

IUPAC Committee on Chemistry Education
Report on Activities 2006-2007
by
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This report is organized as follows

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1. CCE Priority Areas and Activity for 2006-2007

CCE carries out its work through the dedicated efforts of 8 titular members, 8 associate members representing divisions, 21 national representatives and two ex officio members. That work is focused through projects; through two subcommittees - Public Understanding of Chemistry (PUC), chaired by NR Tony Ashmore (UK) and Chemistry Education for Development, chaired by NR Mei-Hung Chiu (Taiwan); and through the biennial International Conferences on Chemistry Education. In addition, educational activities are carried out in cooperation with IUPAC divisions and standing committees, coordinated by TM and division liaison, Eva Åkesson (Sweden).

Listed in italics below are the priority areas identified by CCE for the current biennium. Below each priority area, I have highlighted some of the activities and approaches used by CCE to address each area.

- *To foreground the importance of learner-centred chemistry curriculum, both in the developed and developing world. The extent to which this is done should be one criterion used to assess educational projects.*

This is an important, challenging, and long term goal. Strategies to raise awareness of and show best practices in learner-centred curriculum were the theme of presentations at the 19th International Conference on Chemistry Education (ICCE) held in Seoul, Korea, August 12-17, 2006. Modeling inquiry-based approaches with young learners is also integral to the highly successful Young Ambassadors for Chemistry (YAC) program, spearheaded by TM Lida Schoen (Netherlands). Highly visible YAC events have run in South Africa, Taiwan, Argentina, Korea, and Russia.

- *To give priority to initiatives that highlight the relationship between chemistry and sustainable development, consistent with the goals of the UN Decade for Sustainable Development.*

An example of a current CCE project, directed specifically at this relationship is led by TM Natalia Tarasova from Russia, Project #2006-043-3-050, *The Social Responsibility of Chemists*:

Responsible Stewardship. This project will be carried out in conjunction with the symposium: *The Social Responsibility of Chemists: Green Chemistry*, at the Mendeleev Congress in Moscow, Sept 23-28, 2007.

- *To continue to support initiatives that highlight ethical concerns in chemistry, including the collaboration that has developed between IUPAC and OPCW.*

The CCE chair has worked with Torino IUPAC Congress organizers to put ethics on centre stage through a production of Roald Hoffmann's new play 'Should've' at the opening ceremony, following a plenary lecture on ethics by Hoffmann. A symposium, entitled: '*Beyond Should've: Ethics in Science and Education*,' will carry this important conversation further during the Congress. An example of a current CCE project that focuses on ethical concerns is led by Alastair Hay from the UK, Project 2005-029-1-050, *Educational Material for Raising Awareness of the Chemical Weapons Convention and the Multiple Uses of Chemicals*. Material covering four topics, taking a case-study approach, has been presented at workshops for secondary and tertiary chemistry teachers in Moscow, Leeds, Seoul, Bologna, and (scheduled) for the IUPAC Congress in Torino. Materials start with the beneficial use of chemicals, and raise awareness about the possible misuses of chemicals, including the production of chemical weapons. Students are encouraged to develop their own codes of responsible conduct. Web production of materials is underway at the King's University College, and they have been translated with the support of the Organization for the Prohibition of Chemical Weapons (OPCW) into the six official OPCW languages.

- *Increasing the public understanding of chemistry is of central importance to CCE. In this biennium we plan to work closely with COCI and divisions to obtain broad IUPAC approval for and implementation of our report proposing a niche for IUPAC in public understanding of chemistry. One measure of success will be for Public Understanding of Chemistry to be seen as everyone's responsibility, tied into all IUPAC projects and activities in appropriate ways.*

The report, entitled "*Chemists and the Public: IUPAC's Role in Achieving Mutual Understanding*," has been completed, following the receipt of comments on the draft placed on the IUPAC web site. The report was approved by the IUPAC Bureau, and submitted to Pure & Applied Chemistry for dissemination. The half-day joint meeting of Chemrawn, COCI, and CCE at the General Assembly in Torino will be devoted to consideration of how to tie public understanding outcomes into all IUPAC projects and conferences, and will be facilitated by NR Mort Hoffman (USA). Public Understanding of Chemistry sub-committee chair, NR Tony Ashmore (UK) has organized a high profile symposium at the IUPAC Congress in Torino on the Public Understanding of Chemistry, and CCE has given leadership in mapping the way toward declaration of an International Year of Chemistry, as described more fully below.

- *The biennial International Conferences on Chemistry Education are flagship activities for CCE. We seek to more fully integrate ICCE activities into the work of CCE and use ICCE conferences to report the outcomes of CCE projects and bring participants together to implement CCE strategies and*
- *To build chemistry education networks, using fully the multicultural competence within CCE.*

TM Choon Do (Korea) served as the Chair of the Organizing Committee of the successful 19th International Conference on Chemistry Education, held Aug 12 -17, 2006, with the participation of over 300 chemistry educators from 37 countries. CCE projects were featured in symposia and workshops on public understanding of chemistry, multiple uses of chemicals, and responsible stewardship. In addition a CCE project on automated Japanese-English translation

was reported by TM Masato Ito (Japan). Ito also serves as editor of Chemistry Education International. Conference coordinator Warren Beasley (TM, Australia) will report to the CCE meeting in Torino on plans for the 20th ICCE, to be held in Mauritius, August 3-8, 2008, with a satellite conference in Kenya (<http://www.uom.ac.mu/20icce.htm>). CCE will liaise with both UNESCO and ICSU's regional office on ways to ensure that the conference brings benefits to sub-Saharan Africa. A decision on the site for the 2010 Conference will also be made at the CCE meeting in Torino.

The ICCE has spawned and supported other networks in chemistry education. One good example of such a regional network, which was the focus of a session at the 19th ICCE, is the Network for Inter-Asian Chemistry Educators (NICE). A second NICE symposium, with the purpose of sharing chemistry teaching strategies and materials between Asian chemistry educators, will take place in Taipei just before the IUPAC GA.

Local networks have been built in many regions through the efforts of ex-officio member John Bradley, who continues to hold workshops around the world on microscale chemistry for student laboratories.

- *To articulate clear directions for the Chemistry Education for Development subcommittee, and include the Flying Chemist Program as an integral part of the work of that subcommittee.*

Having reviewed successful FCP visits to India and Sri Lanka under the leadership of former CCE chair Peter Atkins and former CED subcommittee chair Ram Lamba, CED subcommittee chair, Mei-Hung Chiu, will bring to the CCE meeting in Torino recommendations for formalizing application procedures for the Flying Chemist Program. She will also propose mechanisms to develop a roster of expertise within and outside of CCE membership that can be tapped by new applicants. CCE is currently formalizing arrangements for its 3rd FCP visit in early 2008, which will focus on improving the teaching and learning of chemistry at the tertiary level in the Philippines.

2. Designation of International Year of Chemistry

One of the most significant contributions IUPAC will make to enhance public understanding of chemistry may result from the decision in principle for IUPAC to gather partners to launch an International Year of Chemistry. At the request of the IUPAC Bureau, CCE has given leadership to mapping out the necessary steps for designation. This has taken shape through a project (2007-011-1-050) led by the Committee on Chemistry Education with the mandate "to submit to IUPAC a plan to secure the UNESCO (and UN) designation of 2011 as the International Year."

A task group comprising CCE's Tony Ashmore (Chair – UK) and Natalia Tarasova (Russia), John Jost (Executive Director IUPAC), Nina McClelland (USA), and Stanley Langer (UK) visited UNESCO, Paris on 25 May 2007 to learn from the experience of UNESCO staff. Since the task group meeting was only a few days before submission of this report, an update on recommended steps for IUPAC and actions to date will be given at the Bureau and Council meeting in Torino.

At this point, we have the following understanding of what will be needed.

The earliest available year is 2011, the centenary of the award of the Chemistry Nobel Prize to Madame Curie and a year in which an IUPAC World Chemistry Congress will be held. An earlier suggestion to designate 2009 to commemorate the Mendeleev Centenary leaves insufficient

time for planning. However lessons learned from activity in Russia will be valuable, as will the experiences of other international years, such as physics and planet earth.

Formal designation by UNESCO will be essential and additional designation by the UN will be highly desirable if the International Year is to be global and supported by developing countries. These processes are separate. The added benefit of UN designation is that the resolution that is passed is communicated to all member governments and facilitates activity and access to funding in some countries. The decision making body is the annual UN General Assembly and would follow on from UNESCO decision. Decision making in UNESCO is via a recommendation from an Executive Board, meeting in October 2007, to a General Conference, meeting immediately after the Executive Board. UNESCO General Conference meetings are biennial so it is essential that IUPAC develops and carefully meets a timetable for next steps.

Within UNESCO, IUPAC can promote a resolution through:

- the secretariat
- ICSU, or
- a member state

As the General Conference of Member States is the decision making body we are advised that promotion by a member state, supported by others, is the most likely to succeed. Further, promotion by an African country, with support from elsewhere accords with UNESCO priorities. IUPAC should identify a country to take the lead with respect to bringing forward a recommendation for a UNESCO decision.

Member states have Permanent Representatives to UNESCO based in Paris and National Commission for UNESCO based at home. The support of these Representatives and Commissions in promoting and voting for the resolution is vital. This requires urgent action by IUPAC's NAOs and ANAOs and by national chemical societies.

The project group is preparing template letters to these bodies and template letters they can use in communicating with their representatives and commissions. The IUPAC Secretariat will prepare and dispatch individualized communications and monitor consequent activity. The Secretariat will need to follow up and ensure appropriate support is secured and is timely; otherwise designation will not be achieved.

IUPAC will need to submit an information document to the UNESCO Executive Board requesting the designation of an International Year, explaining its importance and showing how IUPAC and its associated organisations will deliver on a global basis.

The experiences of cooperation with UNESCO over the International Year of Physics will be most helpful. UNESCO hosted the launch event at its headquarters in Paris. This comprised a half-day gathering of government representatives, UN ambassadors, leading scientists and politicians, and included a two day conference for 1000 participants on the future of physics. The audience included 500 talented students from across the world selected in part from UNESCO schools and the International Physics Olympiad. Later in the year there was a World Congress on Physics for Sustainability. Both a highly visible launch and a year end closing event are important.

Challenges for IUPAC will include collaboration with others to obtain the necessary funding, obtaining global participation from national societies for activities, and the need to consider carefully the viability and risks inherent in a heavy reliance on volunteers.

3. Relationship Between CCE Priority Areas and IUPAC's Strategic Plan

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

Leadership in the areas of chemistry education and public understanding is evident from the International Year of Chemistry initiative, as well as placing high priority on fostering learner-centred curriculum. The work to define IUPAC's niche in the public understanding of chemistry has also been well received by national chemical societies.

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

Approaches to the development of curriculum and to the public understanding of chemistry must be informed by the extensive research literature in these areas, and this has been a significant focus of CCE's efforts in the past biennium.

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

CCE continues to build a strong relationship with the Committee on Chemistry and Industry (COCI), over topics of mutual interest, such as the public understanding of chemistry. Implementation of the goals of the UN Decade for Education for Sustainable Development has been the focus of CCE projects and activities.

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

The International Conferences on Chemistry Education (ICCE) are designed to bring chemists from around the world together to address common issues. Particular attention is paid to the needs of developing countries with the formation of the Sub-Committee on Chemistry Education for Development.

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

This statement embodies significantly the mandate of CCE. One additional example of attention to the enhancement of chemistry education and the public appreciation of chemistry, not given above, is the launching of CCE's second global poster competition for young people. As with the YAC program, this initiative brought IUPAC into partnership with Science Across the World. TMs Lida Schoen and Choon Do coordinated the effort. Students from around the world were asked to visualize their ideas about "Chemistry for Humanity." Almost 1000 entries from 32 countries were submitted, and 54 posters were displayed at the 19th ICCE in Seoul. A selection of posters can be viewed in the January-February 2007 issue of Chemistry International.

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

CCE has given a great deal of attention to diversity within its own membership, and has developed a new mechanism for membership renewal through the formation of an advisory committee on membership. The committee, chaired by CCE past-chair Peter Atkins, solicits nominations from members and others, and recommends to the CCE chair Titular Members and National Representatives for the next biennium. This process is being piloted at present, and will result in recommendations for CCE membership for 2008-2009.

3. Current CCE Projects

- 2007-011-1-050 - International Year of Chemistry - Initial strategy planning
- 2006-043-3-050 - The Social Responsibility of Chemists: Responsible Stewardship
- 2005-029-1-050 - Educational material for raising awareness of the Chemical Weapons Convention and the multiple uses of chemicals
- 2005-002-2-050 - Micro-scale chemistry for student laboratories in India
- 2004-047-1-050 - Public understanding of science: identifying IUPAC's niche
- 2003-055-1-050 - Young Ambassadors for Chemistry (YAC)
- 2002-021-2-050 - A feasibility study of the scope and limitation of machine translations as a means of disseminating useful reading material for chemical education on the internet
- 2001-016-1-050 - IUPAC chemical nomenclature for chemistry teachers at secondary schools

4. Other Activities and Projects of Interest

- The Flying Chemists Program
- *Chemical Education International* (the e-journal succeeding to the International Newsletter in Chemical Education)
- Chemical Education and Sustainable Development (2004 International Conference)
- DIDAC
- Virtual Chemical Education
- International Network for Locally Produced Low Cost Equipment
- Source Books for Teaching of Chemistry
- CHEMRAWN X - Chemical Education
- Teaching High Temperature Materials Chemistry at University
- Green Chemistry in Africa (a book meant for university students and with a focus on Africa)
- Global Climate Change - a monograph for secondary schools
- Medicinal Chemistry Curriculum
- The Science of Chemical Safety Essential Toxicology - an Educational Resource

5. Membership, Roles and Sub-Committees

Titular Members

- Prof. Peter G. Mahaffy (Canada) – Chair
- Prof. Eva Åkesson (Sweden) - Secretary - *Division Liaison*
- Prof. Warren Beasley (Australia)- *Conference Coordinator*
- Prof. Choon H. Do (Korea) - *Project Group Coordinator*
- Prof. Masato M. Ito (Japan)
- Prof. Ram S. Lamba (Puerto Rico)

- Dr. Lida Schoen (Netherlands)
- Prof. Natalia P. Tarasova (Russia)

Associate Members (Divisional Representatives)

- Prof. A. James McQuillan (New Zealand)
Physical and Biophysical Chemistry
- Prof. Leonard Interrante (United States)
Inorganic Chemistry
- Prof. Gerrit J. Koomen (Netherlands)
Organic and Biomolecular Chemistry
- Prof. Jean-Pierre Vairon (France)
Polymer
- Prof. Roger M. Smith (United Kingdom)
Analytical Chemistry
- Dr. R. Donald Wauchope (United States)
Chemistry and the Environment
- Dr. Mukund S. Chorghade (United States)
Chemistry and Human Health
- Prof. Richard Hartshorn (New Zealand)
Chemical Nomenclature and Structural Representation

National Representatives

- Prof. Ludo Brandt
Belgium
- Prof. Alvaro Chrispino
Brazil
- Prof. Borislav Toshev
Bulgaria
- Prof. Qiankun Zhuang
China/Beijing
- Prof. Mei-Hung Chiu
China/Taipei
- Prof. Ameen Farouk M. Fahmy
Egypt
- Prof. Terence N. Mitchell
Germany
- Prof. Miklos Riedel
Hungary
- Prof. Uday Maitra
India
- Prof. Peter E. Childs
Ireland
- Dr. Mordechai Livneh
Israel
- Prof. Liberato Cardellini
Italy

- Prof. Masahiro Kamata
Japan
- Dr. Maryam Al-Wateed
Kuwait
- Prof. Farzana Mahmood
Pakistan
- Prof. Erica Steenberg
South Africa
- Prof. Katrina Edström
Sweden
- Prof. Phillippe Boesch
Switzerland
- Prof. Hale Bayram - *Project Group Member*
Turkey
- Dr. Anthony D. Ashmore - *Project Group Member*
United Kingdom
- Prof. Morton Z. Hoffman - *Project Group Member*
United States

Ex Officio

- Mark C. Cesa (*COCI Representative*)
- Prof. John D. Bradley
South Africa; Consultant for Microscale Project/Programme

Subcommittee on Chemistry Education for Development

- Prof. Mei-Hung Chiu, Chair and *Project Group Member* (China/Taipei)
- Prof. Warren Beasley (Australia)
- Prof. John Bradley (South Africa)
- Prof. Bob Bucat (Australia)
- Prof. Masahiro Kamata (Japan)
- Prof. Ram Lamba (Puerto Rico)
- Dr. Mordechai Livneh (Israel)
- Dr. Lida Schoen (Netherlands)
- Dr. Erica Steenberg (South Africa)
- Prof. Natalia Tarasova (Russia)

Subcommittee on Public Understanding of Chemistry

- Dr. Anthony D. Ashmore, Chair, and *Project Group Member* (UK)
- Prof. Liberato Cardellini (Italy)
- Prof. Shu-Nu Chang (China/Taipei)
- Prof. Peter Childs (Ireland)
- Prof. Choon Do (Korea)
- Prof. Masato Ito (Japan)
- Dr. Lida Schoen (Netherlands)