# CHemical Research Applied to World Needs

*"In 1865, in Cambridge, England, the 18-year-old William Perkin undertook an independent research study that resulted in the discovery of aniline dyes. Against the advice of his teacher, Professor Hoffman, Perkin applied his research to world needs—and launched the coal-tar-dye industry. Therefore, in reality, the concept of CHEMRAWN, "**CH**emical **R**esearch **A**pplied to **W**orld **N**eeds," is not new. 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 specter 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 depend upon our ability to transform basic elements of raw materials in order 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. Therefore, chemists have a special and vital role to play. Stated simply, chemistry is a central discipline that interacts with virtually every aspect of human endeavor. 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."*

Bryant Rossiter,
first chair of IUPAC's CHEMRAWN Committee

## On the Effectiveness of CHEMRAWN

*by John M. Malin*

**The 28-year history of CHEMRAWN has produced 14 full-fledged CHEMRAWN conferences. The meetings have varied in subject, location, size, and budget, but they have all addressed a single goal—to catalyze the use of chemistry and related sciences and engineering to meet world needs. This article describes how the CHEMRAWN process has fostered new ideas and supported solutions to world problems.**

In the introduction above and in the following paragraphs, Bryant Rossiter, the first chair of IUPAC's CHEMRAWN committee, describes [extracted from an unpublished retrospective drafted in 1994] the origins and goals of the CHEMRAWN conferences.

*"In 1973, the IUPAC conference in Munich included on its agenda a session on 'opportunities for international cooperation through IUPAC.' The suggestion proposed a new mechanism in IUPAC, a mechanism whereby member nations could aid in identifying and solving important chemistry problems that have a direct impact on world needs.*

*"The general idea was unanimously approved and the U.S. delegation, which had begun the discussion, was asked to define and elaborate on the proposal. The U.S. national committee, of which I [Rossiter] was privileged to be a member, subsequently drafted a statement under the heading 'Chemical Research Applied to World Needs.' Like so many other long titles, this one became known by its acronym: CHEMRAWN.*

*The CHEMRAWN statement, designed to reflect a set of purposes around which various activities might be organized, proposes:*

*A. To identify human needs amenable to solution through chemistry, with particular attention to those areas of global or multinational interest.*

*B. To 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.*

*C. To 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."*

This statement is still used today to describe the Terms of Reference of the CHEMRAWN Committee. Rossiter explains that . . .

*"To achieve these ends, it was proposed that CHEMRAWN activities should:*

1. *Provide scientific and organizational leadership for the purpose of identifying chemically related needs, opportunities, and priorities on an international and worldwide scale.*
2. *Organize, in cooperation with established scientific bodies and international conferences, forums, workshops, symposia, collaborative studies, etc., for the gathering, presentation, discussion, evaluation, publication, and dissemination of information relating to chemistry and the needs of humankind in our environment.*
3. *Help provide an understanding of trends, consequences, alternatives, and resources relating to raw materials and supplies of chemical intermediates.*
4. *Act as a focal point, clearinghouse, and coordinating body for individual conferences relating to chemical research and world needs.*
5. *As a part of the International Council for Science, serve as an advisory body to the United Nations and its member nations and agencies—with special attention to developing nations.*
6. *Develop the means to assist public understanding of chemistry and its relationship to the world economy and the betterment of humankind."*

It is important to realize that CHEMRAWN conferences are designed to identify and focus attention on world needs and to recommend actions that should be taken by the global scientific community. Normally, a CHEMRAWN Future Actions Committee has been formed at each conference to promulgate the conference's recommendations and to encourage appropriate sectors of the community to carry them forward. However, it was never the intent of CHEMRAWN to lock academia, industry, and government into any particular structure to solve world problems, or to follow up to ensure that they did.

A study of the recommendations developed by CHEMRAWN conferences and their Future Actions Committees leads to the conclusion that most are being carried out, or have been carried out somewhere on the globe. Many CHEMRAWN recommendations have informed the science policy of nations and the actions of engineers and scientists. However, it is difficult to take credit for specific CHEMRAWN contributions to society because so many people and factors have been involved. One hopes and expects that the world needs under discussion will always be addressed by a plethora of individuals, organizations, and governments. CHEMRAWN contributes especially by pointing the way to solutions and by establishing consensus. That it is rarely the only positive influence evidences the strength and synergy of the process.

The value of CHEMRAWN conferences to societies and governments can be judged on the type of leaders it has been able to attract to its cause. World-class leaders are very busy, have reputations to protect, careers to advance, and cannot afford to waste time and effort on activities that do not pay high dividends to themselves and the institutions they represent. Past conferences have attracted national presidents, eight Nobel laureates, presidents of major universities, and senior industrial scientists and managers. In addition, CHEMRAWN events have raised significant resources: some USD 3 000 000 in support costs and the collaboration of hundreds of scientists.

Important CHEMRAWN results have often been imbedded in some aspect of the bigger picture and were not widely recognized. For example, Alan Bromley, science adviser to U.S. President George H.W. Bush, informed Rossiter that the *Perspectives and Recommendations* from CHEMRAWN VII—Chemistry of the Atmosphere: Its Impact on Global Change, represented a very important input to the U.S. government, resulting in policy changes regarding global warming and atmospheric change. This policy change was aided by the fact that Representative Ron Packard, a member of the U.S. House of Representatives Ways and Means Committee, ensured that every member of the House and Senate received a copy of the CHEMRAWN VII *Perspectives and Recommendations*.

In order to understand fully the results of CHEMRAWN, it is necessary to examine the conferences themselves, to remain mindful of each event's epoch and venue, and to consider the state of the particular chemical discipline and its needs. Following is a summary of the first CHEMRAWN conference. Summaries of all the other CHEMRAWN conferences

(see list in box) can be found online at <www.iupac.org/standing/chemrawn/history.html>.

## CHEMRAWN I: Future Sources of Organic Raw Materials

IUPAC's first CHEMRAWN event was the "World Conference on Future Sources of Organic Raw Materials" held 10–13 July 1978 in Toronto, Canada. The conference was the first significant gathering of major international scientists and decision-makers from industry, government, and academia to address a major problem in a concerted way. It was held shortly after the OPEC oil embargo during a frantic effort to find a substitute for oil. Solar, wind, geothermal, biomass, coal, and shale oil deposits were being highly touted, with an accompanying cry for money to fund the research.

Approximately 800 scientists from 48 countries attended. The organizing committee and attendees included not only internationally recognized technical experts, but also board chairpersons, presidents, vice presidents, and research directors from industry; world banking leaders; advisers to top government officials; and other high-ranking influential people. The purpose of the conference was to seek solutions to the problem of increasing world consumption of organic materials—petroleum and biomass. Particular attention was given to the needs of developing nations. Leaders from those nations were instrumental in many stages of the conference planning and were prominently featured in the plenary, technical, and summary sessions.

Max Tischler (USA) chaired the program committee. The opening plenary session was organized under the chairmanship of Glenn T. Seaborg of the University of California at Berkeley, recipient of the Nobel Prize for chemistry in 1951. The final plenary session was organized under the guidance of William O. Baker, president of Bell Telephone Laboratories.

The program also included eminent personalities, such as the chairman of the Board of E.I. DuPont de Nemours & Company; the assistant director general of the United Nations Forestry Department; a counselor to the prime minister of Egypt; the chairman of the Board, Bayer A.G; the ambassador of Brazil to the UK; the president of the University of Tokyo; a representative of the French Scientific Mission from Washington, D.C.; the chief scientist of the UK Department of Industry; and the vice-president of Exxon Chemical.

### Outcomes and Recommendations

The major conclusion of the conference was that there is no substitute for oil and we should stop pretending

**14 CHEMRAWN Conferences Since 1978**

| | |
|---|---|
| I | Toronto, Canada (1978) Future Sources of Organic Raw Materials |
| II | Manila, Philippines (1982) Chemistry and World Food Supplies: The New Frontiers |
| III | The Hague, the Netherlands (1984) Resources Material Conversion |
| IV | Keystone, Colorado, USA (1985) Modern Chemistry and Chemical Technology Applied to the Ocean and its Resources |
| V | Heidelberg, Germany (1986) Current and Future Contributions of Chemistry to Health |
| VI | Tokyo, Japan (1987) Advanced Materials for Innovations in Energy, Transportation, and Communications |
| VII | Baltimore, Maryland, USA (1991) The Chemistry of the Atmosphere: Its Impact of Global Change |
| VIII | Moscow, Russia (1992) Chemistry and Sustainable Development |
| IX | Seoul, Korea (1996) Advanced Materials and Sustainable Development |
| X | Budapest, Hungary; Washington, DC, USA; Honolulu, Hawaii; and Brisbane, Australia (1999–2000) Chemical Education in Global Development |
| XI | Montevideo, Uruguay (1998) Latin American Symposium on Environmental Analytical Chemistry |
| XIV | Boulder, Colorado, USA (2001) Toward Environmentally Benign Processes and Products |
| XV | Paris, France (2004) Chemistry for Water |
| XVI | Ottawa, Canada (2003) Innovation in the Chemical Industry |
| Forthcoming Conferences | |
| XII | Stellenbosh, South Africa (2007) Chemistry, Sustainable Agriculture and Human Well Being in Africa |
| XVII | Kingston, Ontario, Canada (2007) Greenhouse Gas Mitigation |

that expending massive amounts of money will solve immediate problems. In the short term, the conference recommended, we should promote conservation, exploit untapped oil and gas reserves, begin research on alternative sources of organic raw materials, and pay close attention to the economics necessary to make the alternatives viable in a modern society. The conference adopted the following recommendations:

1. An international group should be formed to assess the organic supply problem in a continuing way.
2. An assembly of high-level government science advisers should be formed. The group should consider the problem of organic supply in terms of governmental actions, determine priorities for budgeting research and development, and provide socio-technical plans for inevitable changes in lifestyle.
3. Industrial research and development bodies must address the problem. Industrial organizations should form a group to monitor and assess technical progress.
4. The leading scientific societies should form a group to ensure that the basic scientific issues are identified, publicized, and presented at scientific gatherings.
5. A task force should be organized, including media experts, to publicize the prospects and consequences of shortages of organic compounds.

All members of the Organizing and Future Action Committees were asked to disseminate the results among their respective institutions and countries. As a direct result of CHEMRAWN I, Eastman Kodak and several other companies started research programs in photovoltaics. Bryant Rossiter, CHEMRAWN chair, was asked by Calvin Rampton, the governor of Utah, to join a four-person multidisciplinary panel to help the State of Utah develop its coal, oil shale, and geothermal resources while avoiding the environmental damages seen in other states. James F. Mathis, senior vice president of Exxon, stated that Exxon revamped its approach to alternative sources of energy as a result of CHEMRAWN I. The Philippine government dropped a project promoting coconut oil as a substitute for diesel fuel because it failed to meet economic requirements, although it met technical requirements superbly. Baker, chairman of the Future Actions Committee, presented the results of CHEMRAWN I to the U.S. National Research Council. William Schneider, organizing chairman, presented the same to the National Research Council of Canada, of which he was president. T. Mukaibo did this in Japan and the pattern was followed by many other institutions and people throughout the world.

There were many side benefits to CHEMRAWN I. The CHEMRAWN concept was judged to be a viable forum for addressing world needs. Thomas F. Malone, foreign secretary of the U.S. National Academy of Sciences and treasurer of the International Council of Scientific Unions, wrote to Colby Chandler, president of Eastman Kodak, that "CHEMRAWN is part of one of the more important processes of our generation—in addressing directly human needs amenable to solution through chemistry." The ability of CHEMRAWN I to draw the very top leaders from all segments of the industrial, academic, and governmental enterprises captured worldwide attention, and in many ways would redirect some of the major IUPAC programs as well as other international programs. CHEMRAWN I demonstrated that conferences devoted to world needs could be financial as well as scientific and technological successes.

**CHEMRAWN Chairs**

| | |
|---|---|
| 1978–1987 | Bryant Rossiter |
| 1987–1991 | John Meurig Thomas |
| 1991–1997 | Alan Hayes |
| 1997–2003 | Parry Norling |
| 2004–2007 | John Malin |

In light of more recent petroleum shortages, CHEMRAWN I was prescient in detailing the importance of conservation of petroleum resources, the need for utilization of biomass, and the dearth of alternate energy sources. It was noted particularly that the chemical industry is primarily petroleum based, and that increases in energy prices lead directly to increasing costs for chemical feedstocks.

The early history of CHEMRAWN is described in *History of IUPAC 1919–1987* (Fennell, 1994); and *History of IUPAC 1988–1999* (Brown, 2001). Coverage of CHEMRAWN I appeared in *Chemical and Engineering News* (Krieger 1978; pp 28–31, 24 July) and in a *Perspectives and Recommendations* volume (St-Pierre, 1978; Multiscience Publications Limited, Montreal ISBN 0-919868-06-01).

**www.iupac.org/standing/chemrawn.html**

**John M. Malin <jmalin023@comcast.net> is the chair of the CHEMRAWN Committee; he has been involved with the committee since 1998.**