International Organization
for
Chemical Sciences in Development

The Role of International Conferences in the Chemical Sciences for Development

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1. Introduction

The chemical sciences have made substantial contributions to global development over the last two centuries, as highlighted in a chapter written by Stephen Matlin and Berhanu Abegaz on behalf of IOCD for the book *'Chemistry's contributions to our global future'*, produced this year for the International Year of Chemistry in 2011 (IYC2011).[1] In the book's Epilogue,[2] the economist Jeffrey Sachs, who was Director of the UN Millennium Project, wrote that *"Chemistry is key to human wellbeing. The appreciation of chemistry's contributions is vital to emerging the next generation of scientists, policy makers and informed citizens."*

The chemical sciences serve two complementary roles. They provide knowledge of facts, theories and scientific processes; and also deliver applications that are useful to people. Both the gathering of knowledge and its transformation into applications often involve working across the interfaces between chemistry and other disciplines – including not only scientific fields, but also non-scientific areas such as those concerned with policy, regulation and human behaviour.

Since 1981, the International Organization for Chemical Sciences in Development (IOCD) has promoted the applications of chemistry and adjacent molecular sciences to development. IOCD has supported projects devoted to key areas of global need – including in fields such as medicinal chemistry, tropical diseases, fertility regulation, agrochemistry, environmental analysis and identification and exploration of natural products. It has also contributed to capacity development in low- and middle-income countries (LMICs) through provision of training grants and workshops, support for equipment and chemicals, provision of analytical services and donations of books and journals to libraries.

Thirty years on, while celebrating IYC2011, it is timely to reflect on what has been achieved in general by the chemical sciences, what has been contributed by IOCD to global development, the needs for the future and how IOCD can adapt its strategies to continue contributing effectively. While the broader stock-taking has been reflected both in IOCD's publications and in its new strategic orientations (see the IOCD website, www.iocd.org and the chapter by Matlin and Abegaz[1] and references therein), this paper addresses one specific issue: the evolution of international conferences in helping to create and sustain momentum in the contribution of the chemical sciences to development.

2. Evolving role of international conferences related to chemical sciences for development

International conferences have long played a role in the presentation and exchange of information among chemists. Karlsruhe, Germany lays claim to the first international congress of chemists, held in 1860 and organized by three chemistry professors, Friedrich August Kekulé, Carl Weltzien, and Charles Adolphe Wurtz, who hoped that it would serve to resolve some heated disputes in the field.[3] Since then, international conferences have dealt with all aspects of the science of chemistry and every area of applications. However, a focus on development issues, bringing together academic and industrial experts and decision makers to examine challenges and chart courses for solutions, has been a much more recent phenomenon.

The second half of the 20th century saw an expanding number of newly emergent nations in the post-colonial world, an increasing awareness of interconnectedness and interdependence in an era of accelerating globalization, and a growing appreciation of the importance of systematic approaches to development on a global scale. These intersecting factors were the driving forces behind a series of world conferences that covered themes such as population and development (1954, 1965, 1974, 1984, 1994)[4] women (1975, 1980, 1985, 1995),[5] health for all (1978, 1986, 1997) and education for all (1990, 1994, 2000). The world conferences, each of which brought together experts, activists and politicians, produced wide-ranging proposals for systemic action and global change and served as precursors to the Millennium Summit at the UN in New York in September 2000 and the formulation of the Millennium Development Goals (MDGs). The MDGs set targets for achievement by 2015, which have been driving the international development agenda for the last decade.

Science and technology (S&T) was relatively slow to engage in this form of global debate, diplomacy and collective decision-making, with the first World Conference on Science only taking place in 1999, in Budapest.[6] The Director-General of UNESCO and President of the International Council for Science (ICSU), heads of the conference's principal sponsoring organizations, wrote:

> *The Conference came in response to a dilemma: public support for science appears to be wavering and yet scientific research and technological development have become more necessary than ever to solve some of the most pressing problems facing humankind. This situation calls for a new commitment – a new social contract – whereby scientists pledge to be responsive to these needs and governments pledge support for research.*
>
> *This commitment appears clearly in the two key documents adopted by the Conference. We believe they will prove to be precious tools in the years to come for all stakeholders committed to seeing science harnessed more effectively for the promotion of human well-being and sustainable development.*

The two key documents produced by the World Conference on Science were: a *Declaration on Science and the Use of Scientific Knowledge*, underscoring the political commitment to the scientific endeavour and to the solution of problems at the interface between science and society; and a *Science Agenda – Framework for Action*, defining guidelines to orient action. The *Declaration* and the *Science Agenda* were subsequently approved by the ICSU General Assembly and by the UNESCO General Conference and the latter further invited the Director-General to transmit both documents to the Secretary-General of the UN for appropriate action.

Although not itself the subject of a direct goal or target in the MDGs, the use of S&T was clearly essential to the achievement of most, if not all of the MDGs, as delineated in the report[7] of the UN Millennium Project's Task Force on Science, Technology and Innovation, and further emphasised in the UN Development Programme's 2001 Human Development Report.[8]

Against this broader background in which there has been a relatively recent focus within global conferences on the important role of S&T in development, the key role of the chemical sciences has become increasingly visible, as exemplified in the following sections.

3. IOCD International Conferences on Natural Products Chemistry

Plants are vital to human wellbeing, providing a wide array of materials for nutrition, health, clothing, structural uses, energy and much else. Plants form an extremely important element of the economy for many LMICs and their value can be further enhanced by the identification and commercial development of specific compounds they contain.[9] In recognition of their potential importance to development and the central role that chemists play in the investigation of plant products, in 1988 IOCD established a Working Group in Plant Chemistry, chaired by Professor Kurt Hostettmann, Director of the Institute of Pharmacognosy and Phytochemistry at the University of Lausanne.

The Working Group, which (which superseded IOCD's earlier Agrochemistry Programme), has organised workshops for training in analytical or bioassay techniques (three in Africa and Latin

America, 1990-1994) and international symposia on the chemical, biological and pharmacological properties of medicinal plants, usually associated with (ten in Africa, Asia and Latin America, 1996-2011). With each symposium, the Working Group also convened a workshop on chemical screening and bioactivity-guided fractionation. Some IOCD funds were provided to assist with travel grants for younger scientists from LMICs to attend each symposium and associated workshop. The Working Group also awarded small research grants to a number of younger scientists from LMICs, selected from among those who were awarded travel grants. Overall, these events have provided opportunities for LMIC natural products chemists to network, update their knowledge about isolation and structure elucidation and learn techniques for preliminary biological screening which they could apply in their own laboratories.[10]

4. International Chemistry Conference in Africa (ICCA)

Instituted by the African Association of Pure and Applied Chemistry, regional *International Chemistry Conferences in Africa* (ICCAs) began in 1980 in Kenya[11] and became a triennial series[12],[13],[14],[15] that has continued for three decades. [16] Organized as opportunities to present scientific research, from prominent chemists in and beyond the region, to a predominantly African audience, they have also served a second purpose, enabling assessment of the state of scientific research capacity in the region and stimulating efforts to enhance this.

Dr Walter Benson, then leading the IOCD Working Group in Environmental Analysis, attended the 5th ICCA[17] in Botswana in 1992, on behalf of the US National Science Foundation and IOCD, reporting on the status of chemical research in Africa and opportunities for collaboration. These were considered to lie particularly in the investigation of African plants as a rich source of novel organic compounds, many of which have potential value as natural insecticides, fungicides, or pharmaceuticals.[18]

It had been evident to IOCD for a number of years that the capacity of chemists in LMICs to undertake research in both natural products and synthetic chemistry was being hampered by the lack of availability of local or regional facilities for spectroscopic analysis and structure elucidation. As an interim measure, IOCD instituted a number of Analytical Service Laboratories in the 1980s in North America and Europe, which received samples from chemists in LMICs, including many in Africa, and provided spectroscopic analyses (including UV, IR, NMR and mass spectrometry) free of charge. Then in 1992, in collaboration with other agencies, IOCD supported the launch of a new activity, the Network for Analytical and Bioassay Services in Africa (NABSA), based at the University of Botswana and headed by Professor Berhanu Abegaz, which was able to provide free spectroscopic analyses to chemists within the African region.[19] This activity continues to the present time.

Many other areas of chemistry were also identified as weak and requiring attention. For example, concern about the situation of theoretical and computational chemistry, and physical chemistry in general, in African universities was formally expressed at the 5th ICCA and led to new initiatives to disseminate information about computational chemistry and foster research.

The 8th ICCA was held in Dakar, Senegal, 30 July-4 August 2001, on the theme ‘Chemistry and Quality of Life’.[20,21] Senegal reported[22] to the UNESCO General Conference later that year that resolutions of the 8th ICCA had included decisions to:

a. establish a chemistry network both inside and outside Africa in order to promote exchanges of students, staff and research data and joint research projects,
b. enlist the help of Africans in the Diaspora,
c. promote national capacities through training, equip libraries, encourage cooperation between universities, industry and governments, develop research and the use of natural products in Africa and encourage measures to monitor pollution through a water purification policy,
d. develop new chemistry teaching methods based on chemistry curricula adapted to African needs,
e. encourage chemistry associations in Africa by means of regional synergies.

The most recent 11th ICCA was held in Egypt in 2010. Despite the overall theme 'The Role of Chemistry in Development of Africa', there was no specific development focus to the list of planned lectures, which followed a standard approach of sub-divisions of chemistry.[23]

Regarding the equipping of libraries, in 2003, Professor James Cosentino at the University of Millersville in the USA created an IOCD programme, Books for International Development.[24] The programme collected good quality textbooks and journals donated by libraries and private sector companies in the USA and, with support from IOCD and UNESCO, arranged the packaging and shipment of these to libraries in LMICs, including countries in Africa, Asia and the Pacific.

5. Conferences of the Pan African Chemistry Network

The UK's Royal Society of Chemistry (RSC), supported by the agri-business Syngenta, helped to launch the Pan Africa Chemistry Network (PACN) in 2007-8. PACN supports local capacity building by funding conferences and supporting African researchers. It links with FASC and other chemistry networks such as the Southern and Eastern African Network for Analytical Chemists and the African Association of Pure and Applied Chemistry.

In 2009, with support from the RSC and Syngenta, PACN held a *Sustainable Water Conference*, hosted by the University of Nairobi, Kenya and attracting 180 scientists and practitioners from 14 different countries in Africa, as well as the UK, Switzerland, Colombia and Uruguay. The conference addressed scientific issues surrounding sustainable water and the concluding open forum called for an increased understanding of the role of scientific research in finding solutions to issues relating to water, especially water quality, in Africa. It also called for an increased scientific voice within African governments, together with a shift towards fostering a science-based water management culture.[25]

6. CHEMRAWN Conferences

In 1973, IUPAC initiated the idea of organizing a series of conferences under the title Chemistry Research Applied to World Needs (CHEMRAWN), which aimed to catalyse the use of chemistry and related sciences and engineering to meet global challenges. The first CHEMRAWN conference was held in 1978 and the 19 conferences to date (Table 1) have addressed sources of materials, food supplies, the environment, health, education and sustainability. The purpose of the conferences was to (A) identify human needs amenable to solution through chemistry with particular attention to those areas of global or multinational interest; (B) serve as an international body and forum for the gathering, discussion, advancement and dissemination of chemical knowledge deemed useful for the improvement of humankind and our environment; and (C) serve as an international, nongovernmental source of advice for the benefit of governments and international agencies with respect to chemistry and its application to human needs.[26]

Describing the rationale for the conferences, Bryant Rossiter, the first Chair of the CHEMRAWN Committee, wrote:

> *What is new is the increasingly complex, interdependent world, with a burgeoning population, limited resources, rising middle class expectations, vastly improved communications, the possibility of nuclear war, and the new spectre of global terrorism. These and other major world problems are not unique to chemists, but afflict the whole of humankind. Solutions to many of the world's material, economic, social, and even political problems rest in our ability to: transform basic elements of raw materials into new means to increase food production; provide alternative sources of energy and chemical feedstocks; deliver new drugs for the alleviation of human disease; supply less costly and corrosion-free substances for building and fabrication; and innovate new materials for communications. These are the domain of chemistry and chemists, therefore, and have a special and vital role to play. Stated simply, chemistry is a central*

discipline that interacts with virtually every aspect of human endeavour. Indeed, chemistry is the wellspring of life itself. Little wonder then that chemists should be called upon to address the world's most pressing needs.

Table 1 IUPAC Conferences of CHEMRAWN (Chemistry Research Applied to World Needs)

1	1978	Canada	Future Sources of Organic Raw Materials.
2	1982	Philippines	Chemistry and World Food Supplies: The New Frontiers
3	1984	Netherlands	Resource Material Conversion: (Bio)Chemical Process Bridges to meet Future Needs.
4	1985	USA	Modern Chemistry and Chemical Technology Applied to the Ocean and its Resources
5	1986	Germany	Current and Future Contribution of Chemistry to Health – The New Frontiers
6	1987	Japan	Advanced Materials for Innovations in Energy, Transportation and Communications
7	1991	USA	Chemistry of the Atmosphere: Its Impact on Global Change
8	1992	Russia	Chemistry and Sustainable Development
9	1996	S Korea	Advanced Materials and Sustainable Development
10	1999-2000	Hungary, USA, Australia	The Globalization of Chemical Education—Preparing Chemical Scientists and Engineers for Transnational Industries.
11	1998	Uruguay	Latin American Symposium on Environmental Analytical Chemistry
12	2007	South Africa	The Role of Chemistry in Sustainable Agriculture and Human Well Being in Africa
13	2003-2004	Not held[27]	Chemistry for Clean Energy
14	2001	USA	Toward Environmentally Benign Processes and Products
15	2004	Paris	Chemistry for Water
16	2003	Canada	Innovation and the Chemical Industry
17	2007	Canada	Greenhouse Gases Mitigation and Utilization
18	2009	UK	Ethics, Science and Development
19	2011	Malaysia	Renewable and Sustainable Energy from Biological Resources

An account of the history and effectiveness of CHEMRAWN conferences by the then chair of the CHEMRAWN Committee, John Malin, emphasised that CHEMRAWN conferences were designed to identify and focus attention on world needs and to recommend to the global scientific community regarding actions to be taken. Normally, a CHEMRAWN Future Actions Committee was formed at each conference to promulgate the conference's recommendations and to encourage appropriate sectors of the community to carry them forward. A study led to the conclusion that most recommendations were being carried out, or have been carried out, somewhere in the world. [26,28]

7. Other international conferences on chemistry and development

A number of groupings of countries, based on regional geographic or historical political associations, have established science councils that have held meetings on development themes, sometimes including chemistry.

For example, the **Science Council of Asia**[29] held its first conference in Bangkok, Thailand, in May 2001 on the theme 'Urgent Agenda for Asian Sustainability through Science and Technology',[30] with sustainable development a recurrent theme in subsequent conferences and the chemical sciences featuring in some, including the Fifth Conference (2005), 'Bioscience and Biotechnology for Sustainable Development: Future of Asian Economy'. While most presentations in the meetings have been technical in orientation, some strands addressed policy issues, such as the 'Special Session on S&T Policy and Biotechnology in Asia' in the Fifth Conference. [31]

The **Commonwealth Science Council** (CSC) played a significant role for many years in organizing conferences related to science for development. Commonwealth co-operation in science pre-dated the formation of the Commonwealth Secretariat in 1966, with the CSC having evolved out of a Commonwealth Scientific Committee first established in 1946 and the name Commonwealth Science Council being adopted in 1975.[32,33] With technology transfer as a key objective,[34] both publications and regional and sub-regional conferences of the CSC tended to deal with a mix of technical and policy issues and occasionally included chemical science aspects.[35,36,37]

1984 Symposium: Chemistry and Developing Countries, Norwich, UK
The objectives of the symposium, organized by the British Council and RSC in conjunction with the Annual Meeting of the British Association for the Advancement of Science,, were to increase awareness regarding chemical and related technological problems confronting scientists in developing countries; demonstrate that chemical problems from developing countries can provide the basis for highly creditable research; consider strategies for encouraging collaboration in research and training between the UK and developing countries; consider possible solutions to chemical problems faced by developing countries, taking account of the scientific, economic, sociological and environmental factors; and discuss the education and training of overseas personnel in UK institutions and the development of chemical education and other relevant courses. Main session topics were food and food chemistry, analysis and quality control, and institutional collaboration in chemical research and in the education and training of chemists and technicians.[38]

1991 Conference: Chemistry and Developing Countries, London, UK
This conference[39] was billed as the Second Conference on Chemistry and Developing Countries, in recognition of the earlier meeting in 1984 in Norwich. It was co-organized by the Commonwealth Science Council, RSC and British Council. The Director-General of UNESCO,[40] Assistant Director-General of British Council, President of IUPAC, Chief Natural Resources Advisor to the UK Overseas Development Administration and representative of the Commonwealth Secretary-General were among keynote speakers. The conference was concerned with two main themes – chemistry for the environment and organising science to benefit the Third World. The Conference produced a number of resolutions and recommendations – some directed to the role of the RSC and some to the Organizing Committee, with the aim of enhancing the contribution of chemistry and chemists to development in the Third World.

8. Conclusion

Since the 19th century, chemistry conferences have played a significant role, globally, in the development of the science itself and in the spread of chemistry knowledge around the world. More recently, conferences have helped to focus attention on the roles that the chemical sciences can play in addressing global challenges, both at the technical level and in terms of policies that governments and leading organizations need to adopt to foster and support scientific advances and enhance capacities of countries to contribute to solutions to their problems.

The chemical sciences will be central to helping the world meet the myriad global challenges that it faces in the 21st century. With this in mind, the time now seems right to consider organizing a global conference on the role of the chemical sciences in sustainable development. Such a conference would, of course, recognize and exemplify the scientific approaches that seem most promising to meet the oncoming challenges. However, its primary focus would be to bring together experts from academia and industry with policy makers and funders of research and innovation, in order to identify and make recommendations for the policy changes necessary to create an enabling environment and to promote the international collaborations necessary to support large-scale and ambitious programmes.

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