. 1 Oil on Canvas by ***Susana Távora***

It should also be noted that although scientific papers are not normally an arena for presenting original works of art, popular articles on science often rely on artistic renderings to introduce concepts and make them understandable to the reader.

Artistic Materials and Their Properties

As well as serving as mutual sources of inspiration, chemistry and art also influence each other in the realm of the physical. Progress in the study of chemistry, for example, brings new techniques and materials to the art world. Research on artistic mediums and materials is relevant to a whole host of artistic fields, including painting, sculpture, photography, holography, cinema, engraving, stained glass, architecture, jewelry-making, perfumery, and textiles. And detailed analysis of the materials and construction of certain paintings and other works of art can afford us insight into the scientific ideas of the artist's own epoch, and of the artist him or herself. The mutual influence between DaVinci's pursuits in the fine arts and his studies in anatomy, mechanics, and optics are perhaps the best example.

Among the large range of properties of materials that influence artistic expression, solubility was chosen as the particular subject of the exhibition *Solubility: Art and Science.* Solubility is important in differentiating pigments from dyes. Both types of materials are natural or synthetic substances used to impart color to another substance, but pigments are powdered substances used in suspension—they are practically insoluble in solvents and binders—whereas dyes are applied in solution. The study of chemistry has been indispensable in the development of both types of materials, from the prehistoric use of natural pigments to the development of modern synthetic dyes. And throughout history, the new colors and techniques made possible by chemistry have had a great influence on the development of art.

Artistic Techniques Presented at the Exhibition

The works of art presented in the *Solubility: Art and Science* exhibition were created using many different technologies and materials, and they represent various forms of artistic expression. Each work of art is unique, even among those produced by the same artist. However, every great artist is aware that he or she must take into consideration the specific properties and limitations of the technology or materials used to produce a work.

Painting:

The paintings presented in the exhibition included *oil on canvas* (Figure 1 and 2), in which the materials used are colorants, both organic and synthetic, mixed with linseed oil and white spirit, allowing the artist to apply successive layers to achieve the desired colors and to give the illusion of shape and volume. This technique has been in wide use since the 15th century. Other paintings in the exhibition were created with *watercolors* (Figure 3), in which transparency is fundamental. The colorants used are soluble in water. The stroke of the paintbrush must be secure and firm—hesitation leads to failure, and corrections are not possible. The use of *acrylics* (Figure 4) is a relatively recent development. Acrylics are soluble in water, but still allow the artist to work in successive layers and to achieve various textures. They dry very quickly, however. In each of these cases, the specific characteristics of the materials used have a profound influence on the technique employed by the artist, and thus on the emotion conveyed by the final work.

Drawing:

The drawings presented in the exhibition were created using ink and graphite, which have traditionally been used to achieve different tonalities of light and shadow, and thus give the illusion of depth and volume (Figure 5 and on page 4).

Serigraphy:

Serigraphy (Figure 6) is used to produce multiple copies of a work. The artist applies beeswax to a fine net of silk or nylon to create a kind of stencil for each color used. This stencil is then placed over a sheet of

*Fig. 2 - Oil on canvas by **Isabel Azevedo***

*Fig. 3 - Watercolor by **Manuela Oliveira***

*Fig. 4 - Acrylics by **Chuva Vasco***

*Fig. 5 - Drawing by **Isabel Seruca***

*Fig. 6 - Serigraphy by **Isabel Maria Dos***

*Fig. 7 - Holography by **Rosa Maria Oliveira***

paper, and colorants are mixed with white spirit and spread out over the netting, transferring to the paper through those areas to which beeswax has not been applied. This process is repeated for each color used in the work.

Holography:

This technique (Figure 7) represents a close relationship between art and science. Holography is based on the principles of physics, using coherent light. A recording of the image is made on a plate of film or glass coated with a light-sensitive emulsion. After imaging, the plate or film is developed in various chemical developers and bleachers in order to develop and fix the recorded image. The holograms presented in the exhibition were also preswollen in different solutions of triethanolamine to achieve multicolored final images. The colors attained are determined by controlling the preswelling of the emulsion.

As can clearly be seen from the illustrations, the specific characteristics of the materials used have a profound influence on the technique employed by the artist, and on the emotion conveyed by the final work of art.

Acknowledgments

The authors would like to express their deep appreciation to each of the artists who contributed to the exhibition, and to all the conference participants for their interest. Special thanks also go to professor Glenn Hefter for his comments on this text.

Maria Clara F. Magalhães <mclara@dq.ua.pt> is a professor in the Department of Chemistry, and Rosa Maria Oliveira is a professor in the Department of Communication and Art, at the University of Aveiro, Aveiro, Portugal.

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Frontier Science in the Middle East

by John M. Malin

The conference, *Frontiers of Chemical Sciences II: Research and Education in the Middle East,* commonly known as *Malta II*, took place on neutral ground in Valetta, Malta, 5–10 November 2005. This groundbreaking event united scientists from Middle Eastern countries and beyond to discuss shared challenges related to the environment, materials science, medicinal chemistry, nanotechnology, energy, and education.

A key objective of the conference was to find ways for scientists from conflicting Middle Eastern countries to work together to achieve common goals. The conference had an outstanding turnout. Of the 80 participants, all convened by invitation, 56 were from Middle Eastern countries: Bahrain (1), Egypt (10), Iran (6), Israel (13), Jordan (3), Kuwait (1), Lebanon (3), Palestinian Authority (11), Qatar (1), Saudi Arabia (3), Turkey (2), and United Arab Emirates (2).

A multinational organizing committee chaired by Professor Zafra M. Lerman from Columbia College in Chicago (USA) organized the event. IUPAC, the American Chemical Society (ACS), the Royal Society of Chemistry (RSC), and the German Chemical Society or Gesellschaft Deutscher Chemiker (GDCh) were cosponsoring organizations. Additional support was provided by the Organization for the Prohibition of Chemical Weapons (OPCW), the Camille and Henry Dreyfus Foundation, and a number of public and private donors.

The conference featured lectures by Nobel laureates Aaron Ciechanover, Richard Ernst, Yuan T. Lee, Jean-Marie Lehn, Roald Hoffmann, and F. Sherwood Rowland. Other presenters included Kurt Begitt, Helmut Ringsdorf, David N. Reinhoudt, Leiv Sydnes, Michael Graetzel, Peter Atkins, and Simon Campbell. A special thank you goes to Charles E. Kolb, Ann Nalley, Catherine Costello, Zafra Lerman, Thomas Spiro, Paul Walter, Stephen Ritter, and Jeffrey Wade, who did an outstanding job organizing the conference.

Plenary Sessions and Workshops

Malta II opened with a welcome reception, dinner, and a plenary session chaired by Ahmeen Farouk Fahmy of Egypt. The first plenary address, by Peter Atkins, was titled *Galileo's Finger: The Ten Great Ideas of Science.* Atkins presented a lively tour-de-force of physics, biology, chemistry, and mathematics in which he lauded the scientific contributions of Charles Darwin, Francis Bacon, J. Willard Gibbs, Albert Einstein, Isaac Newton, James Watson, Francis Crick, William Hale, and Kurt Goedel.

(Purple) Middle Eastern countries participating in Malta II

A formal opening ceremony extended a warm welcome to all conference attendees. Zafra Lerman (conference chair), Paul Walter (master of ceremonies), Ann Nalley (ACS board representative), Simon Campbell (RSC president), Leiv Sydnes (IUPAC president), Kurt Begitt (GDCh representative), and Bijay Chatterjee (OPCW representative) conducted the opening ceremony.

Alfred Abed Rabbo, Bethlehem University (Palestinian Authority) chaired a stimulating session in which Yuan T. Lee (Nobel laureate, Taiwan) spoke on "Energy, Environment and the Responsibilities of Scientists." Dr. Lee posed a sobering question: "If all the world lived as we in the developed countries do, how many Earths would it take to support our lifestyle?" He inspired attendees by stating that the twenty-first century could be a great turning point in human history if we work together to share ideas, solve problems, develop new technical options, and learn how to live with limited resources.

Other plenary sessions covered such topics as medicinal chemistry, environmental air and water quality, nanotechnology, energy and solar cells, and science education. The workshops provided an opportunity for many of the Middle Eastern scientists to share their work with their colleagues while discussing challenges and areas for future development and research.

In a shared cultural experience, participants attended a concert of Middle Eastern and classical music at Valetta's Manoel Theater, now Malta's national theater. Attendees enjoyed compositions by Bach, Schumann, Wiesenberg, and Ben-Haim performed by a trio of Palestinian and Israeli musicians who played an unusual grouping of violoncello, piano, and oud. The event was hosted by Maria E. Michel-Beyerle, a chemistry professor and musician from the Technical University of Munich, who obtained sponsorship from the Aventis Foundation and the Stiftverband für die Deutsche Wissenschaft.

A poster session, featuring some 40 presentations, mostly by Middle Eastern scientists, continued throughout the conference. Discussions and networking sessions took place around the posters during conference breaks and sometimes extended well into the evening. On one evening, after some initial coaxing by Professor Hoffman, participants took part in a lively, impromptu session of Middle Eastern music and dancing. Previous tensions that were evident during *Malta I* were no longer present, which created a friendlier, more relaxed atmosphere for all.

Progress Since *Malta I*

One of the sessions covered the outcomes from the first Malta conference held in December 2003. One of the outcomes is a collaborative proposal for research on water quality submitted by Palestinian scientists from the University of Bethlehem and Israeli chemists from Bra Ilan University and the Weizmann Institute; that proposal has been funded by an international agency. Improved communication between Palestinian and Israeli universities has led to a scientific exchange agreement with the Weizmann Institute.

At *Malta I*, Professor Yuan T. Lee offered full fellowships for three Middle Eastern students to study the use of synchrotron technologies at the Taiwan synchrotron facility. That first group of three students has completed its studies, and a second group will be visiting Taiwan soon.

As a result of the *Malta I* conference, a special symposium on Middle Eastern chemistry was organized at the February 2005 national meeting of the American Association for the Advancement of Science. The U.S. National Science Foundation (NSF) also recognized the *Malta I* conference as an example of outreach to

the broader community by including the conference in a special poster symposium at the Fall 2005 ACS National Meeting. The NSF has also made a substantial grant of more than USD 100 000 to Professor Hoffmann to hold workshops for U.S. and Middle Eastern students. The first workshop was held in Petra, Jordan, and two more are scheduled to be held in Egypt and Quatar. It was also recognized that in August 2004, some 15 scientists from eight countries met at the IUPAC-sponsored International Conference on Chemical Education, held in Istanbul, Turkey, to discuss Middle East collaborations.

Success and Encouragement

On the last day of the conference, attendees were given an opportunity to offer feedback on the week's events. Some of their words follow:

"The conference and the efforts are an excellent way of improving contacts between countries in the region. I hope this meeting will continue the peace process."

"I hope that the political situation would change in such a way as to allow scientists to travel and work in other countries in the region without incurring the disapproval of their governments and colleagues. I am an optimist and believe the conference will further this goal."

"The conference could catalyze the creation of an action group among scientists in the region to work for enhancing harmony and peaceful coexistence in the area."

"In order to fulfill the real goal of the Malta conference, priority should be given at future conferences to establishing a working group for participants, which is supported by the Nobel laureates and funding agencies."

"Let's keep working to bridge the gap between neighbors in the Middle East. Create the atmosphere of trust to lead to a better future for people in this region."

Future Actions

In the final session, recommendations for future actions emerging from each specific workshop were discussed in the areas of environmental air and water quality, nanotechnology, energy and solar cells, chemical education, and medicinal chemistry.

In addition, there was a clear consensus that a *Malta III* conference should be held in 2007. Participants suggested that *Malta III* could be organized under IUPAC auspices, perhaps through CHEMRAWN, involving the SESAME (Synchrotron Light for Experimental Science and Applications in Middle East) facility in Jordan, or possibly in Cyprus.

Participants felt that communications should be facilitated by enabling a Web discussion group. Also, they thought it would be helpful to identify IUPAC events, such as CHEMRAWN conferences, where Middle Eastern participants could discuss their progress.

Conferees (standing, l to r) Sultan Abu-Orabi, Mona Al Huseiny, Hassan Moawad Abd El Al, and Azam Iraji-Zad. (seated, l to r) Nadia Kandile, Ann Nalley, Miriam Waldman, and Zafra Lerman.

Jordanian Chemists Join IUPAC

In January 2006, Jordan became a National Adhering Organization (NAO) of IUPAC through the Jordanian Chemical Society (JCS). The JCS was established in 1976 with 30 members, and that number has increased ten-fold since then. Professor Sultan T. Abu-Orabi, president of Tafila Technical University, is president of the JCS and also president of the Arab Union of Chemists. Strengthening relationships is a key objective of the Society—relationships not only among Jordanian chemists, but also with the regional and international chemistry communities.

Sources of support for international collaboration with Middle Eastern scientists need to be identified. J. Malin and Miriam Waldman volunteered to create a database to facilitate this process. Attendees also felt it would be helpful to have a map of Middle Eastern scientific facilities for research projects.

Overall, it was agreed that scientists need to work harder to help colleagues cross national borders. In addition, participants suggested that students and younger scientists be invited to the next Malta conference.

Conclusion

After the closing session, attendees enjoyed an excursion by boat to the historic Maltese city Vittoriosa and were given one final chance to network and share ideas. During the farewell gala dinner held at the Palazzo Parisio in Naxxar, Professor Sultan Abu-Orabi presented the Shield of the Jordanian Chemical Society to the organizers and representatives of sponsoring societies. Many discussions took place among Israeli, Arab, and Persian participants that are expected to lead to fruitful interactions.

No one could have anticipated the success of the *Malta I* and *II* conferences. Attendees were left with a great feeling of hope and inspiration as they traveled home to further their work of using science as a medium to promote stability in the Middle East.

John M. Malin <jmalin023@comcast.net> is chair of the IUPAC CHEMRAWN committee. He was involved in the organizing committee of Malta I and II.

A longer report is available from the corresponding IUPAC project webpage.

www.iupac.org/projects/2004/2004-030-1-020.html

Communicating Science Information Clearly

by Manuel Carmona Yebra

It happens every day: a journalist or a government official needs scientific information on a thorny subject such as dioxins or genetically modified food. They go online to look for help, and thousands of Web pages pop up in response to their query.

First, they find a long scientific assessment written in technical jargon by a research institution. Then, they come across a seemingly helpful industry report, but are unsure of its credibility because of the financial interests of the corporate author. Finally, they end up on the Web site of an advocacy group that offers a message that is overly dramatic, but at least comprehensible. By this time, the researchers' desire to obtain unbiased scientific information has faded in frustration, and their hope for a balanced article or informed political decision with it.

Fortunately, a solution is at hand. Since 2001, clear, authoritative scientific information on health and the environment has been available at <www.GreenFacts.org>. GreenFacts is a nonprofit organization based in Brussels, Belgium, devoted to communicating the scientific consensus on controversial topics such as genetically modified crops, climate change, and air pollution. In the words of Jacques de Selliers, general manager of GreenFacts, the organization "strives for a reasoned and well-balanced approach to scientific topics by publishing clear summaries of authoritative reports, in cooperation with international organizations such as the World Health Organization (WHO), the Food and Agriculture Organization (FAO), and the European Commission."

Communicating the Scientific Consensus

GreenFacts' sole purpose is to communicate scientific information. It does not lobby or engage in political advocacy; rather, it offers clear summaries of scientific documents on a wide range of issues—from fisheries and endocrine disruptors to ecosystem change and tobacco—free of charge to readers. The summaries are written in plain language accessible to readers without a scientific background. GreenFacts' goal is to help its main audience—journalists and policymakers—engage in fruitful, informed dialogue on difficult topics and contribute confidently to decision-making processes.

In developing its summary documents, GreenFacts culls through a tremendous amount of scientific information, generally avoiding reports produced by organizations that may be influenced by political and financial interests and those produced by individual experts who may include personal views in their findings. Instead, GreenFacts focuses on documents that are produced by large panels of international experts and that reflect the current state of knowledge on any given scientific subject. For example, GreenFacts often draws on documents published by authoritative organizations such as WHO, FAO, or the Intergovernmental Panel for Climate Change (IPCC).

Most of the documents chosen are extensive and are written in a technical language that only experts can easily digest. For example, the *IPCC Third Assessment Report on Climate Change—Summary for Policymakers* runs over 200 pages and is written in highly technical language. GreenFacts' summary of the report, in contrast, offers five pages of clear, readable text and easy access to both more details and the full source document.

Three Levels of Scientific Detail

GreenFacts' approach to presenting information is simple, yet innovative. GreenFacts uses a copyrighted Web-based system to communicate information in three increasing levels of detail.

- Level One presents a brief abstract of the paper's key topics.
- Level Two presents a more detailed summary of the same key topics.
- Level Three presents the source document itself, again broken out by the same key topics.

De Selliers describes the three-level structure like this: "Each paragraph can be expanded with a simple click, so journalists and decision-makers, starting at Level One, can read a short, clearly presented sentence to get the main idea, click to read more details

in Level Two on an issue of concern, and click again to verify the statements within the scientific source document in Level Three."

GreenFacts' process of summarizing scientific documents follows a strict validation scheme—including a scientific peer review. The process is managed by an independent board that ensures that the summaries are faithful to the source and are unaffected by politics or special interests. In addition, representatives from all of GreenFact's member groups—industry, NGOs, and academia—are consulted before and during the process of summarizing documents.

"Our publication process may seem cumbersome," de Selliers comments, "but it is essential, for it allows GreenFacts to maintain its credible position both in the eyes of the scientific community and with environment and health stakeholders who demand impartial, unbiased sources of information."

Increasing Dialogue Among Stakeholders

From the beginning, GreenFacts recognized that progress in communicating health and environmental issues would need to be based on cooperation, solid scientific premises, and multi-stakeholder involvement. GreenFacts was established in December 2001 with the help of Solvay, a Belgian chemical and pharmaceutical group. Initially, industry sources provided a significant amount of GreenFacts' funding, but by 2005, they were providing only 40% of the group's total budget. The remaining 60% is now covered by donations from international institutions, governments, foundations, and individuals.

GreenFacts was established in a period of a remarkable increase in stakeholder dialogue. For example, in 2002, at the United Nations Johannesburg Summit on Sustainable Development, the head of Greenpeace International met with industry leaders to discuss what could be done to improve the world's environmental and health prospects.

Building on this momentum, in 2003, GreenFacts organized a Brussels-based conference: Conveying Science into Policy. The event examined how science is communicated and how environmental decisions are made. It brought together approximately 100 representatives from nonprofit organizations, associations, industry, and government, all of whom took part in working groups that addressed three key questions: Who communicates science? What is the nature of environmental decision-making? How can governments and institutions improve the image of science?

GreenFacts subsequently organized two roundtable meetings at conferences on Communicating European Research sponsored by the European Commission. The first roundtable, held in 2004, focused on how to bring scientific information to nonspecialists. The second, held in 2005, focused on how to communicate environmental research in the media.

In addition, to further foster a spirit of cooperation, GreenFacts offers its members in industry, nongovernmental organizations, media, and government the use of GreenFacts studies and tools on their own Web sites and in their own communication strategies. One such tool, the GreenFacts Question Box (or "Q-Box"), provides ready-made HTML code that lets members easily integrate GreenFacts information on a particular topic into another Web site. This feature allows GreenFacts' partners to improve the credibility of the information they provide by linking to a neutral source of scientific data.

Jacques de Selliers
GreenFacts General Manager

GreenFacts website provides easy access to faithful summaries in layman's terms and in several languages.

Science for the Citizens

In the wake of highly publicized health debates and health threats related to scientific issues ranging from genetically modified crops to stem cell research, the public has grown suspicious of scientists, industry representatives, and even academicians. But it is not too late to win back public trust. One way to do that is to focus on presenting scientific information in a clear, unbiased manner.

GreenFacts has embraced the challenging task of widening the dissemination of scientific information to citizens who want to know the why and how of an issue, be they professionals, journalists, decision-makers, or simply concerned individuals. Increasing the public's understanding of complex scientific issues will ultimately benefit our society at large.

www.greenfacts.org

Can Ambiguous Terminology Cause a Barrier to Trade?

Paul De Bièvre asked us this question in a recent article published in the *CI* series, "Emerging Issues in Developing Countries" (*CI* Sep–Oct 2005, pp. 18–20). The following piece includes both a letter from William Horwitz received in response to De Bièvre's initial publication, and De Bièvre's subsequent reply.

Letter from William Horwitz

Now that I am retired and have no professional responsibilities, perhaps I can comment on the article "Emerging Issues in Developing Countries" by my friend Paul De Bièvre that appeared in the Sept.–Oct. 2005 issue of *Chemistry International*, pp. 18–20. I have admired Paul over the years for his command of non-native English and his zeal in trying to instill the importance of metrology to ordinary analytical chemists.

As a result of my more than 65 years of practice in regulatory analytical chemistry with the U.S. Food and Drug Administration, with AOAC International, and as the U.S. Delegate to the Codex Alimentarius Committee on Methods of Analysis and Sampling, I am aware of the importance of standards, uncertainty, and metrology. I have always referred to the writings of W.J. Youden, John Taylor, and Grant Wernimont, because these authors were readable and understandable. I also have been exposed to the metrological documents from ISO, VIM, and the corresponding documents from our own NIST, but I must confess that after all this time, this literature is still largely incomprehensible to me. Metrology is fundamental to all measurements, but understanding metrological documents is probably inversely proportional to their importance.

Unfortunately, Paul's article is another example in obfuscation. I am a type 2 diabetic and my glucose value can vary from day to day by 5 to 10 percent, so the difference in international standards from country to country of perhaps less than 1 percent is an absurd justification for "identical understanding of the same concepts." It is merely common sense that units should be the same the world around; there should be no problem in obtaining the concurrence of chemists, as in the case of IUPAC nomenclature for organic compounds, when it is presented in understandable terms. The problem occurs because most explanations of the definitions and distinctions in metrology are incomprehensible.

Take the paragraph on "Quantity," which provides a superb example of the problem. After reading the paragraph innumerable times, I still did not see the distinction between quantity and amount. So I turned to my desk dictionary to find that linguistically a quantity is "1. An amount or portion; either, a measurable or numerical amount; or, loosely, any amount capable of an increase or decrease in kind…05. Math. Whatever may be operated upon according to fixed mutually consistent laws;—distinguished from a magnitude."

Turning to magnitude: "1. Greatness; as: a Physical greatness…2. a. Size; special quality. b. Quantity, capability of being greater or less. 3. Astron…4. Math. A number assigned to a quantity, by which the quantity may be compared with other quantities of the same class."

It appears that the distinction that is desired is that "quantity" is the item and "amount" is its magnitude. But then the second sentence destroys this insight: "Thus, in chemical measurement, 'quantity' is 'concentration,' 'content,' 'amount-of-substance fraction,' or 'mass fraction.' But 'quantity' is also used by chemists colloquially to mean 'amount.'" This then pulls the rug out from under my understanding! Further: "Thus we often talk ambiguously about a 'quantity of sample.' If we want to express 'how much of a substance there is,' then the term 'amount' should be used to avoid confusion." To me, a 1.0000 gram test portion (not "sample" by IUPAC and ISO nomenclature!) removed from a test sample is an unambiguous quantity or amount, and I do not yet see the distinction.

There, in a nutshell, is the problem that metrologists have: They are unable to clarify the major distinctions they see in concepts that are indistinguishable to the multitude of chemists.

Dr. Horwitz retired from AOAC International (Gaithersburg, Maryland, USA). In the 90's, he was involved in the IUPAC Analytical Chemistry Division, and more particularly with the former Commission on General Aspects of Analytical Chemistry.

Reply by Paul De Bièvre

It has given me great pleasure that my good American colleague in measurement Bill Horwitz has taken so much notice of my recent article in *CI*. As it is the explicit intention of this series in *CI* to be "up for discussion," I will comply.

I am retired, too, and I do not believe that our professional responsibilities are thereby ended. If one has accumulated professional experience in measurement on the intercontinental scene spanning four decades, and can combine that experience with the ability to look at the measurement scene from a distance in space and time, that constitutes a great asset. In addition, listening to questions from audiences on the six continents is an enormous learning experience. I think both of us should continue to utilize those assets—as Bill does by writing his letter.

However, right away he delivers clear proof of the ambiguity in the English language of a basic concept (and associated term) in measurement: "quantity." He disputes my statement on the use of "quantity" and supports his argument by the results of his diligent search in various dictionaries, the very purpose of which is to explain terms used in daily language. But the meaning of concepts and terms in measurement are not to be found in a desk dictionary for ordinary language but in a vocabulary, defined by the 2000 ISO International Standard 1087-1, 3.7.2 as a "terminological dictionary which contains designations and definitions from one or more specific subject fields." For the field of measurement, that is the International Vocabulary of Basic and General Terms in Metrology (i.e., in all measurement), known as the "VIM," set into existence by international vote in 1983 (ISO).

In the VIM (and such other handbooks, like the IUPAC Green Book *Quantities, Units and Symbols in Physical Chemistry*) "quantity" and "amount" are not synonyms, despite the fact that Horwitz writes: "After reading the paragraph innumerable times, I still did not see the distinction between quantity and amount."

Quantities in measurement include mass, length, time, and, more specifically in chemical measurement, mass fraction and concentration. Quantities are the things we measure. Amount is a concept created to help us talk about "how much is there of what we measure?"—usually in terms of numbers of specified entities (in chemistry: the number of specified particles such as atoms, molecules, or ions of a specified substance).

Must we ask the question whether an internationally agreed-upon specific vocabulary is there to be ignored when "globalization" has also come to chemical measurement results, helping us to determine the value of goods in trade? The use of one term for different concepts or the use of several terms for the same concept is a pain in the neck for non–English-speaking people and for those who must translate these terms in 30 to 40 other languages and try to ensure that the same concepts convey equally in all languages.

The continuing use of one of the most ambiguous terms in the English language—the word "standard"—without qualification is another case in point for people who are not trained to the "interpretation in context" so dear to the English-speaking part of the world, especially when he or she comes from a culture with a totally different language structure than the family of European languages.

It is not difficult to point to other similar examples. Here, in a nutshell, is an ongoing problem for many chemists conducting measurements: Clusters of chemists (e.g., in the food, clinical, environmental, industrial, and isotopic fields) have developed their own terminology, thinking that they had to invent anew their own basic concepts, applicable for their use only, to be understood by themselves only, and usable in a jargon-like fashion. This was done under the assumption that the jargon could be translated in a simple way into other languages. But it cannot.

Basic terms and concepts should be common to all measurement. Common terms and concepts are prerequisites for making meaningful translations in several languages and for intercontinental use.

Large cultural communities, each with their own language, will have to decide whether they want the terms in their language to cover globally understood and agreed-upon concepts. Therefore, they need to respect a common and consistent vocabulary rather than a dictionary. Only then can terms be consistently translated from language to language. If we do not have, consult, or use a common vocabulary (rather than an ordinary language dictionary), how can we speak a common technical language?

Introducing metrological concepts in chemistry is like introducing common communication tools for clarity; it's a prerequisite for understanding. And understanding is a prerequisite for intercontinental agreements, including trade agreements.

Paul De Bièvre <paul.de.bievre@skynet.be>, a long-time member of IUPAC, is an independent consultant on metrology in chemistry based in Belgium. He is currently a member of the Interdivisional Working Party for Harmonization of Quality Assurance of the IUPAC Analytical Chemistry Division.

What Is Butadiene?

by Karl-Heinz Hellwich

What is butadiene? You might think that's a question too simple to ask. But, are you sure? Whatever you guess, your answer will surely be better than the exam response of a student who defined butadiene as "a conjugated double bond." Of course, butadiene is not a double bond. But, what is it then? We can approach this question on two different levels. Butadiene is a word, that is, a name for a thing. In knowledge theory there is much discussion as to whether a thing and the name for the thing can be equated. A name is arbitrary and typically emphasizes a particular aspect of the described thing. However, the thing named by the word remains the same, and many of its other properties remain uncertain, even if another designation is selected. (Another possible word to describe what we call butadiene would be tetradiene, which emphasizes the same property.) The fact that a name never describes all the properties of a thing can cause confusion.

Let's assume that with the designation butadiene we are concerned with the substance. It is therefore clear now that it is a chemical compound. The question of whether it is a single molecule, or the macroscopic substance consisting of many molecules that is gaseous at room temperature and is used in the laboratory or in a chemical plant, is only mentioned and neglected here, but it shows that the aspect under which butadiene is considered is important.

Like the above-mentioned student, most readers will probably think of buta-1,3-diene with its two conjugated double bonds, which is the starting material for Buna® and several copolymers on multi-ton scales or used in Diels–Alder reactions. Recently, when reading a publication, I doubted this was really the starting material of the described products. The authors had failed to mention that they worked with buta-1,2-diene—also a gaseous compound at room temperature, but a much less commonly used material. Only a note at the end of the publication made it reasonable to suppose that the authors wrote about allenes and reactions at cumulated double bonds.

It is apparent that the situation noted at the beginning of this article—that is, that a thing can have different designations in different languages—must be reversed for chemical nomenclature. Here it must be ensured that the information relayed is accurate, such that the recipient of the information—a listener or a reader—understands what the author wants to convey. In the case of butadiene, an author must therefore specify whether he means buta-1,2-diene or buta-1,3-diene.

Authors of publications must realize the importance of being precise in their writing—just as they would be in the laboratory—to ensure that information is readily understood by readers and interpreted in the intended way. In an everyday laboratory setting with a closed team, abbreviations and contractions may be used that are inappropriate in a larger setting because they are inaccessible, especially if the contractions originate in chemical nomenclature or are derived from the international nonproprietary names for drugs.

Dr. Karl-Heinz Hellwich <hellwich@beilstein-gmbh.de>, from Offenbach, Germany, is a member of the IUPAC Chemical Nomenclature and Structure Representation Division (VIII). He is also involved in an IUPAC project dealing with terminology and nomenclature of macromolecules with cyclic structures.

Alexandra Navrotsky Awarded the 2006 Rossini Lecture

The recipient of the 2006 Rossini Lectureship Award, selected by the Board of Directors of Directors of the International Association of Chemical Thermodynamics (IACT), is Professor Alexandra Navrotsky of the University of California at Davis, director of the UC Davis Organized Research Unit on Nanomaterials in the Environment, Agriculture and Technology. The highly esteemed award, made by IACT, is given in recognition of a significant contribution to the field of thermodynamics.

Navrotsky was educated at the Bronx High School of Science and the University of Chicago (where she received a B.S., M.S., and Ph.D. in physical chemistry). After postdoctoral work in Germany and at Penn State University, she joined the faculty in Chemistry at Arizona State University, where she remained until her move to the Department of Geological and Geophysical Sciences at Princeton University in 1985. In 1997, she became an interdisciplinary professor of ceramic, earth, and environmental materials chemistry at the University of California at Davis, and in 2001 she was appointed the Edward Roessler Chair in Mathematical and Physical Sciences.

Her research interests have centered on relating microscopic features of structure and bonding to macroscopic thermodynamic behavior in minerals, ceramics, and other complex materials. She has made contributions to mineral thermodynamics; mantle mineralogy and high-pressure phase transitions; silicate melt and glass thermodynamics; order–disorder in spinels; framework silicates and other oxides; ceramic processing; oxide superconductors; nanophase oxides, zeolites, nitrides, and perovskites; and the general problem of structure-energy-property systematics. The main technical area of her laboratory is high-temperature reaction calorimetry.

The Rossini award is presented at the Biennial IUPAC Conference on Chemical Thermodynamics, where the recipient delivers the Rossini Lecture (see ICCT announcement p. 40). Recipients in the past decade have been Robert A. Alberty (1996), Stanley I. Sandler (1998), William A. Wakeham (2000), John M. Prausnitz (2002), and Jean-Pierre E. Grolier (2004).

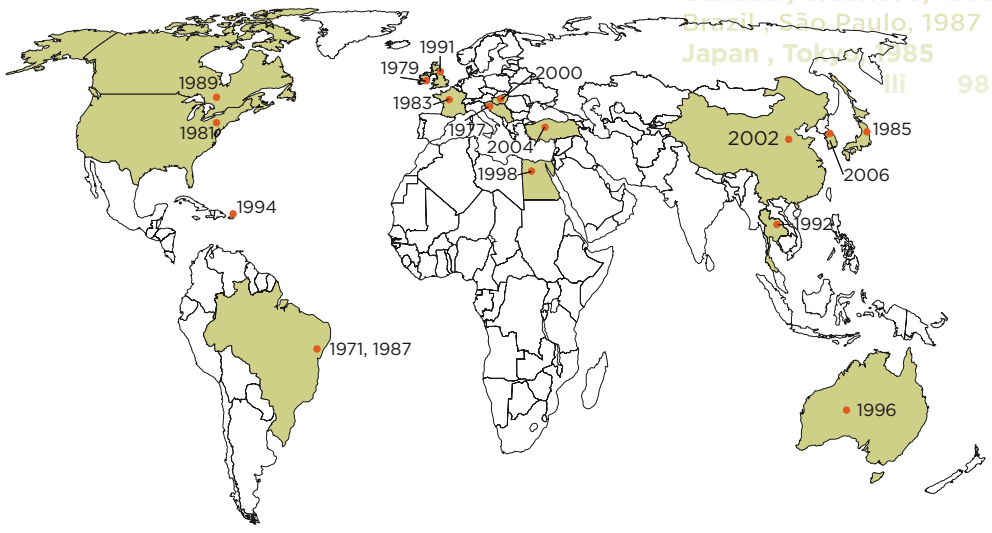
For more about IACT, see CI, Jan–Feb 2004; for more about the Rossini lecture, see CI, March–April 2003.

The CCE Seeks Expressions of Interest in Hosting the International Conference on Chemical Education

The International Conference on Chemical Education is a biennial event planned by the IUPAC Committee on Chemistry Education (CCE). The 19th conference in the series will be held 12-17 August 2006, in Seoul, Korea. CCE now invites possible hosts for the 2010 conference.

A letter expressing interest should be sent to Peter G. Mahaffy, CCE chairman, by 1 August 2006; Mail: King's University College, Department of Chemistry, 9125 50th Street, Edmonton, AB T6B 2H3, Canada; E-mail: peter.mahaffy@kingsu.ca.

Korea, Seoul, 2006
Turkey, Istanbul, 2004
China, Beijing, 2002
Hungary, Budapest, 2000
Egypt, Cairo, 1998
Australia, Brisbane, 1996
Puerto Rico, San Juan, 1994
Thailand, Bangkok, 1992
England , York, 1991
Canada , Waterloo, 1989
Brazil , São Paulo, 1987
Japan , Tokyo, 1985



The Year of . . .

2006—The International Year of Deserts and Desertification

Desertification is one of the world's most alarming processes of environmental degradation. The great scope and urgency of this challenge led the United Nations General Assembly to proclaim 2006 as the International Year of Deserts and Desertification. The "year," now already in progress, is intended to raise public awareness of the problem and to help protect the biological diversity of deserts as well as the traditional knowledge of those communities affected by desertification. The primary objective is to profile desertification as a major threat to humanity, reinforced under the scenarios of climate change and loss of biological diversity.

Drylands constitute about 41 percent of the Earth's surface and support more than 2 billion people. Between 10 and 20 percent of drylands are degraded or unproductive. Land degradation affects one-third of the planet's land surface and threatens the health and livelihoods of more than 1 billion people in more than 100 countries. Each year, desertification and drought cause an estimated USD 42 billion in lost agricultural production. The risks of desertification are substantial and clear. Desertification contributes to food insecurity, famine, and poverty and can give rise to social, economic, and political tensions that further promote conflict, poverty, and land degradation.

www.iydd.org

2007–2008—The International Polar Year

The International Council for Science (ICSU) formally agreed to establish an International Polar Year (IPY) in 2007-2008. It is envisioned that the IPY will be an intense, internationally coordinated campaign of research that will initiate a new era in polar science. IPY 2007-2008 will include research in both polar regions and recognize the strong links these regions have with the rest of the globe. It will involve a wide range of research disciplines, including the social sciences, but the emphasis will be interdisciplinary in its approach and truly international in participation. It aims to educate and involve the public, and to help train the next generation of engineers, scientists, and leaders.

www.ipy.org

2008—The International Year of Planet Earth

The United Nations General Assembly, meeting in New York, has announced that 2008 will be the United Nations International Year of Planet Earth. Related activities will span three years, from 2007 to 2009.

The purpose of the Year of Planet Earth, encapsulated in the tagline "Earth Sciences for Society," is to:

- reduce risks for society caused by natural and human-induced hazards
- reduce health problems by improving understanding of the medical aspects of the Earth sciences
- discover new natural resources and make them available in a sustainable manner
- build safer structures and expand urban areas, utilizing natural subsurface conditions
- determine non-human factors in climatic change
- enhance understanding of the occurrence of natural resources so as to contribute to efforts to reduce political tension
- detect deep and poorly accessible groundwater resources
- improve understanding of the evolution of life
- increase interest in the Earth sciences in society at large
- encourage more young people to study the Earth sciences at the university level

"Around the shores of the Indian Ocean, some 230 000 people are dead because the world's governments have not yet grasped the need to use geoscientists' knowledge and understanding of the Earth more effectively," says Eduardo F.J. de Mulder, project leader

of the Year of Planet Earth and former president of the International Union of Geology and Geophysics. "Yet that knowledge is readily available in the practical experience and publications of some half a million Earth scientists all over the world, a professional community that is ready and willing to contribute to a safer, healthier, and wealthier society if called upon by politicians and decision-makers. The International Year of Planet Earth (2007–2009) aims to contribute to the improvement of everyday life, especially in the less developed countries, by promoting the societal potential of the world's Earth scientists."

www.esfs.org

Safety Training Program — Call for Applicants

Making the world a bit safer, safety experts from developing countries have an opportunity to visit and work in plants of IUPAC Company Associates in the industrialized world for a training period of one to three weeks.

The IUPAC-UNESCO-UNIDO Safety Training Program is a Fellowship Program for Safety and Environmental Protection in Chemical, Biotechnological, and Pharmaceutical Production that allows safety experts from developing countries to learn about safety and environmental protective measures by visiting and working in plants of IUPAC Company Associates in industrialized countries. IUPAC, working with the United Nations Educational, Scientific, and Cultural Organization (UNESCO) and the United Nations International Development Organization (UNIDO), has established and maintained the Safety Training Program to promote interactions between developed countries and the developing world to disseminate state-of-the-art knowledge on safety and environmental protection in chemical production.

Each scientist or engineer accepted into the Safety Training Program is assigned to an IUPAC Company Associate in an industrialized country. Accommodation, subsistence, and travel expenses are provided for all trainees.

Successful candidates are professional scientists and engineers who are currently:

- involved at a supervisory or managerial level in chemical companies, government institutions, or scientific institutions
- engaged in aspects of safety and environmental protection in chemical, pharmaceutical, or biotechnological production or in the teaching of these fields
- have the ability to influence safety practices in their places of employment and elsewhere within their home country

Applications are now invited for placement in the 2006 program. For more information, go to

www.iupac.org/standing/coci/safety-program.html

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

ACD/Labs' Free Naming Software Service Generates 200 000 IUPAC Names via the Web

Advanced Chemistry Development, Inc., (ACD/Labs), the premier supplier of quality systematic nomenclature generation for the past five years, recently generated its 200 000th free IUPAC name on its Web site.

New synthetic structures are constantly being developed, making it increasingly important for scientists to adopt a definitive systematic nomenclature and use a software tool that can ensure accuracy and organizational homogeneity in generating chemical names. ACD/Name has grown to support the nomenclature rules agreed upon by IUPAC, the International Union of Biochemistry and Molecular Biology (IUBMB), and the Chemical Abstracts Service (CAS). ACD/Name systematic nomenclature software is the current industry standard used by nomenclature specialists worldwide and by a multitude of corporations in the chemical and pharmaceutical industries. The software is used to quickly and accurately name compounds for reports, databases, and publications.

The ACD/Labs Online Service enables chemists to generate IUPAC names at no extra cost by using the online portal.[1] Free chemical names can be generated according to the systematic application of a preferred set of IUPAC nomenclature rules for molecules containing no more than 50 atoms, and no more than three rings, with atoms from among only H, C, N, P, O, S, F, Cl, Br, I, Li, Na, and K. Presently, this service generates about 100 IUPAC names per day.

As well as generating IUPAC names online, the ACD/ChemSketch freeware available also includes the free naming algorithms. There have now been more than 520 000 downloads of ACD/ChemSketch, and scientists around the world are benefiting from instant access to ACD nomenclature tools. ACD/Name is now compatible with the InChI™ chemical nomenclature protocol, making it possible to produce unique alphanumeric string representations for chemical compounds that facilitate the communication of molecular structures electronically.[2] ACD/Labs' commercial products also offer the unique "reverse" InChI-to-structure conversion that enables convenient decoding of InChI strings.

ACD's new software product, ACD/Name Chemist Version, which was introduced in August 2005, made ACD/Labs' quality IUPAC nomenclature generation algorithms more affordable for chemists.

www.acdlabs.com

1. One can also access the ACD/Labs Online Service from IUPAC: <www.iupac.org/nomenclature>
2. <www.iupac.org/inchi>

Chmoogle Search Engine Integrates ChemSketch

Advanced Chemistry Development, Inc. (ACD/Labs), has integrated both its commercial and freeware ChemSketch application to the Chmoogle® Web site <www.chmoogle.com> created by eMolecules, Inc. Chmoogle is the world's leading open-access chemistry search engine. Its mission is to discover, curate, and index all of the public chemical information in the world and make it available to the public for free. Chmoogle distinguishes itself with extremely fast searches, an appealing presentation of results, high-quality chemical drawings, and powerful advanced search capabilities such as persistent hit lists and hit list logic operations. ACD/Labs has integrated Chmoogle into the commercial ChemSketch software and freeware. This integration gives ChemSketch users direct access to Chmoogle's structure and substructure searches.

Antony Williams, vice president and chief science officer for ACD/Labs, notes that "the mission of

Chmoogle—to discover, curate, and index all public chemical information in the world and make it available for free—is a worthy mission. ACD/Labs' intention to provide a chemical structure drawing package to every chemist in the world at no charge via our freeware ChemSketch downloads is just as worthy. We are happy to provide an integrated solution between ChemSketch and Chmoogle to allow users to sketch molecules at their desktop and view their results via a Web browser. It is our hope that sketching and Chmoogling will deliver value to chemists around the world."

Chmoogle is created by continuously indexing all of the public chemical information in the world. Chmoogle is attracting a large amount of the chemistry-related Internet traffic by industrial and academic decision-makers.

www.chmoogle.com

In Memorium—Dale B. Baker

Dale B. Baker, director emeritus of Chemical Abstracts Service (CAS), died 11 December 2005 in Columbus, Ohio. He had served as director of CAS from 1958 until his retirement in 1986. Under Baker's leadership over those years, CAS invented database publishing by developing databases from which any form of output, printed or electronic, could be produced.

Baker started with CAS as a part-time office boy in 1939 while attending Ohio State University. After graduating with a degree in chemical engineering, he spent four years working as a supervisory chemist at E.I. du Pont de Nemours & Co., before returning to CAS as an assistant editor in 1946. He rose steadily up the editorial ladder, succeeding E.J. Crane as director in 1958. During Baker's tenure as a director, CAS faced many challenges, including a difficult transition from a subsidized operation of the ACS to a financially self-sufficient division.

When Baker joined CAS, the organization had for decades been identified as the publisher of the printed Chemical Abstracts (CA), the leading reference work for keeping chemists and other scientists in touch with the latest chemistry-related publications. But keeping up with the explosion in scientific research required the adaptation of new technology. Starting in the 1960s, under Baker's direction, CAS moved from the conventional, print-oriented abstracting and indexing cottage industry to become a highly automated operation of international stature. In the course of that evolution, CAS developed one of the world's premier automated information processing and retrieval systems, which served as the model for those in other scientific disciplines.

www.cas.org/dalebaker.html





Chemical Education: Responsible Stewardship

Following on a recommendation from the Organization for the Prohibition of Chemical Weapons (OPCW) and IUPAC that emerged from a joint workshop held in Oxford, England, in July 2005, titled "The Chemical Weapons Convention (CWC), Chemistry Education and Professional Conduct of Chemists," a new project was initiated to promote codes of ethical and professional conduct among chemists and chemical engineers and to share the experience of these new teaching practices.

To jump-start this project, the Chemical Education: Responsible Stewardship conference was organized last October at the D. Mendeleyev University of Chemical Technology of Russia in Moscow. This conference focused on the dissemination of new information in the field of education responsible for stewardship and the promotion of all aspects of chemistry among members of the profession as well as the worldwide community. One hundred fifty scientists and educators from Russia, UK, Italy, Canada, USA, India, and CIS countries participated. Leading experts in the field of chemical education and CWC also took part.

The conference was organized under the auspices of IUPAC, OPCW, the Scientific Council on Problems of Ecology and Emergency Situations of the Russian Academy of Sciences, the Nature Management and Environmental Preservation Department of the Moscow Government, the National Committee of Russian Chemists, and the Institute of Chemistry and the Problems of Sustainable Development, D. Mendeleyev University of Chemical Technology of Russia. Additional support was received from the Moscow Committee on Science and Technologies, the Fund of Intellectual Technologies, and the Russian Regional Environmental Center.

Raising Awareness of the CW

Another IUPAC project has been recently initiated to develop educational material for chemists and chemistry teachers about the Chemical Weapons Convention (CWC). The material will start with the beneficial use of chemicals and raise awareness about the possible misuses of chemicals.

www.iupac.org/projects/2005/2005-029-1-050.html

More than 70 lectures and 50 posters were presented at the conference, which consisted of one workshop, three symposia, and one roundtable discussion. The following key areas were addressed:

- Chemical Synthesis: The Point of Bifurcation
- The Social Responsibility of Chemists: The Codes of Conduct
- Green Chemistry for Megacities
- Industrial Safety: Chemical Aspects

Chemical Synthesis: The Point of Bifurcation

The objectives of this workshop were to prepare educational materials for use by university and high school chemistry teachers. The materials will equip educators to run workshops on multiple uses of chemistry and the need for CWC. Among workshop participants were lecturers and teachers from high schools and universities interested in receiving information on new methods and technologies of chemical education dealing with responsible stewardship. Four working papers (in English and Russian) were distributed to incite discussion in the following areas:

- Multiple Uses of Chemicals
- Chemicals—Good and Bad
- Toxicology of Chemical Warfare Agents
- The Prevention of Chemical Weapons: What Is the Role for Codes of Conduct?

The Social Responsibility of Chemists: The Codes of Conduct

This symposium brought discussions on the theoretical and methodological problems associated with such codes of conduct, the problem of elaboration and of teaching said codes, and the implications of carrying out these codes in research and industrial activities. As a result of this session, it was recommended that the Academic Council of the D. Mendeleyev University of Chemical Technology of Russia create the representative and competent commission for the development of "The Ethical Code of Chemists."

It also was recommended that the efforts of the wider scientific community be integrated, including representatives of humanitarian and scientific knowl-

edge, to develop theoretical-methodological problems of sustainable development.

Universities were encouraged to find opportunities to introduce a course on ethics as a compulsory subject and to develop elective courses such as "Professional Etiquette," "Ecological Ethics," and "Ethics of Consensus-Building."

Green Chemistry for Megacities

During this symposium, a considerable part of the lectures was devoted to the legal issue of wildlife management and the social responsibility of experts as well as the problems of licensing. A number of presentations addressed the methodology of teaching green chemistry in high schools and universities. The presentations focused on the ecological monitoring of the city environment as one of the practical applications of the methods of green chemistry.

The following recommendations arose from the sessions:

- Introduce the methods of green chemistry and their practical applications in the ecological monitoring of the environment into the training programs for chemistry and ecology students.
- Consider it necessary to use the scientific and technical capabilities of the chemical community in searching for new methods and directions of green chemistry to solve the environmental problems of megacities.
- Increase the knowledge and awareness of CWC provisions among chemistry students by using the materials presented during the workshop, "Chemical Synthesis: the Point of Bifurcation."

Industrial Safety: Chemical Aspects

Teachers, scientific employees of chemical institutes, and lawyers took part in the last symposium. Their active participation led to the following recommendations:

- Chemical education should bear safety in mind when creating a global outlook for the next generation.
- Ways to maintain chemical safety should be taught in the curricula of high schools and universities.
- Professional training in the field of chemical safety must be considered as one of the major aspects of chemical education.
- Seminars in specific areas of safety for general education (high school, etc.) should be held in order to promulgate the importance of safety for the population.

Overall, the conference made a substantial contribution to the facilitation of the exchange of scientific information and expertise among state parties of the CWC. It contributed to promoting awareness about the CWC and its implementation in the scientific community. It also provided an additional impetus to develop a culture of responsibility and compliance within the scientific community with international norms, including the CWC. The conference objectives were in line with the OPCW's core objectives of promoting the universality of the CWC and of improving national implementation.

Chemical education could be used effectively for this purpose, because chemistry, as a fundamental science and a scientific basis for a variety of technologies in different branches of industry, is deeply involved in the progress of modern civilization. We live in a world completely grounded in chemistry: Everything that we are and do is controlled by chemistry. The next generation of high school textbooks has been produced in different parts of the world, and significant public interest has been expressed concerning the national and international uniqueness of their application. There are many chemical educators, well trained in environmental issues, who would like to move further and contribute to the education for sustainable development.

Published outcomes will be released and announced at a later date. For more information, including list of conference participants and lecture titles, visit the project Web page. For more details, contact the task group chair, Natalia Tarasova <tarasnp@muctr.edu.ru>.

www.iupac.org/projects/2005/2005-028-1-050.html

Young Ambassadors for Chemistry

Krasnoyarsk, Russia, 14–18 November 2005

Following events in Taiwan and Argentina, the third leg of the Young Ambassadors for Chemistry (YAC) project was in Krasnoyarsk, Russia, where activities took place from 14–18 November 2005. The main aim of the YAC project is to popularize and raise public awareness of chemistry by encouraging young students to act as ambassadors for chemistry. The YAC project is carried out in partnership with Science Across the World, and cosponsored by GlaxoSmithKline.

Lida Schoen (center in a light color shirt) with a group of YACs

After a 24-hour journey into central Siberia, YAC representatives Lida Schoen and Keith Kelly arrived in the snow-covered city of Krasnoyarsk where they were hosted by Natalya Gapanovich and her colleagues at the Pedagogical University of Krasnoyarsk. Gapanovich is the director of the Krasnoyarsk Branch of the D. Mendeleyev University of Chemical Technology of Russia, based in Moscow. Professor Natalya P. Tarasova, titular member of IUPAC's Committee on Chemistry Education—a member of the Russian Academy of Sciences and director of the Institute of Chemistry and Problems of Sustainable Development at D. Mendeleyev University—also played an important role in the coordination of this event and arranged formal invitations and visas for all participants.

Opening

Dean Vladimir Fadeev from the Pedagogical University kicked off the event by welcoming the YAC project to the city and encouraging interschool investigative research projects. Gapanovich also gave opening remarks and read a special letter to the participants, stressing the importance of communicating science to young people and encouraging them to become competent science spokespersons. The letter was signed by academician O.M. Nefedov, chair of the National Committee of Russian Chemists, member of the IUPAC Bureau, and head of the Higher Chemistry College of the Russian Academy of Sciences at D. Mendeleyev University; academician N.P. Laverov, vice president of the Russian Academy of Sciences and head of the Higher College of Rational Use of Natural Resources at D. Mendeleyev University; and Natalya P. Tarasova.

YAC Krasnoyarsk

Forty-three teachers, including 10 English teachers, traveled from all parts of the Krasnoyarsk region for the five-day YAC activity. Ultimately, students and participating teachers serve as mediators between the public and the activities, as they explain what is going on and answer questions. This enables them to gain valuable feedback from the public.

in workshop with a group of teachers

Workshops for Teachers

From 14–17 November, participants engaged in the four-day preparation for the ultimate YAC day event. After introducing themselves, their regions, and their

practice before the YAG day

schools, the participants were introduced to the Science Across the World program. Currently, this program has a membership of more than 3 600 teachers in 114 countries. The program aims to unite students from all over the world in the discussion of scientific topics, all of which have a cultural component. English teachers play a pivotal role in the program's development because English is the main exchange language used.

The workshops focused on the Science Across the World publications "Chemistry in Our Lives" and "Talking about Genetics around the World," which have been translated into Russian by Katya Gapanovitch, a former student of School No.11 in Krasnoyarsk who is now studying high school economics in Moscow. The translated material is available at the Science Across the World web site <www.scienceacross.org>. (Chinese and Spanish translations from earlier YAC events are also available.)

A debate was organized to give participants an opportunity to explore new ways of teaching. Teachers worked essentially to get the workshops ready for the YAC day. Over the four days of workshops, which followed the "train the trainer" model, participants practiced the "experiments" the students would perform during the YAC day event. These included constructing a large DNA molecule from sweets and designing and producing a new line of cosmetics, followed by the marketing of the products in a TV commercial.

A welcome by YAG Korostashev

Attendees worked diligently during the week and were eager to learn more to improve their teaching skills. Their suggestions regarding the educational situation in Russia were valuable, and their knowledge of chemistry was superb. English teacher Svetlana Salkova provided flawless interpreting throughout the week.

Friday—YAC Day

More than 100 children, teachers, parents, university students, and colleagues from the Pedagogical University joined forces to participate in the two workshops or to watch the students in action. One of the YACs, Korostashev Roman, welcomed all YACs, teachers, and the general public, while explaining in English what YAC project is all about.

A whole new meaning to 'Life is Sweet'

During the workshops, several students acted as "roving reporters" and questioned the public about the event. All visitors recognized that studying science was useful, and the majority said that their attitude toward science was changing for the better.

The YACs worked diligently, and everything went smoothly. At the end of the workshops, all pieces of the DNA model were joined to form one long string and all groups prepared a TV commercial for their new line of cosmetics. A welcome initiative

was the use of theatrical skills and music. New chemistry songs were composed, replete with scientific jargon used in actual commercials.

After the performance, the judges rated the quality, appearance, and coherence of the products, along with the originality. The winners, students of School No. 11 and Gymnasium No. 2 in Krasnoyarsk, received a bag full of scientific "goodies" donated by Science Across the World cosponsor GlaxoSmithKline. The event ended with science theater, featuring a play about a witch who misused chemistry, written by Ivanchenko Sasha, a student from Krasnoyarsk School No. 11.

The students did a wonderful job, and with the organizational talents of their teachers and clear instructions, they were able to work independently. This extremely successful day ended with official speeches, presents, kisses, good-byes, and song and dance.

Outcomes

Scientists in this region have agreed to help with the future development of the YAC project in Russia, as so many teachers are trained to share what they have learned with colleagues in neighboring schools. Now they can introduce the Science Across the World program and run a YAC event on their own.

Enhancing the public image and the popularization of chemistry by using the materials and infrastructure of an existing global science program is a positive step. Fortunately, the program also meets demands in Russia for interschool collaboration and for the development of communicative competencies in scientific education. A significant characteristic of this event is the collaboration among English and science teachers, during the event and back in their schools.

For an earlier report on YAC Taiwan, see Mar-Apr 2005 CI, p. 20. For more information about the YAC's project, contact Lida Schoen at <amschoen@xs4all.nl>.

www.iupac.org/projects/2003/2003-055-1-050.html

Can you hear the bravos? YACs were not afraid to put chemistry in songs and plays, and for everyone's entertainment.

Microstructure and Properties of Thermotropic Liquid-Crystalline Polymer Blends and Composites

Liquid-crystalline polymers (LCPs), comprised of rigid (or semi-rigid) rod-like molecules, are usually classified into two groups: lyotropic LCPs and thermotropic LCPs, based on the conditions for the formation of their liquid-crystalline state.

Lyotropic LCPs, such as poly(*p*-phenylene terephthalamide) (PPTA) are processed to high-strength, high-modulus fibers by the solution-spinning technique. Thermotropic LCPs (TLCPs) are processed and molded to structural parts of different shapes by means of conventional processing for thermoplastics, such as extrusion and injection molding.

The synthesis and modification of TLCPs for different final applications are hot topics for industrial and academic research. The copolymerization of different comonomers produces copolymers classified into different series, (e.g. Rodrun, Vectra, and Xydar) with different liquid crystalline characteristics, melting temperatures, and rheological behavior. These series find their different end-use applications by injection molding, extrusion, stretching, blowing, and spinning.

In recent years, the rapid development of information technology products has lead to an annual consumption growth of 25% for commercialized TLCP blends and composites. To fabricate final products, different commercialized grades of TLCP blends and composites are available as glass-fiber or carbon-fiber-reinforced, glass-bead, glass-flake, or silica-filled grades. The microstructure of commercialized TLCP blends and composites is closely related to their processing conditions. The relation between the rheological properties and the resultant microstructure of these blends and composites should be well established. The aim of this project is to evaluate the microstructure–property relation of the commercialized TLCP blends and composites by rheological measurement, morphological observation, and evaluation of property.

Recently, another report has been published in *Pure and Applied Chemistry* **76**, 2027–2049 (2004): "Rheological Properties and Associated Structural Characteristics of Some Aromatic Polycondensates, Including Liquid-Crystalline Polyesters and Cellulose Derivatives," by J.L. White, L. Dong, P. Han, and H.M. Laun. This paper reports four different types of liquid crystalline polyesters and one type of glass, fiber-filled LCP, with sections as polarized light microscopy, capillary rheometry (bagley plots and correction vs. wall-shear stress), extrudate swell, structural studies of extrudates, and oscillatory shear measurements (amplitude sweeps, time sweeps, frequency sweeps, and temperature sweeps).

Inversion wall revealed by Spontaneous band texture in a liquid crystalline polymer; rigid copolyester of hydroxybenzoate (HBA) and hydroxynapthoate (HNA) (1:1); Cross-polarised light microscopy. *(Source: Dr W Song, Department of Materials Science and Metallurgy, University of Cambridge; www.doitpoms.ac.uk)*

This project will focus on TLCP blends and composites. The topics of study include:

1. rheological measurements of TLCP blends and composites
2. dynamic viscoelasticity, stress relaxation, and shear/elongational viscosities
3. morphological observation of molded samples
4. scanning electron microscopy, transmission electron microscopy, and atomic-force microscopy observation
5. blending with other polymers
6. rheological properties of blends and microstructure observation
7. crystallization of TLCP blends and composites
8. differential scanning calorimetry measurements, scanning electron microscopy, and polarized optical microscopy observation
9. mechanical testing of molded samples
10. static mechanical properties and dynamic mechanical analysis

For more information and comments, contact the task group chairman, Jiasong He <hejs@iccas.ac.cn>.

www.iupac.org/projects/2004/2004-044-2-400.html

Validation of Qualitative and Semi-Quantitative (Screening) Methods by Collaborative Trial

Guidelines for method validation need to provide information as to the required number of participating laboratories, characteristics of the test materials to be used in the study, and details on the statistical treatment of the results. It is important to make an objective assessment as to whether a method, once validated, is fit for analysis. Information on how this will be achieved should also be given in the guidelines.

Most quantitative analytical methods, when adopted and published as an international standard, are now required to be validated according to the international harmonized protocol: W. Horwitz, *Protocol for the design, conduct, and interpretation of method performance studies* [*Pure and Applied Chemistry* **67**, 331–343 (1995)] or the ISO 5725 series of standards. The Horwitz protocol is suitable only for quantitative methods. As there is a current, increasing demand and the availability of so-called screening methods (qualitative or semi-quantitative), the existing protocol is not entirely suitable for interlaboratory validation of such methods. For example, many problems in food control are only being handled by qualitative or semi-quantitative methods. For this reason, guidelines for the validation of screening methods, based on immunological or DNA-based technologies, are urgently needed. The aim of this project is to develop suitable guidelines for this purpose.

For more information and comments, contact the task group chairman, Elke Anklam <elke.anklam@cec.eu.int>.

www.iupac.org/projects/2005/2005-024-2-600.html

Calibration of Organic and Inorganic Oxygen-Bearing Isotopic Reference Materials

During the past three decades, the determination of the relative amounts of stable isotopes of the light elements (H, C, N, O, and S) has dramatically increased because of expanded use in hydrology, environmental studies, microbiology, forensic investigations, atmospheric investigations, oceanography, and other fields. In the past 10 years, the determination of the relative amounts of the isotopes of oxygen in organic and inorganic solids has increased because of developments in instrumentation. In the past 5 years, several new oxygen isotopic reference materials have been prepared. However, the values of the relative amounts of oxygen isotopes in these new materials, and in older materials, are not well known. Thus, the problem arises that two isotope laboratories analyzing the same sample may not report the same result within analytical uncertainty, because they do not know what values to accept for internationally distributed oxygen isotopic reference materials.

The purpose of this two-year project is to bring together expert analytical laboratories (Jena, Reston, Leipzig, Canberra, and Zurich) to measure the relative amounts of oxygen isotopes in isotopic reference materials. This highly coordinated analytical effort will include inorganic materials, organic materials, atmospheric oxygen, and two water reference materials.

Strict analytical protocols will be designed and followed by all laboratories. An initial phase of the project will be to assess the oxygen exchangeability of potential materials to eliminate those with exchangeable oxygen. At the conclusion of the analytical effort, task group members will convene for a three-day workshop to determine consensus values and uncertainties. Isotopic reference materials considered for this project include: IAEA-CH-3 cellulose, IAEA-CH-6 sucrose, IAEA-600 caffeine, IAEA-601 & IAEA-602 benzoic acid, USGS40 & USGS41 L-glutamic acids, USGS32 KNO_3, IAEA-NO-3 KNO_3, USGS34 KNO_3, USGS35 $NaNO_3$, NBS-127 $BaSO_4$, IAEA-SO-5 $BaSO_4$, IAEA-SO-6 $BaSO_4$, and methionine.

For more information and comments, contact the task group chairman, Tyler B. Coplen <tbcoplen@usgs.gov>.

www.iupac.org/projects/2005/2005-022-1-200.html

Provisional Recommendations

IUPAC Seeks Your Comments

Provisional Recommendations are drafts of IUPAC recommendations on terminology, nomenclature, and symbols made widely available to allow interested parties to comments before the recommendations are finally revised and published in *Pure and Applied Chemistry.*

www.iupac.org/reports/provisional

Explanatory Dictionary of Key Terms in Toxicology

The objective of the explanatory dictionary of concepts in toxicology is to give full explanations of the meaning of toxicological terms chosen for their importance and complexity from the point of merging chemistry and toxicology. This requires a full description of the underlying concepts, going beyond a normal dictionary definition. Often, linguistic barriers lead to problems in obtaining a common understanding of terminology at the international level and between disciplines. The explanatory definitions should help to break down such barriers. The dictionary consists of about 68 terms chosen from the IUPAC "Glossary of Terms Used in Toxicokinetics" [*Pure Appl. Chem.* **76**, 1033–1082, (2004)] organized under 22 main headings. The authors hope that among the groups which will find this explanatory dictionary helpful are chemists, pharmacologists, toxicologists, risk assessors, regulators, medical practitioners, regulatory authorities, and everyone with an interest in the relationship of chemistry to toxicology. It should also facilitate the use of chemistry in relation to risk assessment. Thus, it is expected that there will be a wide audience for this document.

Comments by 31 May 2006

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www.iupac.org/reports/provisional/abstract06/nordberg_310506.html

Glossary of Terms Relating to Pesticides

The glossary contains definitions of more than 500 terms frequently used in relation to the chemistry, mode of action, regulation, and use of pesticides. A wide range of disciplines are involved in this field and the glossary was developed as a step in facilitating communication between researchers, government regulatory authorities, and chemists in associated professional areas. The range of terms relates to pesticide residue analysis, sampling for analysis, good laboratory practice, metabolism, environmental fate, effects on ecosystems, computer simulation models, toxicology, and risk assessment. The number of important, 'pesticide-related' terms has more than doubled since 1996, when the first IUPAC glossary of this type was developed [*Pure Appl. Chem.* **68**, 1167–1193 (1996)], an indication of how this field has become so integrated with many other scientific and regulatory disciplines.

Comments by 31 May 2006

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www.iupac.org/reports/provisional/abstract06/stephenson_310506.html

Nomenclature for Rotaxanes

Expanded definitions of rotaxanes, their components, and other terms concerning rotaxanes are given. The classification of rotaxanes and nomenclature principles for naming of different types of rotaxanes are described and illustrated with examples. Recommendations are provided for unambiguous description of rotaxane isomerism with special descriptors that include information about the position and orientation of rotaxane components.

This document includes the following main parts:

1. definitions of terms used in rotaxanes:
   a. rotaxane itself,
   b. rotaxane components,
      i. threading component and linear section
      ii. macrocyclic component and threadable ring
   c. molecular shuttles and recognition sites
2. history of the nomenclature of rotaxanes
3. classification of rotaxane types
4. generic name format for rotaxanes
5. types of rotaxane isomerism and description of the location of simple macrocyclic components at different linear sections of a complex threading component and location of simple threading components in macrocyclic components with several threadable rings
6. types and specification of rotaxane stereo isomerism orientation of rotaxane components in relation to each other
7. examples of rotaxanes and recommended names

Comments by 30 April 2006

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www.iupac.org/reports/provisional/abstract05/yerin_300406.html

Quantities, Units and Symbols in Physical Chemistry

The purpose of this manual 3rd edition is to improve the exchange of scientific information among the readers in different disciplines and across different nations. As the volume of scientific literature expands, each discipline has a tendency to retreat into its own jargon. This book attempts to provide a readable compilation of widely used terms and symbols from many sources together with brief understandable definitions. This edition reflects the experience of the contributors with the previous editions, and we are grateful for the many thoughtful comments we have received. Most of the material in this book is "standard," but a few definitions and symbols are not universally accepted. In such cases, we have attempted to list acceptable alternatives.

The book has been systematically brought up to date and new sections have been added.

Comments by 31 March 2006

See Jan–Feb 2006 *CI*, p. 28, for contact.

www.iupac.org/reports/provisional/abstract05/stohner_310306.html

Glossary of Terms Used in Photochemistry

This third edition, following the second published in 1996 [*Pure Appl. Chem.* **68**, 2223–2286 (1996)], incorporates revisions and enhances the "Glossary" introducing terms related to molecular anisotropy, the use of polarized ultraviolet, visible, or infrared radiation, and nonlinear optical techniques, as well as the emerging field of computation of excited species. Some changes have been introduced in this "Glossary" regarding the terms related to radiation energy to make this collection fully compatible with internationally agreed upon terms.

Comments by 31 March 2006

See Jan–Feb 2006 *CI*, p. 28, for contact.

www.iupac.org/reports/provisional/abstract05/braslavsky_310306.html

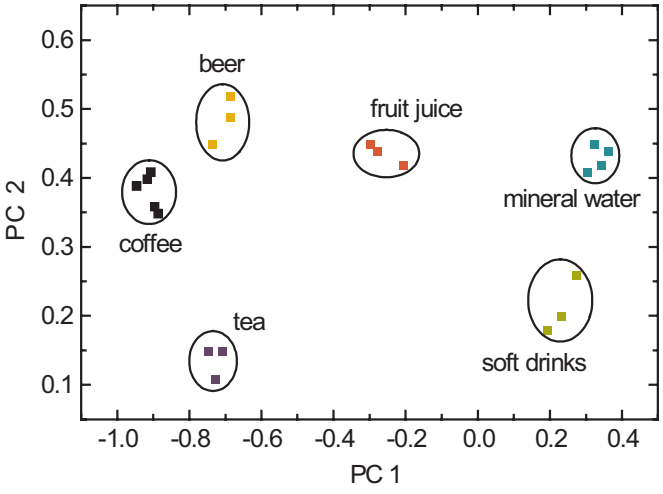
Nonspecific Sensor Arrays ("electronic tongue") for Chemical Analysis of Liquids (IUPAC Technical Report)

Yuri Vlasov, A. Legin, A. Rudnitskaya, C. Di Natale, and A. D'Amico

Pure and Applied Chemistry
Vol. 77, No. 11, pp. 1965–1983 (2005)
doi:10.1351/pac200577111965

The history of the development of potentiometric sensors over the past century demonstrates progress in constructing single, discrete (i.e., separate, to distinguish from sensor arrays) ion sensors, which have been made as selective as possible. Only a few types reveal high selectivity. However, easy measurement procedures, with low cost and availability, have given rise to the search for new ways to successfully apply them.

This document describes a new concept for the application of potentiometric multisensor systems (i.e., sensor arrays for solution analysis) and the performance of this new analytical tool—the "electronic tongue." The electronic tongue is a multisensor system that consists of a number of low-selective sensors and uses advanced mathematical procedures for signal processing based on the pattern recognition (PARC) and/or multivariate analysis (e.g., artificial neural networks (ANNs), principal component analysis (PCA)). Definitions of the multisensor systems and their parameters are suggested. Results from the application of the electronic tongue, both for quantitative and qualitative analysis of different mineral water and wine samples, are presented and discussed.



Discriminating abilities of the electronic tongue with respect to different types of beverages. PC1 and PC2 are produced by principal component analysis (PCA) when data dimension is reduced from 30D (the number of sensors in the array) to the 2D presentation shown in this figure. PC1 and PC2 are the most significant species containing the largest part of information about the analyzed beverages (from A.V. Legin et al., Sens. Actuators, B 44, 291 (1997)).

www.iupac.org/publications/pac/2005/7711/7711x1965.html

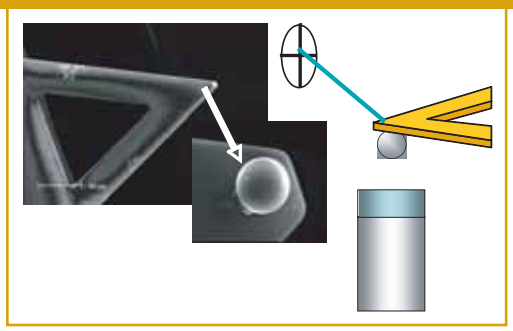
Atomic Force Microscopy and Direct Surface Force Measurements (IUPAC Technical Report)

John Ralston, Ian Larson, Mark W. Rutland, Adam A. Feiler, and Mieke Kleijn

Pure and Applied Chemistry
Vol. 77, No. 12, pp. 2149–2170 (2005)
doi:10.1351/pac200577122149

The atomic force microscope (AFM) is designed to provide high-resolution (in the ideal case, atomic) topographical analysis, applicable to both conducting and nonconducting surfaces. The basic imaging principle is very simple: a sample attached to a piezoelectric positioner is rastered beneath a sharp tip attached to a sensitive cantilever spring. Undulations in the surface lead to deflection of the spring, which is monitored optically. Usually, a feedback loop is employed, which holds the spring deflection constant, and the corresponding movement of the piezoelectric positioner thus generates the image.

From this it can be seen that the scanning AFM has all the attributes necessary for the determination of surface and adhesion forces; a sensitive spring to determine the force, a piezoelectric crystal to alter the separation of the tip and surface, which if sufficiently well calibrated also allows the relative separation of



Schematic diagram of an AFM. The sample is placed on a piezoelectric scanner. A laser is reflected off the upper side of the cantilever and into a split photodiode via a mirror. *Courtesy of J. Ralston and A. Feiler, Ian Wark Research Institute, University of South Australia.*

the tip and surface to be calculated. One can routinely quantify both the net surface force (and its separation dependence) as the probe approaches the sample, and any adhesion (pull-off) force on retraction.

Interactions in relevant or practical systems may be studied, and, in such cases, a distinct advantage of the AFM technique is that a particle of interest can be attached to the end of the cantilever and the interaction with a sample of choice can be studied, a method often referred to as colloid probe microscopy. The AFM, or, more correctly, the scanning probe microscope, can thus be used to measure surface and frictional forces, the two foci of this report. There have been a wealth of force and friction measurements performed between an AFM tip and a surface, and many of the calibration and analysis issues are identical to those necessary for colloid probe work. This report confines itself primarily to elements of colloid probe measurement using the AFM.

www.iupac.org/publications/pac/2005/7712/7712x2149.html

Supramolecular Assemblies With DNA (Special Topic Article)

Philippe Barthélémy, Stephen J. Lee, and Mark Grinstaff

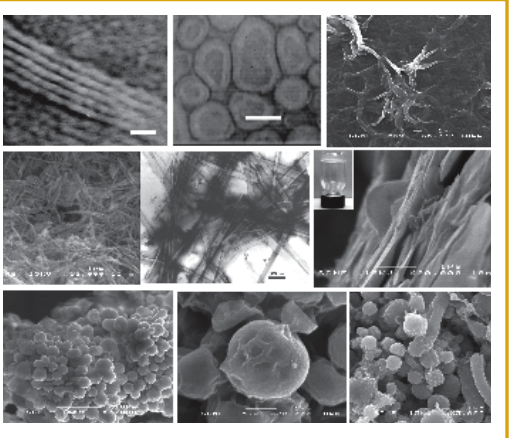
Pure and Applied Chemistry
Vol. 77, No. 12, pp. 2133–2148 (2005)
doi:10.1351/pac200577122133

Information storage in chemical and biological systems involves recognition processes occurring at the molecular and macromolecular level. The implementation of a "code" can consist of multiple noncovalent interactions that include hydrogen bonds, π-stacking, hydrophobic interactions, and appropriate molecular and supramolecular architectures.

With the double-helical DNA structure stabilized by Watson-Crick hydrogen bond base-pairing and aryl π–π stacking interactions, nature provides to scientists an example of one of the most sophisticated supramolecular systems. Molecular organization using these types of processes has become a very powerful strategy for the construction of well-defined nanostructures. Self-assemblies using noncovalent interactions have been designed to build fibers, membranes, two-dimensional monolayers, hydro, and organo gels, for example.

This article highlights the research presented at the *DNA Supramolecular Assemblies* workshop held in Avignon, France, on 5–6 May 2004. It first focuses on the recent progress achieved in the design of supramolecular self-assemblies that mimic the molecular recognition functionalities found with nucleic acids. It next presents several synthetic-DNA supramolecular assemblies currently developed to transport nucleic acids into cells. The marriage of supramolecular chemistry with nucleic acids as illustrated through examples opens new avenues for designing artificial molecular devices and expand the current repertoire of supramolecular assemblies available.

www.iupac.org/publications/pac/2005/7712/7712x2133.html



Examples of supramolecular assemblies formed by nucleolipids. See PAC article for details. *Courtesy of P. Barthélémy, Université de Bordeaux, France.*

Macromolecule-Metal Complexes

by Francesco Ciardelli and Giacomo Ruggeri

The **11th International Symposium on Macromolecule-Metal Complexes** (MMC-11), sponsored by IUPAC, was held in Tirrenia (Pisa, Italy) 10–13 September 2005, chaired by R. Barbucci, of Siena, and F. Ciardelli, of Pisa. The symposium was part of the series of regular biennial meetings of the MMC group sponsored by IUPAC Polymer Division.

Approximately 170 participants from 30 countries demonstrated the increasing interest and exciting progress in the field of macromolecule-metal systems and complexes, which is devoted to the synthesis of artificial combinations of metal ions/metals, ligands, and macromolecules and has the aim of creating new materials with a variety of properties.

The meeting was organized by the University of Pisa and University of Siena with the sponsorship of the European Polymer Federation; AIM (Associazione Italiana di Scienza e Tecnologia delle Macromolecole); The Society of Polymer Science, Japan; and the Chemical Society of Japan.

Scientific topics debated during the symposium included:

- biological aspects
- synthesis, formation, and characterization
- environmental applications
- binding of small molecules, sensors
- catalysis and photocatalysis
- conductivity, photoconductivity, and ionic conductivity
- electronic, optical, and magnetic applications
- alternative processes of energy conversion

As invited speakers, a number of specialists covered both basic areas and new developments. The founder and honorary chairman of MMC, Professor Tsuchida (Waseda University, Japan), gave an opening lecture on "Safety of Oxygen-Infusion and Efficacy as Artificial Red Blood Cells," followed by invited speakers from 13 countries. All lectures and titles of conferences are available at <www.dcci.unipi.it/~bea/mmc-11>, along with information about poster sessions and poster awards. Nearly 100 other participants made oral or poster presentations.

Francesco Ciardelli, MCC-11 cochairman (right), and Giacomo Ruggeri, a member of the local organizing committee

Proceedings of this conference will appear in an upcoming issue of *Macromolecular Symposia.*

Francesco Ciardelli <fciard@dcci.unipi.it> is a professor in the Department of Chemistry and Industrial Chemistry at the University of Pisa in Italy and was cochairman of the symposium with Rolando Barbucci, professor at the University of Siena. Giacomo Ruggeri, also professor at the University of Pisa, was a member of the conference's local committee.

Analytical Chemistry and Chemical Analysis

by Vladimir Zaitsev

The **International Congress on Analytical Chemistry and Chemical Analysis** (AC&CA-05) took place in Kiev, Ukraine, 12–18 September 2005.

AC&CA-05 belongs to the series of Ukrainian conferences in analytical chemistry established in 1970 by the Ukrainian Chemical Society and Chemical Division of the Ukrainian Academy of Sciences. AC&CA-05 is the seventh conference in analytical chemistry in Ukraine and the first international meeting on analytical science in Ukraine.

AC&CA-05 was organized by the Scientific Council of Analytical Chemistry at the Academy of Sciences of Ukraine, the Ukrainian Chemical Society, and Kyiv Taras Shevchenko National University, in collaboration with the European Association for Chemical and Molecular Sciences (EuCheMS) and IUPAC. The congress was

dedicated to the centenary of the birth of the outstanding Ukrainian scientist Anatoly K. Babko for his expertise in analytical chemistry and in the chemistry of complex compounds. The congress was sponsored by IUPAC and by the International Association for the Promotion of Cooperation with Scientists from the New Independent States of the Former Soviet Union (INTAS). The organizing committee was chaired by Professor Vladimir Zaitsev (Kiev, Ukraine), and the program committee was chaired by Professor Valery Antonovich (Odessa, Ukraine).

The main goals of the conference were to survey the status of modern analytical science in Ukraine against the status of modern analytical science globally, to renew international collaboration of Ukrainian analytical chemists and educators, and to approach positions of scientists and analytical engineers.

The organizing committee received great help and support from many international bodies, including chemical societies from Russia, Japan, Austria, Germany, and Great Britain, as well as scientific Web portals such as SpectroscopyNOW and ChemWeb.

AC&CA-05 consisted of 12 invited lectures and seven symposia: "General Aspects of Analytical Chemistry," "Analytical Methods," "Objects of the Analysis," "Sensors and Tests," "Separation and Preconcentration," "Pharmaceutical and Biomedical Analysis," and "History and Methodology of Analytical Chemistry." The conference program included two special symposia: "Memorial 1," dedicated to Anatoly Babko, and "Analytical Russian-Germany-Ukrainian Symposium" (ARGUS-9).

AC&CA-05 had 327 participants from 30 countries, including Ukraine (45%), Russia (25%), Iran, Serbia and Montenegro, Byelorussia, Germany, France, Japan, and Spain. There were 303 presentations in total: 123 oral sessions and 180 posters. Oral presentations were distributed as follows: 12 invited, 40 keynote, and 71 regular lectures. The highlight of the congress was active participation of young scientists. The audience was distributed as follows: 47% PhD students and 26% young scientists. The congress provided an excellent opportunity for young Ukrainian researchers, teachers, and students, as well as for scientists from neighboring countries to meet representatives of the international scientific community and to reestablish links with European colleagues, thus initiating new collaborative work.

The main results of the congress as well as list of participants and a book of abstracts is available through the congress Web site: www.achem.univ.kiev.ua/conference/babko/.

The congress materials were published in the book of abstracts and as special issue of *Ukrainian Journal of Chemistry* (Issues 9 and 10, 2005).

Professor Vladimir Zaitsev <zaitsev@univ.kiev.ua>, who chaired the local organizing committee, is chair of the Analytical Chemistry Department at Taras Shevchenko National University in Kiev, Ukraine.

Novel Materials and Synthesis

by Yuping Wu

The **International Symposium on Novel Materials and Synthesis** (NMS) was initiated in 2005 and was held jointly with the International Symposium on Fine Chemistry and Functional Polymers (FCFP), held for the first time in 1985 in China and on a near-annual basis since. This year, the 15th symposium (FCFP-XV) was held 16–20 October 2005 at Fudan University in Shanghai, China. The joint holding of these two important symposia was part of the celebration of the Centennial Anniversary of Fudan University.

Fudan University, established in 1905, is one of the most famous universities in China. The name "Fudan," which means "unremitting effort," comes from the Confucian classics. The university is situated in Shanghai City, on the west coast of the Pacific. Shanghai City is one of the most dynamic metropolises in China and recently won a bid to host the 2010 World Expo.

NMS-I was sponsored by the National Natural Science Foundation of China, IUPAC, the Shanghai Key Laboratory of Molecular Catalysis and Innovative Materials, and the Shanghai Society of Chemistry and Chemical Industry. Cochairman Professor Yingyan Jiang, vice president of Fudan University, Professor Xiaoman Chen, and IUPAC representative Professor S. Penczek delivered welcome and opening addresses on the morning of 17 October 2005.

Professor Yuping Wu and his group group of Fudan University acted as secretariat of FCFP-XV

Joining the symposium were 188 participants, including 117 from outside China. Foreign participants included industry representatives from Sony Corporation, Sanyo Chemical Industries Ltd., Sharp Corporation, Givaudan Schweiz AG, DSM Pharma Chemicals, and Givaudan Ltd. Speakers from companies introduced their latest development on novel materials. The symposium concentrated on novel polymers with various functions, novel organic chemicals, asymmetric synthesis and other synthesis methods, and other novel materials and synthesis related to energy, environment, medicine, fragrance, and nanotechnologies. Prominent scientists who lectured on their research work included Professor Robert Ballini (Italy), Professor Heinz Berke (Switzerland), Professor Shohei Inoue (Japan), Professor Ming Jiang (China), Professor Yusuke Kawakami (Japan), Professor Shun-Ichi Murahashi (Japan), Professor S. Penczek (Poland), Professor Makoto Shimizu (Japan), Professor James M. Takacs (United States), Professor M.G. Voronkov (Russia), Professor Changchun Wang (China), and Professor Peter Zugenmaier (Germany).

The symposium discussion was active, and participants highly evaluated the symposium and its organization, regarding it as a good high-level platform for exchanging academic ideas on novel materials and synthesis.

The organization committee arranged wonderful social programs such as a night tour by boat along the Pujiang River, a Shanghai Opera, and a city tour. Participants left the symposium knowing more about Fudan University, Shanghai, and China. Organization activities were shouldered by Professor Yuping Wu's group.

The NMS-I International Organizing Committee has decided to hold this symposium in Shanghai biennially, with the next symposium scheduled for 21–25 October 2007.

Yuping Wu <wuyp@fudan.edu.cn> is a professor in the Department of Chemistry and Shanghai Key Laboratory of Molecular Catalysis and Innovative Materials at Fudan University in Shanghai, China.

Polymers for Africa

by Dhanjay Jhurry

The **8th UNESCO School and IUPAC Conference on Macromolecules** was held in Mauritius in June 2005, and for the first time since its inception, the meeting took place outside South Africa. It was a great honor for the Mauritian organizers to have been given the opportunity to host this meeting and also a great challenge to achieve the high level set in the past by Professor Ron Sanderson and his team at Stellenbosch University.

The meeting started with a two-day UNESCO School on 4–5 June 2005 held at the University of Mauritius. The School was officially opened on 4 June 2005 by Dr. M.S. Alam, director, Division of Basic & Engineering Sciences, UNESCO, Paris. The UNESCO School aims at capacity building in existing and emerging areas in polymer science and technology through training of undergraduate/graduate students and young researchers. An important innovation brought to the UNESCO School was the organization of lectures both in English and French, the first setup of this kind in the world.

Eight lectures were delivered covering a wide range of topics in polymer science, including biopolymers, biodegradable polymers, and polysaccharides, all of which are of prime interest to the region vis-à-vis sustainable development: Professor Michel Vert, "Biodegradable Polymers"; Professor Robert Gilbert, "Polysaccharides: Molecular Weights in Synthetic and Natural Polymers"; Dr. Daniela Held, "Polymer Characterization: Size-Exclusion Chromatography"; Professor Goerg Michler, "Polymer Characterization: Electron Microscopy Techniques"; Professor Helmut Ritter, "Functionalized Polymers: Synthesis and Modification"; Professor Henri Cramail, "Coordination Polymerization: Ziegler-Natta/Metallocenes"; Dr. Bert Klumperman, "Polymer Synthesis: Living Free-radical Polymerization"; and Professor Axel Müller, "Polymer Synthesis: Living Anionic Polymerization."

All lectures have been compiled on a CD-ROM available free of charge to all 50 participants. The enthusiasm of both lecturers and students and their hard work during the weekend was highly commendable and contributed to the success of this first event.

The IUPAC Conference was held 6–9 June 2005

Participants at the 8th UNESCO/IUPAC Conference on Macromolecules. Front row, center right, wearing a tie is Professor Dhanjay Jhurry, and on his right is Professor Jean Fréchet.

at the La Pirogue Hotel, Flic en Flac, Mauritius. The first day of the conference started with the opening ceremony in the presence of University of Mauritius officials and other distinguished guests. UNESCO and IUPAC were represented by Dr. M.S. Alam and Professor R. Gilbert, respectively.

The IUPAC Conference was attended by approximately 100 participants, including 70 from 17 foreign countries. Participants included high-caliber polymer scientists as well as young researchers and post-graduate students. Major objectives of the conference included providing young scientists of the region a forum for presenting their research work, providing networking opportunities, and fostering research collaborations between the north and the south.

The conference featured five plenary lectures, 27 invited lectures, 15 contributed papers, and 30 poster presentations covering the following five major themes in polymer science and frontier areas of particular interest to the greater African region (Africa and Indian Ocean island states):

- biopolymers/biodegradable polymers/polysaccharides
- polymers in food and textile
- polymers in health and medicine
- functional polymers
- new emerging materials and characterization techniques

The enthusiastic participation of numerous young graduate students and scientists led to many lively discussions during the well-attended poster sessions. Eighteen papers presented at the IUPAC Conference have been collected in a special volume of *Macromolecular Symposia* entitled "Polymers for Africa" (Vol 231, 2006; ISBN 3-527-31334-6). In the preface of that volume, Professor Jean Fréchet writes:

"It is obvious that this conference series can make an important contribution to the development of polymer science in the African continent as more young scientists are exposed to and participate in state-of-the-art polymer research in contexts of relevance to their local environment. While it is clear that holding such conferences on the African continent stimulates the all-important participation of both young and more mature African scientists, should the rest of the world not be exposed to the needs and issues of polymer science in the developing world? Should topics such as “Polymers for Africa” or “Polymers for the Developing World” be included in the major IUPAC-sponsored polymer conferences held in the developed world to sensitize polymer scientists to the special needs of developing nations? It is hoped that the readers will be stimulated to attend and participate in the next edition of the “Polymers for Africa” conference for a better understanding of the global significance of this topic."

It is undeniable that the organization of such meetings in countries far from the major centers of education and research can contribute to the development of polymer science and help lay the groundwork for future economic development in those countries and regions. Professor Gilbert wrote: "Because of the excellent organization, the relaxed atmosphere and the high quality of invited speakers, this was one of the most fruitful conferences I have ever attended."

Sponsors included the University of Mauritius, UNESCO, IUPAC, ACU, the French Embassy in Mauritius, TWAS, and the Tertiary Education Commission (Mauritius).

Dhanjay Jhurry <djhurry@uom.ac.mu> is associate professor and head of the Department of Chemistry at the University of Mauritius in Réduit. He was chairman of the local organizing committee.

Carotenoids
by George Britton

When the first satellite meeting on the chemistry of carotenoids was held in Trondheim, Norwary, in 1996, only 30 participants attended. But almost 300 came from nearly 40 countries to the **14th International Symposium on Carotenoids** held 17–22 July 2005. The growing attendance clearly illustrates interest in carotenoids and the diversification of the field, especially in the areas of human nutrition and health, which are of particular public concern.

The 1996 meeting proved to be the first of a series of IUPAC International Carotenoid Symposia, the latest of which was held in the Edinburgh International Conference Centre (EICC) in Edinburgh, Scotland, with George Britton from the University of Liverpool as chairman. Much of the framework of the symposium was put in place by Andrew Young from Liverpool John Moores University, before George Britton took on the role for the last few months.

The program in Edinburgh was designed to encourage an integrated, interdisciplinary approach for tackling key issues and to stress the importance of a solid foundation of knowledge of the fundamental physical and chemical properties of carotenoids for understanding and controlling biological functions and actions. The excellent facilities and services of the EICC helped the symposium to maintain the tradition of a friendly, lively atmosphere and stimulating formal and informal discussions. Generous financial support from commercial sponsors in many countries made the symposium possible.

In the formal scientific program, about 220 papers were presented, 80 as lectures or selected oral communications in plenary or parallel sessions, and 140 as posters. As with previous symposia, the texts of plenary and invited lectures will be published in *Pure and Applied Chemistry*, with Richard Cogdell and Peter Bramley as symposium editors. For the first time, the book of abstracts has also been published as an issue of *Carotenoid Science* (Volume 9, July 2005, Hideki Hashimoto, ed.), the journal of the Japanese Society for Carotenoid Research.

In the opening session on "Skin Protection by Carotenoids," lectures by Helmut Sies, Peter Schroeder, and Regina Goralczyk concentrated on molecular studies and insights into the mechanism of the photoprotective effect of beta-carotene in human skin. Two plenary sessions emphasised the importance of interdisciplinary approaches and studies. In the session "Oxidation and Breakdown Products," topics included the chemistry of the oxidative breakdown of carotenoids (presented by Catherine Caris-Veyrat) and the significance of such oxidation and its products for human health (presented by Werner Siems). In a highly informative and entertaining lecture, Roman Kaiser used example extracts to illustrate the role of "Carotenoid-Derived Aroma Compounds in Flower Scents." The important influence of the natural physical states of carotenoids and of interactions with proteins on properties and functions was the subject of a further session in which Robert Birge and Tom Moore also reported some novel applications of carotenoids and retinal-proteins. Jonathan Blount spoke in a session on "Carotenoids and Nature" that highlighted the role of carotenoids in coloration and behavior in birds and invertebrate animals. Two plenary sessions reported progress in studies of carotenoids in relation to cancer (speakers included John Bertram and Angelika Herzog) and other aspects of human health (including an invited lecture by Olaf Sommerburg). In additional plenary lectures, Frederick Khachik evaluated available procedures for the analysis of carotenoids by HPLC in his

Continued on page 42

Biocalorimetry

30 April–4 May 2006,
Rio de Janeiro, RJ, Brazil

The Workshop on Biocalorimetry and Biological Thermodynamics (WBBT 2006) will be held in Rio de Janeiro, RJ, Brazil, from April 30 to May 4, 2006. It will focus on thermodynamics of biological macromolecules, with special emphasis on the application of calorimetry to biochemistry. WBBT-2006 will also focus on the acquisition and interpretation of the calorimetric data and how calorimetric data enhances our understanding of biological systems. One purpose of the meeting is to encourage the interaction between students and young scientists with senior researchers from the International scientific community. The opening session of the conference will be in honor of the late Dr. Julian Sturtevant, in recognition of his many contributions to the field of biocalorimetry.

See Mark Your Calendar on page 43 for contact information.

www.bioqmed.ufrj.br/biocal

Macro and Supramolecular Architectures and Materials

28 May–1 June 2006, Tokyo, Japan

The 3rd IUPAC International Symposium on Macro- and Supramolecular Architectures and Materials (MAM-06): Practical Nano-Chemistry and Novel Approaches will be held 28 May to- 1 June 2006, in Tokyo, Japan.

Nanomaterials will play a key role in science and technology in the 21st century. This symposium provides an interdisciplinary forum for scientists engaged in the full spectrum of research, development, and application to discuss the current status and recent developments of these materials, with a focus on the chemistry involved in their production and practical approaches. In addition, the meeting will cover a wide range of topics, providing a broad overview of the field. Themes have been selected to accommodate a wide range of interests to facilitate interdisciplinary interactions in both academic fields and industrial science and technology.

The symposium program will cover the following topics:

- nanomaterials
- chemistry and analysis of nanomaterials
- nanoscale processes
- nanoscale self-assembly and self-organization
- building blocks for nanoscience
- supramolecularity of nano-systems
- functionalization of nanomaterials
- nanoclusters
- nanoparticles, nanotubes, and nanowires
- nanolayered materials
- polymers with nanostructures
- nanostructured surfaces
- nanocomposite materials

The symposium will take place at the International Conference Center at Waseda University, one of the oldest and the most prestigious universities in Japan, located in downtown Tokyo in the Shinjuku area.

Oral and poster contributions of papers covering any area of the symposium topics are encouraged. Poster sessions will be an important part of the program.

See Mark Your Calendar on page 43 for contact information.

www.waseda.jp/assoc-MAM-06

Advanced Polymeric Materials

11 June–15 June 2006, Bratislava, Slovakia

The Polymer Institute of the Slovak Academy of Sciences invites participants for the 20th Bratislava International Conference on Macromolecules—Advanced Polymeric Materials (APM-2006).

The conference will cover:

- advanced polymeric materials with emphasis on nanomaterials, thin-layer technologies, composites, and optically and electrically active systems
- surfaces, interfaces, interphases, and confined systems
- methods for molecular characterization of advanced polymers by chromatography and mass spectrometry
- bulk methods for characterization of advanced polymers
- modern processing and testing methods
- biopolymers and biodegradable and biocompatible polymers

The Organizing Committee is chaired by Dušan Berek and Mária Omastová.

For more infomation, write to <upolapm6@savba.sk> or to APM 2006, c/o Polymer Institute, Slovak Academy of Sciences, Dúbravská cesta 9, SK-842 36 Bratislava, Slovakia.

www.upoldber.sav.sk

Chemical Thermodynamics

30 July–4 August 2006, Boulder, Colorado, USA

For the first time, the following three conferences will be held simultaneously in a one-time event being called THERMO International 2006: the **19th IUPAC International Conference on Chemical Thermodynamics, the 61st Calorimetry Conference, and the 16th Symposium on Thermophysical Properties.**

The 19th IUPAC International Conference on Chemical Thermodynamics (19-ICCT) will be held in Boulder, Colorado, in the United States, from 30 July to 4 August 2006. This conference is being organized by the National Institute of Standards and Technology and the University of Colorado at Boulder. The International Conferences on Chemical Thermodynamics are traditionally held every 2 years and rotate between North America, Europe, and Asia; the 18th conference was held in Beijing, China, in August 2004. The upcoming conference will be held under the auspices of IUPAC and the International Association of Chemical Thermodynamics (IACT).

The program will include major award lectures, plenary lectures, invited lectures, oral presentations, poster papers, database and software demonstrations, and scientific exhibitions. Among the highlights of the program are the Rossini Lecture, the highest award of the ICCT, as well as the IACT Doctorate Awards. The recipient of the 2006 Rossini Lectureship Award is Professor Alexandra Navrotsky of the University of California at Davis, USA (see Wire section, p. 18).

The Joint Scientific Program of the 19th International Conference on Chemical Thermodynamics and the 61st Calorimetry Conference will include the following Symposia and Workshops (an asterisk indicates that the symposium is jointly organized with the 16th Symposium on Thermophysical Properties):

Symposia

- Thermochemistry and Molecular Energetics
- New Materials
- Electrolyte and Non-Electrolyte Solutions Thermodynamics
- Phase Equilibrium, Supercritical Fluids, and Separation Technologies
- Colloid and Interface Science
- Thermodynamics and Properties in the Biological, Medical, Pharmaceutical, Agricultural, and Food Sectors*
- Molecular Modeling including Simulation*
- Ionic Liquids*
- Databases, Data Systems, Software Applications, and Correlations* (in memory of Dr. Randolph Wilhoit)

Workshops

- Thermodynamic Frontiers and Education

- New Experimental Techniques
- Properties and Processes for a Hydrogen-Based Economy

This unique event will provide opportunities for researchers and practitioners worldwide to meet and discuss a broad spectrum of scientific problems in the fields of thermodynamics and thermophysical properties for a wide variety of systems and to discuss applications in chemistry, biology, chemical engineering, mechanical engineering, physics, and other areas of science and engineering. Perhaps more important than the distinctions between the institutional labels applied to the disciplines is the continuum of activities involved, from fundamental science, to more empirical engineering approaches to thermodynamics and thermophysical properties, to the field practices where needs may be specific and immediate.

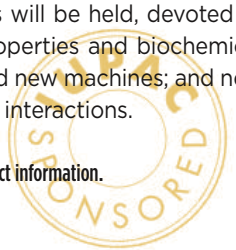
See Mark Your Calendar on page 44 for contact information.

www.icct2006.org

Physical Organic Chemistry

20–25 August 2006, Warsaw, Poland

"New Interactions, New Materials, New Prospects in Physical Organic Chemistry"—these will be the themes of the **18th IUPAC International Conference on Physical Organic Chemistry** (ICPOC 18) to be held in Warsaw, Poland, 20–25 August 2006. The event will be held at the Gromada Hotel near the Warsaw Airport. Warsaw, Poland's capital, is one of the fastest-growing cities in Europe; with a population of nearly 2 million, it houses the country's largest university and research center and is known for its historic buildings and glorious past. The conference topics will cover the diversity of modern research in physical organic chemistry and its interplay with other fields of science. Three parallel stream sessions will be held, devoted to structural versus chemical properties and biochemical functions; nanotechnology and new machines; and new materials, new processes, and interactions.



See Mark Your Calendar on page 44 for contact information.

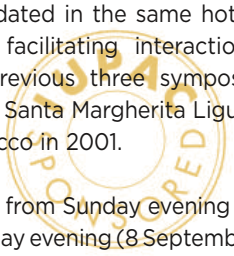
www.science24.com/event/icpoc18

Radical Polymerization

3–8 September 2006, Il Ciocco, Italy

The 4th International Symposium on Radical Polymerization: Kinetics and Mechanism will take place in September at the Il Ciocco hotel in the province of Lucca (Tuscany), Italy.

This symposium series is based on a scientific program covering all aspects of radical polymerization. It emphasizes poster sessions and avoids parallel sessions. The Italian setting contributes to the atmosphere, and all participants are accommodated in the same hotel, Il Ciocco, encouraging and facilitating interactions between participants. The previous three symposia were held also held in Italy: at Santa Margherita Ligure in 1987 and 1996, and at Il Ciocco in 2001.



The meeting will take place from Sunday evening (3 September 2006) through Friday evening (8 September 2006). No lectures will be given on Wednesday, when two main excursions will be organized.

The scientific program will center on the following topics:

- fundamentals of free radical polymerization
- heterogeneous polymerization
- controlled radical polymerization
- polymer reaction engineering
- polymer characterization

Each topic will be covered by main lectures given by invited speakers (approximately 23). Eight more short lectures will be selected from the submitted poster abstracts. The preliminary program can be found on the conference Web site.

See Mark Your Calendar on page 44 for contact information.

www.sml06.nl

Inorganic Materials

23–26 September 2006, Ljubljana, Slovenia

The Fifth International Conference on Inorganic Materials will be held 23–26 September 2006 in Ljubljana, Slovenia. The meeting aims to bring together scientists working in fundamental and applied areas to review recent developments in aspects of inorganic materials research and to identify emerging and future areas of growth in this exciting field. The conference will comprise six sessions covering electronic, optical and multifunctional materials; biomaterials; nanostructured materials; catalytic and porous materials; new materials for energy systems; and ceramics and glasses.

Contributions on the latest scientific and technological results will be supplemented by a number of high-level invited presentations and reviews by world experts in these fields.

For more details, contact Nick Williams, Inorganic Materials Conference Secretariat, at +44 (0) 1743 241289 or <im-conference@elsevier.com>.

www.im-conference.elsevier.com

Conference Call *continued from page 38*

talk "Distribution and Metabolism of Dietary Carotenoids in Humans as a Criterion for Development of Nutritional Supplements," while Aldona Dembinska-Kiec reported on a major European project and presented details of her own work on "Beta-Carotene and Angiogenesis."

The remainder of the program was filled with parallel sessions covering "Nutrition and Conversion into Vitamin A," "Photosynthesis and Photochemistry," "Eye Health," "Biosynthesis," "Chemistry," and "Commercial Production and Applications."

The standard of posters displayed was high, and prizes for best poster presentation were awarded to four young researchers: Marc David Grynbaum (Germany), Thais Guaratini (Brazil), Nicole Tillinger (Austria), and Tokutake Sashima (Japan). Each received a copy of *The Carotenoids Handbook*, from the carotenoids book series.

As a new venture for the symposia, International Carotenoid Society Awards were presented to mark distinguished achievements and dedicated service to the carotenoid field. The Otto Isler Award was presented to Synnove Liaaen-Jensen for "a lifetime of achievement in research on carotenoid chemistry and of dedicated service to the carotenoid field." Unfortunately, Norman Krinsky was unable to attend the meeting to receive the Trevor Goodwin Award for "achievement in research on carotenoid biochemistry and a lifetime of dedicated service to the carotenoid field"; the award was presented to him later. Finally, the President's Outstanding Service Award was presented to George Britton "in appreciation of exceptional service and dedication to the principles and scholarship of The International Carotenoid Society."

In addition to an energizing week of inspiring carotenoid science, participants delighted in exploring Edinburgh and taking part in a whisky-tasting event and a Scottish-themed symposium dinner and Ceilidh.

The 15th International Symposium on Carotenoids will be held in 2008 in Okinawa, Japan, with Hideki Hashimoto from Osaka City University as chairman. Information about this and other carotenoid-related events is on the Web site of the International Carotenoid Society: www.carotenoidsociety.org.

George Britton <g.britton@liv.ac.uk>, who was program chair of the 2005 conference, recently retired from the School of Biological Sciences at the University of Liverpool.

Mark Your Calendar

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

2006 *(later than 1 May)*

IUPAC poster prizes to be awarded

30 April–4 May 2006 • Biocalorimetry • Rio De Janiero, Brazil
Workshop on Biocalorimetry and Biological Thermodynamics
Prof. Lucia Bianconi, Instituto de Bioquimica Medica, Universidade Federal do Rio de Janerio, Predio do CCS - Bloco E, Sala 27B, Rio de Janeiro, 21941-590, Brazil, Tel.: +55 21 2562 6759, Fax: +55 21 2270 8647, E-mail: lucia.bianconi@gmail.com

28 May–1 June 2006 • Macro- and Supramolecular Architectures and Materials • Tokyo, Japan
3rd International Symposium on Macro- and Supramolecular Architectures and Materials (MAM-06): Practical Nanochemistry and Novel Approaches
Prof. Kurt E. Geckeler, Lab. of Applied Macromolecular Chemistry, Gwangju Institute of Science & Technology, 1 Oryong-dong, Puk-gu, Gwangju 500-712, South Korea, Tel.: +82 62 970 2316, Fax: +82 62 970 2338, E-mail:keg@kjist.ac.kr

11–15 June 2006 • Organic Synthesis • Merida, Yucatan, Mexico
16th International Conference on Organic Synthesis (ICOS 16)
Dr. Eusebio Juaristi, Instituto Politecnico Nacional, Departamento de Quimica, Avenida IPN #2508, Esquina Ticoman, Mexico City, DF, 07360, Mexico, Tel: +52 55 50613722, Fax: +52 55 57477113, E-mail: juaristi@relaq.mx

17–18 June 2006 • Neurotoxic Metals • Brescia, Italy
Workshop on Neurotoxic Metals: Lead, Manganese, and Mercury. From Research to Prevention
Dr. Roberto G. Lucchini, Institute of Occupational Health, University of Brescia, Italy, Brescia, Italy, Tel.: +39 0303996080, Fax: +39 0303996080, E-mail: lucchini@med.unibs.it

25–30 June 2006 • Analytical Sciences • Moscow, Russia
International Congress on Analytical Sciences
Prof. Vladimir P. Kolotov, Vernadsky Institute of Geochemistry, Russian Academy of Sciences, 19, Kosygin Str., Moscow B-334 119991 Russia, Tel.: +7 (095) 137 04 86, Fax: +7 (095) 938 20 54, E-mail: kolotov@geokhi.ru

2–7 July 2006 • Polymers and Organic Chemistry • Okasaki, Japan
12th International Conference on Polymers and Organic Chemistry 2006 (POC'06)
Prof. Shinichi Itsuno, Department of Materials Science, University of Technology, Toyohashi, 441-8580, Japan, Tel.: +81 532 44 6813, Fax: +81 532 44 6813, E-mail: itsuno@tutms.tut.ac.jp

16–21 July 2006 • Macromolecules • Rio de Janeiro, Brazil
41st International Symposium on Macromolecules—IUPAC World Polymer Congress MACRO 2006
Prof. Ailton de Souza Gomes, Caixa Postal 68525, Rio de Janeiro, 21945-970, Brazil, E-mail: asgomes@ima.ufrj.br or macro2006@linkway.com.br

23–28 July 2006 • Biodiversity and Natural Products • Kyoto, Japan
ICOB-5 & ISCNP-25 IUPAC International Conference on Biodiversity and Natural Products
Prof. Michio Murata, Department of Chemistry, Osaka University, Graduate School of Science, 1-16 Machikaneyama, Toyonaka, Osaka, 560-0043, Japan, Tel.: +81 6 6850 5437, Fax: +81 6-6850-5774, E-mail: iscnp25@ch.wani.osaka-u.ac.jp

24–29 July 2006 • Solubility Phenomena • Freiberg, Germany
12th International Symposium on Solubility Phenomena and Related Equilibrium Processes (12th ISSP)
Prof. Wolfgang Voigt, Technische Universitat Bergakademie Freiberg, Institut fur Anorganische Chemie, Leipziger Strasse 29, D-09596 Freiberg (Sachs), Germany, Tel.: +49 3731 39 4338, Fax: +49 3731 39 4058, E-mail: wolfgang.voigt@chemie.tu-freiberg.de

30 July–4 August 2006 • Chemical Thermodynamics • Boulder, Colorado, USA
19th IUPAC Conference on Chemical Thermodynamics
Dr. Michael Frenkel, Physical and Chemical Properties Division, National Institure for Standards and Technology, 325 Broadway, Mail Stop 838.0, Boulder, CO 80305-3328, USA, Tel.: +1 303 497 3952, Fax: +1 303 497 5044, E-mail: frenkel@boulder.nist.gov

Mark Your Calendar

6–11 August 2006 • Pesticide Chemistry • Kobe, Japan
11th International Congress of Pesticide Chemistry
Dr. Hisashi Miyagawa, Division Applied Life Sciences, Graduate School of Agriculture, Kyoto University, Kyoto 606-8502, Japan, Tel.: +81 75 753 6118, Fax: +81 75 753 6123, E-mail: miyagawa@kais.kyoto-u.ac.jp

7-10 August 2006 • Environmental Best Practices • Olsztyn, Poland
The First International Environmental Best Practices Conference
Prof. Miroslaw Luczynski, Department of Environmental Biotechnology, University of Warmia and Mazury in Olsztyn, Sloneczna 45G, Olsztyn 10-709, Poland, Tel.: +48 89 5234119, Fax: +48 89 5234119, E-mail: mirekl@uwm.edu.pl

12–17 August 2006 • Chemical Education • Seoul, Korea
19th International Conference on Chemical Education
Prof. Choon H. Do, Sunchon National University, Department of Polymer Science and Engineering, 315 Maegok-dong, Sunchon, Chonnam 540-742, Korea, Tel.: +82 61 750 3565, Fax: +82 61 750 3565, E-mail: choondo@sunchon.ac.kr

13–18 August 2006 • Coordination Chemistry • Cape Town, South Africa
37th International Conference on Coordination Chemistry
Prof. K.R. Koch, Department of Chemistry, Univsersity of Stellenbosch, Private Bage X1 Matieland, Stellenbosch 7602, South Africa, Tel.: +27 21 808 3020, Fax: +27 21 808, E-mail: krk@sun.ac.za

20–25 August 2006 • Physical Organic Chemistry • Warsaw, Poland
XVIII International Conference on Physical Organic Chemistry: New Interactions, New Materials, New Prospects in Physical Organic Chemistry
Prof. Tadeusz Marek Krygowski, Department of Chemistry, University of Warsaw, ul. Pasteura 1, PL-02093 Warsaw, Poland, Tel.: +48 22 822 28 92, Fax: +48 22 822 28 92, E-mail: tmkryg@chem.uw.edu.pl

20-25 August 2006 • Raman Spectroscopy • Yokohama, Japan
20th International Conference on Raman Spectroscopy (ICORS 2006)
Prof. Hiro-o Hamaguchi, Department of Chemistry, University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo, 113-0033 Japan, Tel.: +81 3 5841 4327, Fax: +81 3 3818 4621, E-mail: hhama@chem.s.u-tokyo.ac.jp

3–8 September 2006 • Radical Polymerization • Il Ciocco/Castelvecchio Pascoli, Italy
International Symposium on Radical Polymerization: Kinetics and Mechanism
Prof. Michael Buback, Institut für Physikalische Chemie, Universität of Göttingen, Tammannstraße 6 D-37077 Göttingen, Germany, Tel.: +49 5-513-931401, Fax: +49 5-513-93144, E-mail: mbuback@gwdg.de

4-8 September 2006 • Nanostructured Composite Films • Warsaw, Poland
E-MRS 2006 Symposium A on Nanostructured Composite Films
Prof. Yves Pauleau, CNRS-LEMD, National Polytechnic Institute of Grenoble, 25 Rue des Martyrs, B.P. 166, F-38042 Grenoble cedex 9, France, Tel.: +33 476 881071, Fax: +33 476 887945, E-mail: yves.pauleau@grenoble.cnrs.fr

9-13 September 2006 • Chemical Biology • Antalya, Turkey
9th Eurasia Conference on Chemical Sciences - Innovations in Chemical Biology at the Bridge of Eurasia
Prof. Bilge Sener, Department of Pharmacognosy, Gazi University, Maltepe, TR-03360 Ankara, Turkey, Tel.: +90 312 212 22 67, Fax: +90 312 213 39 21, E-mail: bilgesen@gazi.edu.tr

10–15 September 2006 • Green Chemistry • Dresden, Germany
First International IUPAC Conference on Green-Sustainable Chemistry
Prof. Pietro Tundo, Dipartimento di Scienze Ambientali, Ca' Foscari, University of Venice, Calle Larga S. Marta, Dorsoduro 2137, I-30123 Venizia, Italy, Tel.: +39 41 2348642, Fax: +39 41 2348620, E-mail: tundop@unive.it

18–22 September 2006 • High Temperature Materials • Vienna, Austria
12th International Conference on High Temperature Materials Chemistry (HTMC XII)
Prof. Dr. Adolf Mikula, Wahringstr. 42, A-1090 Vienna, Austria, Tel.: +43 4277 52606, Fax: +43 4277 52679, E-mail: Adolf.Mikula@univie.ac.at

27-29 September 2006 • Occupational Health and Safety Management in East Africa • Nairobi, Kenya
Mr. Kelvin Khisa, Kenya National Cleaner Production Centre, P.O. Box 30650, City Square, Nairobi, 00200, Kenya, Tel.: +254 2 604870, Fax: +254 2 604871, e-mail: kkhisa@cpkenya.org

10–13 October 2006 • Advanced Polymers • Busan, Korea
Advanced Polymers for Emerging Technologies
Prof. Sung Chul Kim, Department of Chemical Engineering, Korea Advanced Institute of Sci. & Tech., 373-1 Guseongdong, Yuseong-gu, Daejeon 305-701, Korea, Tel.: +82 42 869 3914, Fax: +82 42 869 8435, E-mail: kimsc@kaist.ac.kr

16–20 October 2006 • Chemistry for Life • Havana City, Cuba
27th Latin American Congress on Chemistry and 6th International Congress of Chemistry and Chemical Eng.
Prof. Alberto J. Núñez Sellés, Center of Pharmaceutical Chemistry, Sociedad Cubana de Quimica, Ave 21 & 200, Rpto. Atabey, Apdo. 16042 Havana, CP 11600, Cuba, Tel.: +53 7 218 178, Fax: +53 7 273 6471, E-mail: alberto.nunez@cqf.sld.cu

2007

IUPAC poster prizes to be awarded

15–21 April 2007 • Phosphorus Chemistry • Xiamen, China
17th International Conference on Phosphorus Chemistry
Prof. Yufen Zhao, Xiamen University, Department of Chemistry, Xiamen, China 361005, Tel.: +86 5922185610 Fax: +86 5922186292, E-mail: yfzhao@xmu.edu.cn

21–25 May 2007 • Mycotoxins and Phycotoxins • Istanbul, Turkey
XIIth International Symposium on Mycotoxins and Phycotoxins
Dr. Hamide Z. Senyuva, Tubitak-Atal, Konya Yolu No. 67, Besevler, 06530, Ankara, Turkey, Tel.: +90 312 2124620/ext.14, Fax: +90 312 2123749, E-mail: hamide.senyuva@tubitak.gov.tr

26-30 June 2007 • Advanced Materials • Kharkiv, Ukraine
Modern Physical Chemistry for Advanced Materials (MPC'07)
Prof. Yuriy Kholin, Materials Chemistry Department, V.N. Karazin Kharkiv National University, Svobods Square 4, Kharkiv 61077, Ukraine, Tel.: +380 57 707 51 26, Fax: +380 57 705 12 61, E-mail: kholin@univer.kharkov.ua

16–20 July 2007 • Solution Chemistry • Perth, Australia
30th International Conference on Solution Chemistry
Prof. Glenn Hefter, School of Mathematical and Physical Sciences, Murdoch University, Murdoch, WA 6150 Australia, Tel.: +61 8 9360 2226, Fax: +61 8 9360 1711, E-mail: g.hefter@murdoch.edu.au

22–27 July 2007 • Novel Aromatic Compounds • Tsuna-Gun, Japan
12th International Symposium on Novel Aromatic Compounds (ISNA-12)
Prof. Yoshito Tobe, Division of Frontier Materials Science, Osaka University, Toyonaka, Osaka University, Japan, Tel.: +81 6 6850 6225, Fax: +81 6 6850 6229, E-mail: tobe@chem.es.osaka-u.ac.jp

2–6 August 2007 • Organometallic Chemistry • Nara, Japan
14th International Symposium on Organometallic Chemistry Directed Towards Organic Synthesis (OMCOS-14)
Prof. Kazuhiko Takai, Dept. of Applied Chemistry, Okayama University, Faculty of Engineering, Tsushimanaka 3-1-1, Okayama 700-8530, Japan, Tel.: +81 86 251 8097, Fax: +81 86 251 8094, E-mail: ktakai@cc.okayama-u.ac.jp

4–12 August 2007 • IUPAC 44th General Assembly • Torino, Italy
IUPAC Secretariat, Tel.: +1 919 485 8700, Fax: +1 919 485 8706, E-mail: secretariat@iupac.org

5–11 August 2007 • IUPAC 41st Congress • Torino, Italy
Chemistry Protecting Health, Natural Environment, and Cultural Heritage
E-mail: IUPAC.2007@unito.it

2-7 September 2007 • Ionic Polymerization • Bayreuth, Germany
International Symposium on Ionic Polymerization
Prof. Axel Müller, MC II / NW II, Universität Bayreuth, D-95440 Bayreuth, Germany, Tel.: +49-921-553399, Fax: +49-921-553393, E-mail: axel.mueller@uni-bayreuth.de

International Union of Pure and Applied Chemistry

Advancing the worldwide role of chemistry for the benefit of Mankind

Mission Statement—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.

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