International Organization for Chemical Sciences in Development

The Chemistry *KnowBase*
A New Form of Knowledge Source for the Digital Age

IOCD proposes to develop a new a new form of knowledge source for the digital age, containing a set of internet-accessible documents on a subject. The documents can be located by a search engine by author, title or subject, by keyword; or by specific words or phrases located anywhere in the text.

The *KnowBase* integrates and cross-links with information in dictionaries and encyclopaedias but extends beyond these concepts, presenting coherent, lucid and detailed, illustrated accounts of subject areas, complete with references and regularly updated by experts.

The *Chemistry KnowBase* contains documents on each aspect of chemistry – e.g. analytical, inorganic, organic, physical chemistry. These are written/peer reviewed by experts, providing authoritative sources of information. The documents are not organized as lectures, but as lucid and clearly illustrated descriptions and explanations. They may be used as sources for work by teachers or students, providing a global standard of knowledge at a specified level – whether for school- or university-level study; and as sources of information by non-specialists such as policy-makers and the general public.

Sourcing Knowledge in the Digital Age

The traditional knowledge repository is indeed a 'ledge' – a library shelf where textbooks, manuals, dictionaries, encyclopaedias and other reference works relating to a subject are stored. Finding information requires selecting the relevant tome, searching the Contents or Index sections or browsing the pages. A Library Catalogue provides a centralized point from which searches can be made by author, title or subject.

With the advent of the World Wide Web, access to knowledge has, in principle, become globalised, instantaneous and democratic – anyone in the world with access to a computer connected to the internet can search for all information that is available online. However, in practice the search for knowledge on the internet is fraught with difficulties: there is an enormous range of sources of differing qualities, levels and degrees of reliability; and the materials located take many forms and may not necessarily be organized to give the searcher a comprehensive understanding

Several partial solutions have been emerging in recent years. Online dictionaries and encyclopaedias provide fragments of information at the level of words, phrases and topics, but are not generally organized to provide a coherent and comprehensive coverage of a field of study. Open encyclopaedias of the 'wiki' variety have value as quick reference points for some purposes, but the degree of reliability of information is open to question and, for fields of science (e.g. 'organic synthesis'), the articles lack the range, depth and degree of detail necessary for in-depth study.

Many lecture courses and tutorial notes are now available on-line. These provide access to knowledge that is already organized around a specific learning objective or approach and provide a limited range of examples and illustrations to assist the learner, rather than attempting to be a comprehensive and detailed account of a subject area. Traditional textbooks provide a better approach to the latter, but while free texts are now becoming available they are often old editions of printed books or relatively brief materials written for the web that have not yet reached the range or depth that is envisaged in the KnowBase.

The Chemistry KnowBase

IOCD proposes a solution for the digital age in the 21st Century: a knowledge repository that is a ***KnowBase*** – a computer-based, internet-accessible collection of documents on a subject. The KnowBase will be the result of intense collaborative work between scientists under the leadership of IOCD, with the aim of opening global access to learning. The individual documents can be located by a search engine by author, title or subject, by keyword; or by specific words or phrases located anywhere in the text.

A ***Chemistry KnowBase*** contains documents on each aspect of the subject – e.g. analytical, inorganic, organic, physical chemistry – written/peer reviewed by experts in the field, providing authoritative sources of information. They are not organized as lectures, but as lucid, illustrated descriptions and explanations. They may be used as sources for work by teachers or students, providing a global standard of knowledge at a specified level – whether for school- or university-level study – or as sources of information by non-specialists such as policy-makers and the general public.

Phase 1: University-level study in Organic Chemistry

IOCD's ***Chemistry KnowBase*** will be initiated with the development of a Chemistry KnowBase in Organic Chemistry – aiming at University students from first degree level up to initiation of a PhD in organic chemistry and related fields at the frontiers of biological and pharmaceutical sciences. It will:

- contain documents on each aspect of organic chemistry
- be written by a scientists from universities and industries in each domain - they will be identified /peer reviewed by experts in the field, providing an authoritative set of sources of information.

Further phases: Multi-level study in any field of Chemistry

The model that is proposed will broaden in a second stage to cover other fields of chemistry – e.g. analytical, inorganic, physical, polymer, pharmaceutical chemistry – at the university level.

In subsequent stages, a 'school level' Chemistry KnowBase will be developed – providing a comprehensive source of knowledge of chemistry for teachers and learners from basic foundations up to the standard needed for university entry; as well as a '"Public level" Chemistry KnowBase – enabling the general public and policy makers to have ready access to knowledge that is accurate and reliable; is written in less technical language and having much less depth of coverage; and is extensively cross-referenced to the school—and university-level KnowBases for those who wish to dig deeper.

Some technical aspects of the Chemistry KnowBase

Modularity and inter-operability are key characteristics of the KnowBase project:

- It should involve different scientists working on the same chapter side by side, using their personal knowledge but sharing the same vision and the same objectives. While benefitting from the 'informal creativity' of the collaborating team, the overall work of the project will be formalized through a Table of Contents that is essential to organize the work of the large number of authors in multiple teams.
- The system will accept addition of new content, modification or removal of the existing data, when required.
- In Phase 1, the university-level Organic Chemistry KnowBase will incorporate two complementary modules that involve:
  1. ***ChemDic***: an unusual chemical dictionary that encompasses the characteristic of all types of dictionaries, being a glossary of chemical terms and acronyms, providing short definitions, grammatical analysis possessing etymology and ontology entries and being also an encyclopaedic dictionary that can serve as an entry point to the Organic Chemistry KnowBase, as well as a spellchecker. For each entry, it will include a series of at least eight sentences using the term in all the contexts it is used and a series of leading references.
  2. A series of texts (each typically ≤15 pages) written in textbook style and linked to pertinent references and equations selected by the authors amongst a larger set of related pertinent references and equations located in different but interconnected knowledge-bases.
- The system will also offer access to a series of typical experiments and through "***ChemDic***" to information about equipment and chemists who have play a major role in the world.
- There will be an opportunity, in parallel, to offer a series of essays from major actors in chemistry on they own work, without requirement to be comprehensive.
- All the information in the KnowBase will be interconnected and access to the text can be from the Table of Contents or from the Index, using query tools; but also from the references or via the embedded equations.

About IOCD

IOCD promotes the pursuit and application of the chemical sciences for sustainable, equitable human development and economic growth, especially in low- and middle-income countries. One major activity is capacity building in education: e.g. Organic Chemistry course in Spanish http://organica1.org; training in Medicinal Chemistry (http://ntpd.pharm.ku.edu/IOCD/), shipments of books and equipment for international development (http://www.iocd.org/WhatWeDo/books.shtml), promotion, in collaboration with UNESCO and IUPAC of Global Microscience Project (http://www.iocd.org/WhatWeDo/microscience.shtml).