IUPAC Division VI Takes Stock and Looks Ahead

by Patrick Holland and Kenneth Racke

The Division of Chemistry and the Environment (IUPAC Division VI or DCE), which has historically had one of the broadest mandates of active bodies within IUPAC, deals with many areas of applied chemistry (soil, water, air, food, environmental contaminants, and naturally occurring toxins). In fact, DCE was formerly known as the Division of Applied Chemistry until its reconstitution in 1996. In the preceding years there were a number of changes to the supporting commissions, with a number of splits and mergers occurring. Particular areas of intense project activity during the commission-era included the chemistry of fats and oils, pesticide environmental chemistry, soil-and water-pollution chemistry, and the chemistry of mycotoxins. Expertise in the area of fundamental biophysico-chemical processes was added during 1996, at which time the Commission on Fundamental Environmental Chemistry was transferred to DCE from the Physical Chemistry Division.

The current Division Committee, of which Kenneth Racke is president and Patrick Holland is secretary, last met in May 2004 in Bethesda, Maryland, USA. At that meeting, DCE affirmed the following slightly revised terms of reference:

> *Through its internationally recognized membership and project teams, the Division of Chemistry and the Environment (DCE) will provide unbiased and timely authoritative reviews on the behavior of chemical compounds in food and the environment. The DCE will undertake both fundamental and applied evaluations that contribute to solving environmental problems and enhancing the quality of food on a global scale.*

Following the cessation of commission activities in 2001 and the IUPAC-wide move to a flexible, project team-based system, it was agreed that DCE required a strong sub-structure to fulfill its terms of reference. Thus, several subcommittees assist DCE with identifying new project areas, stimulating proposals and recruitment of project teams and leaders, and communicating to an external audience on issues of environmental and food chemistry. Four subcommittees were formed to handle the following key project areas in the DCE:

- Food Chemistry (current subcommittee chairman: Patrick Dysseler)
- Biophysico-Chemical Processes in Environmental Systems (Nicola Senesi)
- Chemistry of Environmental Compartments (Yehuda Shevah)
- Crop Protection Chemistry (Ken Racke)

Project Activities

Projects sponsored by the DCE generally fall into three broad categories. These categories are described below along with some recent examples.

Authoritative Reviews. The expertise within the DCE subcommittees is used to coordinate reviews, which are generally published in book form. For example, the Wiley book series on "Analytical and Physical-Chemistry of Environmental Systems" was edited by DCE members. Top international experts were recruited to write the chapters of each volume in the series. Nine volumes have been published in the particular so far, and two more are currently in preparation as part of specific DCE projects. These include *Bio-Physical Chemistry of Fractal Structures and Processes in Environmental Systems* (project #2003-014-2-600), led by task group chairman/editor Nicola Senesi, and *Environmental Colloids: Behavior, Structure, and Characterization* (project #2004-015-1-600), led by task group chairman/editor Kenneth Wilkinson. One added benefit of this cooperative approach with Wiley is that book royalties are credited back to DCE so that it may sponsor additional projects in the series.

Technical Evaluations. These are traditional IUPAC projects that focus on developing a critical evaluation and arriving at a set of specific recommendations to assist and influence research and regulatory approaches. Primary areas of emphasis include definitions, methodologies, and regulations dealing with environmental or food chemistry. For example, two influential glossaries previously published in *Pure and Applied Chemistry* are currently under revision via

new project teams. These are *Glossary of Terms in Atmospheric Chemistry* (project #2003-030-1-600), led by task group chairman Tomislav Cvitas, and *Glossary of Terms Related to Pesticides* (project #2004-002-1-600), led by task group chairman Gerry Stephenson.

A good example of the potential impact of such projects in the regulatory arena is provided by the recently completed *Regulatory Limits for Pesticide Residues in Water* (project #1999-017-1-600), led by task group chairman Denis Hamilton. This critical evaluation of assessment methodologies for establishment of standards drew attention to the varied nature of current practices, which range from very scientifically based to politically based, and made practical recommendations targeted in particular at developing countries seeking to establish a way forward. It so happened that the final report was completed at just the moment this issue was reaching a critical point in India, and the recommendations were prominently featured at a conference of government and private-sector policymakers who sought to resolve their differences on the issue. This is an excellent example of the type of influence IUPAC can exert by highlighting the fundamentals of applied chemistry and chemical principles—areas that sometimes not given enough prominence.

Outreach. In addition to standard IUPAC sponsorship of important chemistry conferences, DCE has made strong efforts to actively plan and organize international congresses and workshops. The DCE has not been satisfied just to have some group adopt the IUPAC name and then run a conference under local leadership and with token or no IUPAC involvement. These conferences are designed not only to bring together leading scientists and regulators to exchange and debate their latest findings, but also to highlight key IUPAC projects and project outcomes. Multiple levels of IUPAC involvement are maintained, from the organizing and scientific committees to individual lectures highlighting IUPAC projects. These technology-transfer activities have involved three types of conferences.

First, for more than 20 years DCE has been involved with two long-standing international congresses. These events have consistently attracted 500–1000 or more of the top international experts, and are generally organized in cooperation with a major national/regional chemistry society and held in a world-class city.

- IUPAC International Symposium on Mycotoxins and Phycotoxins. The 11th symposium in the series was held 17–21 May 2004 in the Washington, D.C. area, USA. The 12th symposium is now being planned for 21–26 May 2007 in Istanbul, Turkey.

- IUPAC International Congress on Crop Protection Chemistry. The 10th congress in the series was held 4–9 August 2002 in Basel, Switzerland. The 11th congress is scheduled for 6–11 August 2006 in Kobe, Japan <www.iupac2006.jtbcom.co.jp>.

Second, DCE was heavily involved in the organization of a special one-time international symposium coordinated by SCOPE and IUPAC on "Environmental

Dr. Kenneth Racke is currently president (2004–2007) of the Division of Chemistry and the Environment. Racke served the Division as vice president (2002–2003), and was formerly chairman (1995–2001) of the Commission on Agrochemicals and the Environment. His first encounter with IUPAC occurred in 1986 as a graduate student poster presenter at the IUPAC International Congress of Pesticide Chemistry in Ottawa, Canada. Racke's background and expertise are in the area of pesticide environmental chemistry and impact assessment. He has worked for the agrochemical division of the Dow Chemical Company for the past 16 years, where he currently serves as Global Regulatory Leader. He lives in Indianapolis, Indiana, USA.

Dr. Patrick Holland is currently secretary (1998–2005) of the Division of Chemistry and the Environment. He has been active in IUPAC since attending a commission meeting in 1979 as National Representative. Holland has many years of experience with mass spectrometry and analytical aspects of trace analysis for contaminants in food and environmental samples. For the past several years he has focused his efforts on the chemistry and analysis of marine biotoxins in seafoods, with an emphasis on LC-MS and QA/QC for trace analytical methods. He lives in Nelson, New Zealand.

Implications of Endocrine Active Substances (EASs): Present State-of-the-Art and Future Research Needs." This high-profile symposium was held 17–21 November 2002 in Yokohama, Japan, as part of a mega-project that was the brainchild of the late Junshi Miyamoto (past president of DCE). Miyamoto was instrumental in developing the IUPAC-SCOPE project proposal, gaining seed money support from IUPAC, securing significant co-funding from SCOPE as well as a variety of private and government organizations, and in hosting and organizing the conference. The project work was divided into two-phases, with multiple project teams holding preliminary working sessions during 2001, and culminating in the conference during 2002 where the state-of-the-art was reviewed and recommendations to direct research and risk management were debated and finalized. Miyamoto was assisted by DCE members who contributed 5 of the 10 plenary papers to Main Topic 2 "Environmental Fate and Metabolism of Endocrine Active Substances." A set of eight recommendations was developed for environmental risk management of EASs. The symposium reviewed many other lines of research and reached conclusions and recommendations that are contributing to resolving the significance of EASs to human health and the environment. The full proceedings were published in a special double issue of *Pure and Applied Chemistry* in November-December 2003.

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Third, international workshops targeted at developing countries have also been an important component of DCE's outreach activities. These smaller conferences of 150–350 participants serve to bring together a mix of international experts and local/regional scientists from government, academia, and industry. The conferences create a forum where IUPAC project outcomes can be discussed and applied within the context of local environmental problem areas. The workshops generally involve a range of national and international sponsors and thus also fulfil the need for IUPAC to interact with other agencies in promoting the chemical sciences. These activities have given IUPAC high visibility in countries in which it has traditionally had minimal interactions. Participants from developing nations often predominate, and the workshops enable IUPAC to contribute directly to changes in practices that lead to improved environmental management or higher-quality food production. Crop protection, air pollution, and food-quality chemistry are three topics for which workshops have been regularly held in various regions. DCE currently has two projects that involve a workshop as one of the key outputs:

- Workshop on Fats, Oils, Oilseeds Analysis and Production, 6–8 December 2004, Tunis, Tunisia (project #2002-011-2-600). Organized by IUPAC and AOCS in cooperation with the Tunisian Office National de l'Huile, the American Soybean Association, and the International Olive Oil Council. <www.aocs.org/meetings/analysis>

- International Workshop on Crop Protection Chemistry in Latin America, 4–17 February 2005, San Jose, Costa Rica (project #2003-013-1-600). Organized by IUPAC in cooperation with the Costa Rica Ministry of Agriculture, the University of Costa Rica, and CropLife Latin America. <www.altcomcr.net/crop-prot-chemistry>

Current Projects

DCE currently has about 20 projects underway. In addition to those mentioned above, the following projects provide a flavor of the range of topic areas being addressed within DCE's program:

- Impact of Transgenic Crops on the Use of Agrochemicals and the Environment (project #2001-024-2-600), task group chairman Gijs Kleter. There is a high degree of interest in this topic area because of the current scientific, regulatory, political, and public perception issues surrounding transgenic crops. The project provides an opportunity for IUPAC to take important leadership roles in promoting the importance of chemistry in molecular biology.

- Standardization of Analytical Approaches and Analytical Capacity-Building in Africa (project 2004-017-1-500), task group chairman Walter Benson. This is a cooperative project with the IUPAC Analytical Chemistry Division, International Organization for Chemical Sciences in Development, and Association of Official Analytical Chemists International. Uganda and Kenya are the initial focus of the project, with Nigeria, South Africa, and Mozambique of future

interest in conjunction with an ongoing World Bank project. The project aims to build regional analytical laboratory capabilities in relation to monitoring and enforcement of international trade standards. Key activities will involve lectureships, local workshops, visiting scientist apprenticeships, and laboratory equipment procurement initiatives.

- Remediation Technologies for Removal of Arsenic from Water and Wastewater (project #2003-017-2-600), task group chairman Hemda Garelick. The impetus for this project is the affect on the health of millions of people caused by reduced standards for arsenic in water and the already apparent toxicity of water supplies in several regions caused by natural arsenic contamination. There is an urgent need to reduce arsenic levels in drinking water supplies and, in some areas, irrigation waters. Although several technologies have been proposed, there has not been sufficient in-depth evaluation, especially for routine treatment of large volumes of water; agreement on assessment criteria is also lacking. This project will address these important issues in collaboration with WHO and other IUPAC initiatives in this area. The project will result in a report whose recommendations will be presented at a future workshop organized by IUPAC in the Asian subcontinent.

Challenges and Future Directions

To remain effective and maintain relevance, DCE will need to address current strengths and weaknesses of the IUPAC approach, and seek a way forward that takes advantage of the opportunities while avoiding looming threats. The Division Committee recently took the first steps toward developing a long-range plan by completing a SWOT analysis of the DCE program.

- **Strengths**—Global audience; international viewpoint and approach rather than a national/regional one; good productivity; important issues for society; credibility; networks (individuals, institutions, cross discipline); flexibility for projects to garner external funding; breadth (scholarly, applied, workshops/symposia); subcommittees helping bring new issues, projects and people to IUPAC.

- **Weaknesses**—Token in-house funding; heavy reliance on enthusiasm and availability of volunteers; very high dependence on single individuals (i.e., project task group leader); lack of direct influence for project performance and completion; limited peer-review process in place for final project reports (in absence of the commissions); lack of recognition for individual efforts; low impact/visibility for PAC; lack of a long-range strategic direction for division.

- **Opportunities**—Increase credibility through more rigorous project review (planning, outputs); increase inputs from developing countries; more emphasis on food chemistry (functional foods); increase partnerships with other international organizations; seek more interdivisional projects; make better use of electronic media (Web, e-mail); attract funding from multiple sources to make viable projects.

- **Threats**—Loss of relevance; losing intellectual property to collaborating organizations; having division direction driven by randomly submitted project proposals; having lead on key areas taken by other organizations; slowness in addressing key issues of interest and project areas; not reaching the intended audience; conflicts of interest in funding decisions; inability to define and measure success.

The ultimate aim of the Division Committee, which will be further wrestling with these topics at the Beijing General Assembly, is to develop a long-range strategic plan. The division is already taking action to reinvigorate the area of food chemistry. Through past mergers of divergent commissions (oils and fats with food-borne mycotoxins) and subsequent disbandment of the Food Chemistry commission, the current level of expertise for food chemistry available to IUPAC has been depleted and food chemistry-related project activities have been dramatically reduced. A subcommittee has been appointed to organize a discussion forum in Beijing to reexamine the IUPAC approach to food chemistry, and chart a new direction that brings to bear the traditional strengths of the Union and contemporary issues and problems related to food chemistry.

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