



International Organization for Chemical Sciences in Development

*Promoting the chemical sciences
for sustainable
human development and
economic growth*

Established¹ in 1981 at UNESCO, IOCD was *the first international non-governmental organization (NGO) devoted to enhancing the role of the chemical sciences in development* and involving chemists in low- and middle-income countries, enabling them to contribute to key science and technology areas for development.^{2,3}



Pierre Crabbé
1928- 1987

Chemist, humanitarian
and founder of IOCD⁴

**Organization Outline
and
Strategy**

2014

www.iocd.org



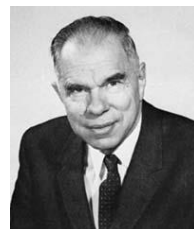
Chemistry is a 'platform' science

Chemistry provides **understanding** of the physical and chemical properties of atoms and molecules and **practical methods** for creating new **molecular structures with useful applications**. It also contributes to **fundamental aspects of a range of other sciences, underpinning the dramatic advances** seen in recent decades in such fields as **biotechnology, energy, environment, genetics, materials and medicine**.

Impact of IOCD

IOCD builds on more than 30 years of achievement in **promoting the chemical sciences for sustainable, equitable human development and economic growth, especially in low- and middle-income countries (LMICs)**.

IOCD has helped raise awareness of the importance of the chemical sciences nationally and internationally and the profile of chemists and their contributions to development. This was aided by success in attracting prominent chemists to IOCD's cause, including the Presidents (two Nobel laureates), Council (included four additional Nobel laureates) and Working Group leaders and members.



Glen T. Seaborg
Nobel Laureate in
Chemistry

IOCD President
1981-1995



Jean-Marie Lehn
Nobel Laureate in
Chemistry

IOCD President
Since 1995

Working Groups in medicinal chemistry, natural products, environment and bioprospecting made important contributions to training, capacity building and networking in areas including analytical and synthetic chemistry, laboratory management and national policy development for ethical bioprospecting; attracting support and collaboration from many international agencies, foundations, academia and the private sector.

IOCD's analytical services supported many chemists striving to conduct isolation, structure elucidation and synthesis work in resource-poor settings. Successful localization as NABSA (Network for Analytical and Bioassay Services in Africa) has ensured that service provision and individual, institutional and system capacity building are being sustained.

IOCD has helped strengthen teaching capacities through creating web-based open and distance learning materials in organic and medicinal chemistry; donations of books and computers; and support for microscale laboratory kits enabling science to be taught where resources and chemical supplies are very limited.

Role of the chemical sciences in development

During the last two centuries, the chemical sciences have contributed enormously both to **broad improvements in human well-being** (including enhancements in health and life expectancy) and to **wealth creation** for individuals and nations.⁵ Landmark examples include:

- **Innovations in the generation, storage and use of energy**
- **Creation of new materials**
- **Advances in agriculture, food and nutrition**
- **Better health**
- **Economic growth**

But the benefits from advances in chemistry and other sciences have not been evenly distributed globally. The least industrially and technologically advanced countries have remained the poorest and people in LMICs often have much lower life expectancies than those in high-income countries (HICs).

Economists have concluded⁶ that *much of the decline in mortality in the 20th century had its origin in technical progress* (i.e. technological advances and their diffusion and uptake in different countries and the capacities of the countries to conduct and apply research). Much of the variation in life expectancies between countries is explained by differences in the rate of this technical progress.⁷

Efforts to tackle the large global inequities reflected in the high levels of poverty, illiteracy, ill health, gender inequality, lack of access to improved water and sanitation and poor environment seen in LMICs led to

agreement by the world's governments in 2000 on the *Millennium Development Goals* (MDGs) with targets for 2015. However, uneven progress has been made and attention is already turning to new post-2015 sustainable development goals (SDGs). *Achieving the MDG and SDG goals requires collective global effort – including harnessing science technology, and innovation (ST&I) for development.*

The Millennium Project Task Force on ST&I highlighted⁸ key areas for policy action, including the need to focus on platform technologies; and to improve infrastructure services and higher education in science and engineering and redefine the role of universities; and focus on areas of underfunded research for development.

Why has it been so difficult to pursue chemistry and related sciences in LMICs in the past? By the 1980s, many chemists from LMICs had been, or were being, trained in research in universities in HICs, but found it difficult to engage in productive and rewarding careers in research in the growing number of university chemistry departments in their home countries. Common problems included lack of access to funds, laboratory supplies and equipment and difficulty in staying abreast of the latest advances in their fields. *IOCD's response was a twin track approach of active research support and capacity building, achieved through the operation of its scientific working groups (WGs) and analytical service centres.*

IOCD's Mission and objectives

IOCD's mission is to promote the pursuit and application of the chemical sciences for sustainable, equitable human development and economic growth, especially in low- and middle-income countries, through:

1. *Raising the profile of the chemical sciences in development* among researchers, funders and policy-makers;
2. *Increasing the capacity to conduct and use the chemical sciences in LMICs to advance their development* by strengthening capacities at the individual, institutional and national/systems levels to apply the chemical sciences to meet current and future challenges;
3. *Strengthening the participation of LMIC researchers in the chemical sciences* in national and global priority areas, including attaining the MDGs and SDGs and advancing the domains of better health and a better environment.

IOCD's Strategy 2011-2020

IOCD is focusing on *three strategic priorities*.

Strategic priority 1: Chemistry for better health

The nature of health challenges faced in every part of the world is changing, as a result of shifting patterns of disease, the globalization of health threats, changes in the environment and in human behaviour.

Drug discovery and development

LMICs are increasingly concerned to develop their own capacities in areas like drug analysis, discovery, development and production, both to meet their own specific health challenges and to benefit economically from participation in one of the world's largest industries.

African Network for Drugs and Diagnostics Innovation (ANDI)⁹

IOCD's strategy is to support:

- **capacity building for medicinal chemistry**, including drug analysis, discovery and development, in and for the health needs of LMICs. IOCD has worked extensively in this field and its ongoing programme in this priority area includes **provision of on-line training**.
- **chemists working on the isolation, structure elucidation and bioassay of natural products**.

IOCD scientists at the University of Kansas have created an open and distance learning package to update skills and knowledge in medicinal chemistry

About a third of all currently used medicines are derived from compounds first extracted from natural sources such as plants, bacteria and fungi. IOCD has a long track record of working in this field.

Since the 1990s, the Plant Chemistry Working Group has organized workshops for training in analytical or bioassay techniques (three have been held in Africa and Latin America) and international

symposia on the chemical, biological and pharmacological properties of medicinal plants (a dozen have been held in Africa, Asia and Latin America). With each symposium, the WG also convenes a workshop on chemical screening and bioactivity-guided fractionation.

IOCD is now collaborating with a group based at France's National Natural History Museum, on the identification of natural products of potential benefit to animal and human health through studies of self-medication by the great apes in Africa.

The **Biotic Exploration Working Group** has helped countries in Africa, Asia and Latin America to develop policies for ethical, sustainable bioprospecting, to establish the foundations for new products and processes that will contribute to economic development, better health and a sustainable environment.

Strategic priority 2: Chemistry for a better environment

Concern for the environment, including contamination of air, land and water, has become increasingly a matter for global attention since the first Earth Summit in 1992.¹⁰ All countries must learn how to engage in sustainable development and avoid the historic pathways which have led to pollution, exhaustion of resources and loss of biodiversity.

IOCD's strategy is to:

- **enhance capacities for environmental chemical analysis** and sustainable use of biological resources, addressing the need to ensure a sustainable environment. For many years, IOCD's Environmental Chemical Analysis WG, formed in partnership with the International Union of Pure and Applied Chemistry (IUPAC), supported workshops and training in laboratory management and in practical analytical techniques, including for the analysis of pesticide residues and water quality.

IOCD is now forming a new Working Group in Analytical Chemistry, with a remit to strengthen capacities and encourage application of analytical chemistry techniques to solving environmental challenges.

- **enable local-scale energy conversion, energy storage and energy savings** in targeted regions in LMICs through new materials at the forefront of renewable energy technologies.

IOCD has formed a new Working Group on Materials for Energy Conversion, Saving and Storage (MATECSS).¹¹ The goal of MATECSS is to enable local-scale energy conversion, energy storage and energy savings in targeted regions in LMICs through new materials at the forefront of renewable energy technologies. In cooperation with local researchers in LMICs, MATECSS will work

towards identifying specific energy needs and developing solutions, using inexpensive adaptive technologies that do not require significant investments in capital equipment and infrastructure and that can make use of local/regional resources. It will also emphasize capacity building through training of young scientists and engineers.

Strategic priority 3: Capacity building in chemical education

To be able to respond to changing conditions and new challenges over time and to become self-reliant in their abilities to determine their own futures, all countries need to ensure they have an adequate supply of well-trained chemical scientists and suitable institutions and conditions in which they can work.

IOCD's strategy is to assist in enhancing capacities for chemical education, including:

- **Books and equipment for international development:** An IOCD group collects university textbooks across all disciplines, including the chemical sciences, as well as laboratory equipment and computers, and in collaboration with UNESCO makes a number of shipments each year to universities in Africa, Asia and Latin America.
- **Microscale science kits:** In many LMICs, there is little or no opportunity for chemistry students to gain practical experience, especially at the advanced school level. Together with UNESCO, IUPAC and the International

Foundation for Science Education, IOCD has supported the Global Microscience Project – portable micro-scale kits enabling chemical reactions to be conducted with very small quantities of chemicals. The kits and materials are designed to be easily adaptable to different national curricula, and are supported in multiple languages.

- **Web-based resources:** IOCD groups have developed **on-line tutorials** in organic chemistry, available in Spanish¹² and **training in practical medicinal chemistry**, available on-line and as a CD, to help up-grade the skills of chemists in the field of drug design and development.

IOCD has now embarked on the development of a suite of free on-line resources, **ChemKnowCore**, for teaching and learning in chemistry. The suite will include a chemical dictionary, accounts of chemistry research, chemistry experiments and games and, most important of all, a new knowledge repository, **ChemKnowBase**.

ChemKnowBase will cover the entire field of chemistry and include a comprehensive, searchable contents/index that will enable the user to quickly find subjects, topics and data. It will be curriculum, examination and pedagogy independent, providing a unified global standard of verified chemistry knowledge, while supporting context-dependent knowledge delivery by teachers and learning by their students.



Promoting the chemical sciences

IOCD promotes recognition of the importance of the chemical sciences for development, through its website, publications by members, presentations at symposia and organization of meetings on scientific advances. IOCD's President and other members played an active role in the 2011 International Year of Chemistry.

In partnership with the Namur Research College (NARC), IOCD has initiated a series of International Symposia. The Nobel Laureate Ryoji Noyori participated in the first of these symposia, in July 2012.¹³

Communications

IOCD's communications work aims to:

- Highlight the key role of the chemical sciences in development;
- Inform about IOCD's role as a proponent of the chemical sciences in development;
- Provide informational resources that facilitate and enhance capacities to conduct and use the chemical sciences in LMICs to advance their development;
- Promote the stronger participation of LMIC researchers in the chemical sciences in national and global priority areas.

Governance, structure, funding and accountability

Overall responsibility for governance and strategic direction rests with a small **General Assembly (GA)**, led by the President, who is currently a Nobel laureate in chemistry.

General Assembly 2014

Jean-Pierre Décor (France)
John Kilama (Uganda/United States),
Alain Krief (Tunisia/France/Belgium)
Jean-Marie Lehn (France)
Stephen Matlin (United Kingdom)
Goverdhan Mehta (India)
Carlos Rius (Mexico)
Michael Tempesta (United States)
René Van Griegen (Belgium)

The annual work programme approved by the GA is managed and overseen by an **Executive Director** and implemented by IOCD's Working Groups and Projects. The GA also appoints members of a **Senior Advisory Council**, who are eminent persons willing to assist IOCD to attain its mission.

Senior Advisory Council 2014

Prof. Berhanu Abegaz: Executive Director, African Academy of Sciences
Prof. Yitzak Apeloig: Department of Chemistry, Technion, Israel
Prof. Vadim Ivanov: Director, Shemyakin Institute of Bioorganic Chemistry, Russian Acad. Sciences
Prof. Koji Nakanishi: Department of Chemistry, Columbia University, New York, USA
Prof. Ryoji Noyori: President, RIKEN; Nagoya University, Japan
Prof. Ata Ur-Rahman: Patron in Chief, International Centre for Chemical and Biological Sciences, Karachi University, Pakistan
Prof. C. N. R. Rao: Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, India



IOCD has received **funding** from a wide range of public and private sector sources, including UN agencies, governments, national and international agencies and industry-funded foundations. IOCD is registered in Belgium; its USA affiliate, the Organization for Chemical Sciences in Development, Inc. (OCDI), is a 501(c)(3) tax-exempt organization.

Monitoring and evaluation is undertaken annually by the GA, to which the Secretariat and all IOCD programmes report.

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For further information and details of IOCD's programmes

Visit IOCD's Website:

www.iocd.org

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