

Date: March 31, 2010
From: Peter Mahaffy, CCE Chair
To: IUPAC Bureau
Re: Committee on Chemistry Education Chair's Report to the Bureau

This report highlights significant CCE activities during the current year and plans for new initiatives in the first year of the biennium, leading up to the International Year of Chemistry in 2011. I also highlight emerging opportunities and challenges for CCE (and for IUPAC) presented by IYC 2011.

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1. CCE mandate and mechanisms to carry out that mandate

(a) CCE mandate

- ❑ To advise the President and the Executive Committee on matters relating to chemistry education, including the public appreciation and understanding of chemistry.
- ❑ To maintain a portfolio of educational projects and to coordinate the educational activities of IUPAC.
- ❑ To monitor chemistry education activities throughout the world and to disseminate information relating to chemical education, including the public appreciation and understanding of chemistry.
- ❑ To develop liaisons with international organizations such as UNESCO, national and regional chemical societies, chemical education committees, and organizations concerned with the public appreciation and understanding of science.

(b) Mechanisms to carry out that mandate

CCE met as a full committee in August 2009 at the IUPAC General Assembly in Glasgow, and the committee will meet again in 2010 just prior to and during the 21st ICCE in Taipei. In formal meetings and beyond, CCE accomplishes its work through the dedicated efforts of 6 titular members and 2 officers, 8 associate members representing divisions, 23 national representatives and two ex officio members – representing a total of 36 countries.

Our work is carried out through projects and partnerships; through two subcommittees - Chemistry Education for Development, chaired by NR Mei-Hung Chiu (Taiwan), and the International Year of Chemistry Education Sub-committee, co-chaired by Mustafa Sozibilir (Turkey) and Anthony Wright (Australia); and through biennial ICCE conferences. In addition, educational activities are carried out in cooperation with IUPAC divisions and standing

committees, coordinated by division liaison, Eva Åkesson (Sweden). CCE also has built and nourished relationships with partners outside of IUPAC. Presently CCE has either on-going or developing partnerships with chemical industry, UNESCO, Science across the World, the Chemical Heritage Foundation, and the Comenius School partnership.

2. CCE Priorities for 2010 -2011 biennium

As agreed at our meeting in Glasgow, the six priorities that will shape the work of CCE during the 2010-2011 biennium are:

- (a) To maintain a primary focus on working with other partners and stakeholders to implement the International Year of Chemistry
- (b) To foreground the importance of learner-centred chemistry curriculum and education, both in the developed and developing world. The extent to which this is done should be one criterion used to assess educational projects.
- (c) To give priority to initiatives that highlight the relationship between chemistry and sustainable development, consistent with the goals of the IYC and the UN Decade for Education for Sustainable Development.
- (d) To build chemistry education networks, using fully the multicultural competence within CCE.
- (e) The biennial International Conferences on Chemistry Education are flagship activities for CCE. We continue to 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
- (f) To continue to support initiatives that raise awareness and understanding of ethical issues that are important in chemistry.

A CCE project group is developing a framework to guide CCE priorities and activities. A final report is expected at our 2010 meeting in Taipei, and this may be helpful in refining these priorities

3. CCE Role in the International Year of Chemistry

Consistent with our first priority for the biennium, CCE has decided that our resources and global educational network will be directed to whatever extent possible to mesh and build synergy with other IYC activities and programs over the next biennium. To that end, CCE has established an **International Year of Chemistry Education Sub-Committee**, whose mandate is focused on contributing to the planning and activities needed for a successful International Year of Chemistry. The mandate of the committee is to: (a) advise on some global educational activities that might be part of the year's activities, (b) advise on how activities might be made available to countries with less well-resourced chemical societies and NAOs, (c) recommend ways to integrate existing CCE programs such as YAC, FCP, and microscale workshops into IYC activities, and (d) use the momentum of IYC to build sustainable partnerships with UNESCO and other partners and regional networks of chemistry educators.

In that context, I provide below an update on on-going projects, new projects, and proposed projects that are most relevant to our priority to "work with other partners and stakeholders to implement the International Year of Chemistry."

- **Flying Chemist Program (FCP).** The Flying Chemists Program is integrated into the activities of CCE and the Chemistry Education for Development subcommittee, and has the overall goal to provide emerging or economically disadvantaged countries means to

improve the teaching and learning of chemistry at primary, secondary, and tertiary levels. The FCP provides a country with the expertise needed to strengthen chemistry education and to assist it in its development. Two new FCP program visits are proposed for the next year: The first is proposed for Croatia (November 2010), and the second to help launch IYC in February 2011 in Ethiopia.

Both proposals follow a model used successfully in the Philippines, India and Sri Lanka in the three previous FCP initiatives, namely bringing together at the national level a critical mass of chemistry educators to improve chemistry education, facilitated by external resource persons with expertise in areas targeted by the country, and including experience with previous FCP programs.

Croatia has identified its main focus on chemistry education at the primary and secondary levels. The Croatian FCP will bring together a partnership including the Ministry of Science, Education and Sport; the Croatian National Teacher Education and Teacher Training Agency (ETTA); and the Croatian Chemical Society.

Ethiopia proposes to bring together a network of chemists and chemistry educators to enhance the capacity of the country to provide quality chemistry education at the secondary and tertiary level. Particular emphases will be placed on laboratory instruction; designing and implementing contextualized and learner-centred chemistry education; and promoting innovative ways of training quality chemistry teachers. The FCP visit is proposed to coincide with the 27th Annual Conference of the Chemical Society of Ethiopia, and is being planned in consultation with both the Chemical Society of Ethiopia and the Federation of African Societies of Chemistry.

Chemistry Education for Development Sub-committee chair Mei-Hung Chiu (Taiwan) and several members of CCE have worked closely with local organizers on the development of proposals for these next two FCP visits.

- **Young Ambassadors for Chemistry (YAC).** The YAC program was originally set up as a partnership between CCE and Science Across the World. Using a '*Train the Trainers*' approach, YAC facilitators have worked with teachers and students to increase public appreciation for and understanding of chemistry in Argentina, Bulgaria, Egypt, Jordan, Korea, Lithuania, Russia, South Africa, Taiwan, Mauritius, and Cyprus. CCE is particularly pleased to have facilitated bringing this program to Cyprus and notes with great interest that the Pancyprian Union of Chemists has just been approved as a Provisional NAO of IUPAC.

Just prior to the Bureau meeting in April, two additional YAC programs will be held. The first one on April 5-6 in Malaysia, was coordinated with the help of Datuk Dr Soon Ting Kueh, CCE NR and President of Institut Kimia Malaysia. The second will be held April 12-14 in Philippines with the facilitation of the former FCP host in the Philippines, Dr. Fortunato B. Sevilla III, and Mij Rodriguez, president of the Philippine Association of Chemistry Teachers.

An on-going CCE project is assessing the impact of this program on teacher attitudes. CCE envisions both YAC programs and the model used by YAC to be important contributions to IYC 2011.

I would invite the Bureau to formally thank TM Lida Schoen and her YAC leadership team of NR Erica Steenberg and TM Mei-Hung Chiu (YAC); and TM Mei-Hung Chiu (FCP) for their tireless work on these two program that have created a great deal of awareness and understanding of chemistry, cemented relationships

between IUPAC and other partners, and raised the profile and reputation of IUPAC's educational work.

- **ICCE conferences.** The 21st ICCE will be held in Taipei in August 2010. The organizing committee, chaired by TM Mei-Hung Chiu, has invited 10 well known international plenary speakers, and will hold four workshops and a variety of other activities for participants to benefit from the conference week. A substantial effort will be made to inform the participants from around the globe of IUPAC activities during IYC and to encourage them to play roles of leadership in their own countries and regions. In Glasgow, a decision was made to hold the 22nd ICCE in Rome in 2012, and we plan to hold this meeting as a joint meeting with a European Chemistry Education network. We are most grateful to our conference coordinator Morton Hoffmann (USA) for his work with local organizers to facilitate this important biennial event for CCE.
- **Proposed IYC projects.** After working through many ideas brought forward by CCE members and many others for new IYC projects to support the International Year of Chemistry, CCE has proposed three new IYC projects, which are under review in the CCE and IUPAC project system.
 - **Global Experiments on the Theme of Water: A Chemical Solution.** A complex partnership has been formed of the scale needed to launch a highly visible series of global experiments to be carried out by young people during IYC. The task group has decided to focus on water - the substance identified by all of our partners as of pressing global importance, and the right icon for a highly visible link between chemistry and our sustainable future. The theme, *Water: A Chemical Solution*, was proposed by one of the industrial members of the task group, and it pulls together two complementary threads: (a) Chemistry provides solutions to some global challenges with respect to potable water and (b) Chemistry provides understanding of the fundamental properties of water and its solutions. The proposed global chemistry experiments have strong potential to become an IUPAC/UNESCO/industry flagship for IYC, and also an exemplar of the way in which IUPAC can build partnerships with industry, educational networks, and others that extend beyond IYC. In addition to the involvement of CCE members, members of three IUPAC Divisions, and three IYC management committee members, the task force has benefitted from the participation of both UNESCO and chemical industry who are represented by BASF, CEFIC (which serves as secretariat of the group), and the American Chemistry Council. A great deal has been accomplished by the group, and much more needs to be done for this to launch successfully in eight months time. IYC Chemistry Education Sub-committee co-Chair Tony Wright (NR, Australia) and Div II TM and CCE AM Javier Garcia-Martinez are task group chairs, and together with Colin Humphris (IYC Management Committee) and Madeleine Laffont (CEFIC) they form the executive group for the task force.
 - **Developing Tool Kits for National Chemistry Weeks and Exploring the Possibility of Synchronizing those Weeks During IYC.** This proposed project has been developed in response to the second mandate of the IYC Chemistry Education Sub-committee to: (b) advise on how activities might be made available to countries with less well-resourced chemical societies and NAOs. A task group has been formed to facilitate the celebration of national chemistry days and weeks throughout the world during IYC and beyond, with an emphasis on countries that do not currently have the resources or experience to have done so to date. A second goal is to explore the feasibility of synchronizing to whatever extent possible the celebration of National Chemistry Weeks so as to obtain truly global coverage of events and activities such as

the global water experiments during IYC. IYC Chemistry Education Sub-committee co-Chair Mustafa Sözbilir (Turkey) is the task group leader.

- **Chemistry as a Cultural Activity.** This proposed project aims at intercultural reflections on chemistry developments in order to foster better understanding and appreciation of chemistry as a human and cultural enterprise. An electronic communication network will be established with partners that have been identified to encourage 13-16 year old students to participate in national competitions in their own country about chemistry important to their lives, and to document their findings on the electronic platform so as to exchange their experiences internationally. Examples might include the investigation by students of national and local chemical developments (everyday products, washing powder, biographies of local heroes, chemistry of medicinal plants, conservation of cultural heritage, etc.). The task group proposes that exemplary projects will be selected to participate in the IYC closing event in Brussels. IYC Chemistry Education Sub-committee member Christiane Reiners (NR, Germany) is the task group leader.

- **The secretariat and Chemistry International.** We are most grateful to the secretariat for their assistance and particularly to Fabienne Meyers for her help with processes and for excellent coverage of IUPAC's educational activities in Chemistry International.

4. IYC Opportunities and Challenges

We see the International Year of Chemistry as providing important opportunities for CCE to carry out its mandate to coordinate IUPAC's educational activities and to work with partners to enhance the public understanding and appreciation of chemistry on a global scale. We believe that it is possible that local, national, regional, and global IYC activities and events, as well as media coverage of those activities can move the bar in the awareness by various publics of how the tools of chemistry can be used to improve the human condition and the environment.

We have already experienced new and strengthened partnerships brought together for IYC projects, including IUPAC, UNESCO, chemical industry, and science education networks. An unprecedented opportunity exists for IUPAC to set in place mechanisms to sustain both activities and partnerships far beyond IYC. But this will require a determined strategy, and will require developing that strategy before IYC is upon us.

It would be helpful if the Bureau would discuss further what can be done in 2010 to sustain IYC partnerships over education and public understanding, so that they do not end with the closing IYC ceremony in Brussels.

In carrying out our mandate focused on IYC, CCE also experiences challenges. We would like to further clarify the flow of communication and decision making with respect to global IYC educational activities among CCE, the IYC Management Committee, and the Project Committee. Closely related to this challenge is the uncertainty about the funding parameters and fund-raising mechanisms for IYC-specific activities that are being planned and proposed now. Enthusiastic chemists and chemistry educators are committing large amounts of time and energy to translate good ideas into concrete proposals for activities that will help to move IYC from a series of national activities bookended by several cornerstone events to several truly global activities. But it is difficult to move these forward without knowing parameters, timelines, and mechanisms for obtaining resources to support these activities. We note that external funding will largely determine the success of activities in the many countries in the developing world that played such an important role in obtaining designation of 2011 as IYC.

An additional challenge is for the divisions and standing committees of IUPAC to work together to use IYC to identify gaps in our fundamental scientific understanding with respect to chemistry and sustainability. As examples, what scientific breakthroughs are needed to fully implement alternative energy sources such as solar and fuel cell technologies? Or to provide potable water to the 1/3 of the world that currently does not have dependable supplies?

Might divisions consider taking the lead in forming a task group to identify and profile these scientific challenges, and involve both the science and education communities in a scoping exercise that could be profiled during the year to identify what chemistry can do in the decade following IYC to meet global needs?

We are hopeful that further discussions of these challenges and opportunities at the meetings of both the IYC Management Committee and the Bureau will be helpful in moving us forward as we are now only eight months before the launch of IYC.

5. Current CCE Projects

- 2008-042-1 - Development of a framework of priorities for CCE
- 2008-043-1-050: Visualizing and understanding the science of climate change
- 2007-005-2-050 – Research-Based Evaluation of the Young Ambassadors for Chemistry (YAC) Programme
- 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

Joint Projects with Other Divisions/Standing Committees

- Project No. 2008-017-4-300 – Green Chemistry – creation and Implementation of International Cooperation in Teaching and Investigations, Joint with Div III
- Project No. 2007-038-3-200: Development of an isotopic periodic table for the educational community, joint with Div II
- 2007-032-1-100 – Green Book – Abridged Version, Joint with Div I
- 2007-050-2-600 – Climate and Global Change: Observed Impacts on Planet Earth, joint with Div VI
- 2007-022-2-020 – Recommendations for Codes of Conduct
- 2004-037-1-400 – Design of Polymer Education Material for French Speaking Countries, joint with Div. IV
- 2004-045-1-700 – Training of School Children on Pesticides and Health – Toxicology in the Classroom, Joint with Div. VII

Projects Under review

- 2009-055-1 Toward Higher Quality of Chemistry Teacher In-service Training in Croatia.
- 2010-011-1 Global Chemistry Experiment for the International Year of Chemistry – Phase One – Design and Development
- 2009-037-2 Developing Toolkits for National Chemistry Weeks and Exploring the Possibility of Synchronizing Those Weeks During IYC

6. Current Membership, Roles and Sub-Committees

- Prof. Peter G. Mahaffy (Canada) – *Chair*
- Prof. Eva Åkesson (Sweden) – *Vice-Chair and division liaison*

Titular Members

- Prof. Mei-Hung Chiu (China/Taipei)
- Prof. Choon H. Do (Korea)
- Prof. Ram S. Lamba (Puerto Rico)
- Dr. Lida Schoen (Netherlands)
- Prof. Mustafa Sözbilir (Turkey)
- Prof. Natalia P. Tarasova (Russia)

Associate Members (Divisional Representatives)

- Dr. Assaf Friedler (Israel)
Physical and Biophysical Chemistry
- Dr. Javier Garcia-Martinez (Spain)
Inorganic Chemistry
- Prof. Mary Garson (Australia)
Organic and Biomolecular Chemistry
- Prof. Jean-Pierre Vairon (France)
Polymer
- Prof. Maria Filomena Camões (Portugal)
Analytical Chemistry
- Dr. Hemda Garelick (United Kingdom)
Chemistry and the Environment
- Dr. John Duffus (United Kingdom)
Chemistry and Human Health
- Prof. Richard Hartshorn (New Zealand)
Chemical Nomenclature and Structural Representation

National Representatives

- Prof. Tony Wright
Australia
- Prof. Muhammed Muhibur Rahman
Bangladesh
- Ludo Brandt
Belgium
- Prof. Borislav Toshev
Bulgaria
- Prof. Zhigang Shuai
China/Beijing

- Prof. Ameen Farouk M. Fahmy
Egypt
- Prof. Theodros Solomon
Ethiopia
- Ms. Nina H. K. Aremo
Finland
- Dr. Christiane Reiners
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
- Prof. Abdulaziz A. Al-Najjar
Kuwait
- Dr. Ting-Kueh Soon
Malaysia
- Prof. Farzana Mahmood
Pakistan
- Prof. Erica Steenberg
South Africa
- Prof. Maja Elmgren
Sweden
- Prof. Phillippe Boesch
Switzerland
- Prof. Morton Z. Hoffman – *Conference coordinator*
United States
- Prof. Norman Reid
United Kingdom

Ex Officio

- Dr. Michael J. Dröscher (Germany), *COCI Representative*
- Audra Wolfe (USA), *Chemical Heritage Foundation*

Subcommittee on Chemistry Education for Development

- Prof. Mei-Hung Chiu (China/Taipei), *Chair*
- Prof. Jan Apotheker (Netherlands)
- Dr. Chin-Cheng Chou (China/Taipei)
- Prof. Masahiro Kamata (Japan)
- Prof. Ram Lamba (Puerto Rico)
- Prof. Christiane Reiners (Germany)
- Dr. Lida Schoen (Netherlands)
- Dr. Erica Steenberg (South Africa)
- Prof. Natalia Tarasova (Russia)

International Year of Chemistry Education Sub-Committee

- Prof. Mustafa Sözbilir (Turkey), *co-chair*
- Prof. Anthony Wright (Australia), *co-chair*
- Prof. Liberato Cardellini (Italy)
- Prof. Christiane Reiners (Germany)
- Dr. Lida Schoen (Netherlands)
- Prof. Mustafa Sözbilir (Turkey)
- Prof. Natalia Tarasova (Russia)

CCE Project Group

- Prof. Prof. Mustafa Sözbilir (Turkey) – *Project Coordinator*
- Prof. Mei-Hung Chiu (Taiwan)
- Prof. Morton Z. Hoffman (USA)
- Prof. Masahiro Kamata (Japan)
- Prof. Mary Garson (Australia)
- Prof. Ram Lamba (Puerto Rico)