



**International Organization  
for Chemical Sciences  
in Development**

**Imperial College  
London  
Institute of Global Health Innovation**

# *ChemKnowBase*

**A new internet-based knowledge resource to support  
teachers and learners in chemistry**

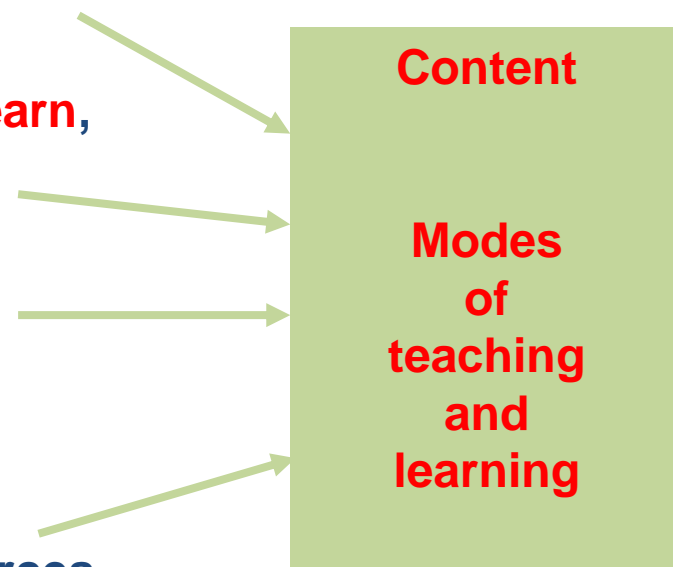
## **Stephen Matlin**

- **Adjunct Professor, Institute of Global Health Innovation  
Imperial College, London**
- **Head of Strategic Development, IOCD**



## Diverse forces shaping teaching and learning of chemistry at beginning of 21<sup>st</sup> century:

- fundamental changes in the contours of chemistry as defined by **new interfaces and research areas**
- changes in **our understanding of how students learn**, and how that applies to chemistry education
- widespread **implementation of computer and information technologies** to visualize complex scientific phenomena
- external forces, such as
  - **global concerns** about energy and water resources and the environment
  - the level of **chemical literacy** and **public understanding of science**





## Modes of teaching and learning



- Teacher-learner direct interactions in real time
- Age of the classroom & textbook



- Open & Distance Learning
- Age of the correspondence course; then age of the broadcast & mailed supporting materials



- Open & Distance Learning
- Age of computer-based learning with computer & web-based supporting materials



- Massive Open Online Courses (MOOCs)  
“education for everyone” / “education at scale”
  - ❑ Coursera, edX, Udacity



- Age of the smartphone

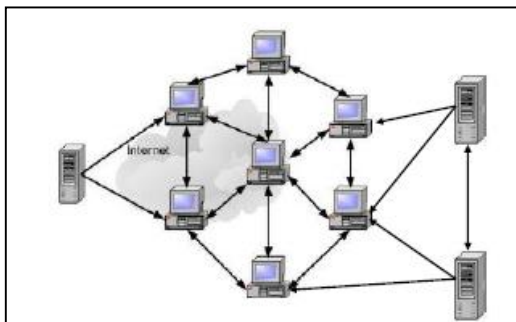


Teaching and learning



**Chemistry  
KnowLedge**

**Chemistry  
text books  
on the  
shelf**



**Chemistry  
KnowBase**

**Chemistry  
knowledge  
resources  
on the  
web**



## Knowledge resources supporting teachers and learners

### IOCD: *ChemKnowCore*

*ChemKnowBase*

Alain Krief (U Namur, Belgium)  
Stephen Matlin (Imperial College, UK)

*Chemistry dictionary*

Alain Krief (U Namur, Belgium)

*Chemistry virtual text books, courses, tutorials*

Lester Mitscher (U Kansas, USA)  
Carlos Rius (UNAM, Mexico)

*Chemistry accounts*

Oliver Reiser (U Regensburg, Germany)

*Chemistry experiments*

Burkhard König (U Regensburg, Germany)  
John Bradley (RADMASTE, South Africa)

*Chemistry games*

Alain Krief (U Namur, Belgium)

*Chemistry links*

IOCD website  
William Reusch (Michigan, USA)  
David Evans (Harvard, USA)





Devi Shan

# ChemKnowCore Website (Atomicka) ver 2.0



[CHEMKNOWBASE](#) [CHEMDIC](#) [CHEMCOURSE](#) [CHEMACCOUNT](#) [CHEMEXP](#) [CHEMGAME](#)



An initiative of the International Organization for Chemical Sciences in Development

## Welcome to ChemKnowCore

ChemKnowCore is a comprehensive resource for chemistry. It provides a knowledge base with detailed explanations about chemical substances, reactions and properties; course materials for teachers and learners; a dictionary of chemical terms; an encyclopaedia of chemistry; and much more.

Just click on any of the tabs above to enter the fascinating world of chemistry.



Welcome to Chemknowcore,



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CONTACT



### ChemKnowbase

ChemKnowBase is a knowledge base with detailed explanations about...

[More](#)



### ChemExp

ChemExp is a repository of experiments in chemistry that covers the whole range...

[More](#)



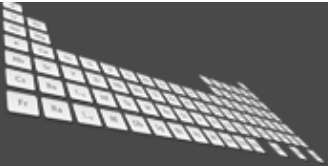
### News

efforts of Chris Lloyd from...

\* Organic chemistry is the scientific study of the structure, properties, composition, reactions, and synthesis of organic compounds that by definition contain carbon.

\* Inorganic Materials (Неорганические материалы)



# ChemKnowCore Website (Atomicka) ver 2.0



## CHEMKNOWCORE

A RESOURCE CENTRE FOR TEACHING AND LEARNING IN CHEMISTRY

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### *Chemistry Tutorials*

**SPANISH**

The IOCD partner Prof. Carlos Rius (Faculty of Chemistry, Universidad Nacional Autónoma de México (UNAM)) ...

[More](#)



### *Virtual Textbook of organic chemistry*

**ENGLISH**

Since the birth of organic chemistry over two hundred years ago...

[More](#)



### *Distance Learning Course on Medicinal Chemistry*

**ENGLISH**

The "Distance Learning Course on Medicinal Chemistry" designed by Prof. Lester Mitscher...



### *News*

\* Inorganic Materials (Neorganicheskie Materialy) was established in 1965; the journal contains reviews, original papers, and news about chemistry, physics, and applications of various inorganic materials including high-purity substances and materials. The journal discusses phase equilibria.

[More](#)



### *Tips*

\* Tip of the day Read our to get updates on Learn....

\* Give regular and devoted time to this subject. Best time will be morning time. First of all, try to learn the Periodic Table...

\* Study the properties of the elements by dividing your study material in



# ChemKnowCore Website (Atomicka) ver 2.0

<http://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/intro1.htm>

Prof. W. Reusch

## Virtual Textbook of Organic Chemistry

The two columns on the right are the main Table of Contents. An Alphabetical Index is at the bottom of the page.

### Useful Information

#### MENU

[Browser Test Page](#)

[For the Novice](#)

[Functional Groups](#)

[Alphabetical Index](#)

[Other Topics](#)

[Problem Collection](#)

[TextBook Format](#)

[Useful Data Tables](#)

[Useful Web Site Links](#)

[About Jmol](#)

[Chemicals & Risk](#)

[Molecular Model Viewer](#)

[Division of Organic Chemistry](#)

### General Principles

#### Structure & Bonding

[Electron Configurations of Atoms](#)  
[Chemical Bonding & Valence](#)  
[Charge Distribution in Molecules](#)

[Practice Problems](#)

[The Shape of Molecules](#)

[Isomers](#)  
[Analysis of Molecular Formulas](#)  
[Resonance](#)  
[Atomic and Molecular Orbitals](#)

[Practice Problems](#)

#### Intermolecular Forces

[Boiling & Melting Points](#)  
[Hydrogen Bonding](#)  
[Crystalline Solids](#)  
[Water Solubility](#)

[Practice Problems](#)

#### Chemical Reactivity

[Reaction Classification](#)  
[By Structural Change](#)  
[By Reaction Type](#)  
[Acid-Base Reactions](#)  
[Oxidations & Reductions](#)  
[By Functional Group](#)  
[Reaction Variables](#)

### Functional Group Reactions

#### Alkanes

[Combustion](#)  
[Substitution \(of H by halogen\)](#)

[Practice Problems](#)

#### Alkenes

[Electrophilic Additions](#)  
[Strong Brønsted Acids](#)  
[Lewis Acids \(non-Proton Electrophiles\)](#)  
[Electrophilic Halogen Reagents](#)  
[Other Electrophilic Reagents](#)

[Reduction](#)  
[Oxidation](#)  
[Radical Additions](#)

[Allylic Substitution](#)

[Practice Problems](#)

#### Dienes

[Addition Reactions](#)  
[Diels-Alder Cycloaddition](#)

[Practice Problems](#)

#### Alkynes

[Addition Reactions](#)  
[Hydrogenation](#)  
[Electrophiles](#)  
[Hydration & Tautomerism](#)  
[Hydroboration](#)





## **Free/open access chemistry “text books” on the web**

➤ **Variety of types**

- Text books
- Courses
- Units

➤ **Variety of levels**

- High school/college
- University undergraduate/Masters

➤ **Variety of formats**

- Texts: eBooks, HTML pages, PDF files
- Videos
- PowerPoints

➤ **Varied quality**

- eBooks and courses by eminent academics
- Materials from little-known individuals, groups and organizations
- ‘Wiki’ chemistry sites

➤ **Incomplete and inconsistent coverage of chemistry**

➤ **Lack of inter-linkages to enable search of topics between chemistry fields**

➤ **Content often shaped to a specific national or institutional curriculum or course**



*Knowledge resources supporting teachers and learners*

## *ChemKnowBase*

A new internet-based knowledge resource to support teachers and learners in chemistry

➤ **Comprehensive approach**

- covering all areas of chemistry consistently at a defined level (university; high school; general public)
- providing a uniform, verified, up-to-date account of topics

➤ **Topics that are identifiable and searchable, through**

- Table of Contents
- keywords
- text strings

➤ **Not driven by any specific curriculum or course**

- aims at extensive, in-depth coverage of the whole of chemistry

➤ **Providing a global resource base**

- from which any educator can derive a curriculum or course and construct lecture notes and exercises;
- in which any student can find in-depth explanations, clarifications, examples and links to further reading to supplement course materials.



# ChemKnowBase

An online resource supporting teachers and learners

ChemKnowCore

ChemKnowBase

ChemKnowCore

- Dictionary
- Accounts
- etc

CKB Topic

- Text
  - Observations
  - Theory & Mechanisms
  - Examples
  - Applications/  
real world problems
  - Figures/illustrations
  - Exercises
- Structures & Equations
- Experiments
- References
- Hot links
  - internal
  - peripheral
  - external

CKB Databases

- Text
- Structure
- Reference
- Experiments
- Table of contents

Chemistry & other literature



## **Construction and Development Plan**

- **Construction** through a collaborative global process involving chemists and software experts from academia and industry
- **Initiated** at university degree level
- **Parallel development** of
  - Content
  - Databases
  - Website architecture
  - User interface
- **Quality control** elements embedded in content development
  - Every topic draft subjected to **peer review**, ensuring
    - ✓ that it is accurate, up-to-date, clear and appropriate in range and depth of coverage and references, breadth and relevance of examples.  
**Relevance:** showing the critical linkages and interfaces of chemistry to industrial processes and products; other science disciplines; tackling contemporary challenges of global and local concern.
  - Every finalised topic subjected to strict **editorial process**, ensuring
    - ✓ complete consistency in the uses of terminology, abbreviations and explanations.
- Beginning with **pilot project**



## Pilot Project

### IT Element (Atomicka, India)

- Structure Database (ChemAxon tools)
- Text database
- Reference database
- Experiment database
- Website
- User interface

### Content Element (IOCD)

#### 4 Pilot subjects: University Chemistry Level

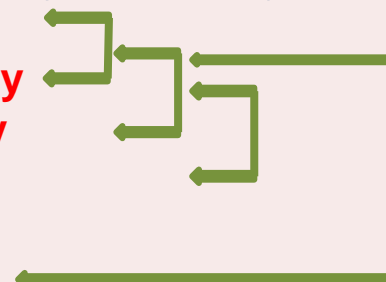
- Organo-iodine chemistry
- Organo-fluorine chemistry
- Organo-lithium chemistry
- Theoretical chemistry

and

- Laboratory experiments

Quality control

- Peer review
- Editorial process



*ChemKnowBase*

### Pilot website

- Open access for evaluation and feedback
- Invited panel reviews

ChemKnowCore

*ChemKnowBase*

Expanded website





*ChemKnowBase*

*An online resource supporting teachers and learners*

**Comments, ideas, volunteers  
welcome!**

*Thank you*

**s.matlin@imperial.ac.uk**