OPCW Temporary Working Group on the Convergence of Chemistry and Biology.

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* The views expressed are those of the author, and do not necessarily represent the views of the Australian Government or any other entity.
Convergence of biology and chemistry

A rapidly growing understanding by scientists of the fundamental chemistry of living systems, through interdisciplinary teams using more sophisticated equipment and experimentation.
Convergence of biology and chemistry

• The BWC and CWC are two separate legal instruments.

• The Conventions themselves are not “converging”.

• But there is increasing convergence of the science and technology underpinning the two treaties.

• Areas of overlap between the two treaties
  – Certain classes of chemicals, including toxins and bioregulators, are covered by the scope of both treaties.
Convergence: The Chemical & Biological Threat Spectrum

- Mustard
- Nerve Agents
- Hydrogen Cyanide
- Phosgene

- Agents not found in nature

- Toxic industrial, pharmaceutical and agricultural chemicals

- Peptides
  - Botulinum
  - Saxitoxin
  - Ricin

- Agents of biological origin

- Modified/tailored bacteria and viruses

- Bacteria
  - Viruses
  - Rikettsia

(Prepared by: Chemical Defence Establishment, UK, 1982)
Convergence of biology and chemistry

These advances result in:

• Increasing use of biologically mediated processes (catalysts, naturally occurring organisms and genetically modified organisms) for the production of chemicals (biosynthesis);

• Development of DNA chemical synthesis of replicating organisms (synthetic biology);

• Recombinant DNA technology that allows replacement of the original genome in bacterial cells with synthetically produced genomes, to produce bacteria with new capabilities (synthetic genomics).
Convergence of biology and chemistry

These advances promise major benefits, including:

- Improved medical / health care;
- More efficient food production;
- Renewable energy resources; and
- Pollution management.
Changing production of chemicals

From traditional chemical production processes to increasing use of biosynthesis and more advanced biotech methods.

Implications for CWC: production of toxic chemicals, including toxins and bioregulators.
Convergence - IUPAC/OPCW S&T Reviews


Potential POSITIVE implications for CWC:
• Improved methods of protection against chemical weapons, including:
  – Detection;
  – Personnel protective equipment
  – Medical countermeasures
  – Decontamination
  – Improved methods of analysis relevant to IAUs

Potential NEGATIVE implications for CWC:
• Advances could be misused for production of large quantities of toxic chemicals, including toxins and bioregulators, for use as chemical weapons.
Excerpt from: Note by the Director-General – Report of the Scientific Advisory Board on Developments in Science and Technology

Paragraph 2.6  The growing convergence between chemistry and biology is an issue that may need further reflection. These trends clearly have an impact on the scientific basis of the Convention, but it is less clear at this stage how the implementation process should be adapted. ... At the practical level, however, more study is required.

• Note by the Director-General, Report of the Scientific Advisory Board on Developments in Science and Technology, RC-2/DG.1 (28 February 2008), Paragraph 2.6.
TWG Agenda – Nov 2011

• Areas of overlap between the CWC and BWC
• Advances in life sciences
  – Advances in life sciences relevant to the production of chemicals.
• What processes are included in the biologically mediated synthesis for the:
  – Commercial scale production of chemicals
  – Production of toxic chemicals
  – Synthesis/production of toxins and bioregulators.
• The application of chemical synthesis methods for the production of toxins, bioregulators and peptides.
• Other aspects of convergence of chemistry and biology of potential relevance to the CWC, including the analysis of biologically active compounds.
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Concluding Comments

• The BWC and CWC are two separate legal instruments..

• But there is increasing convergence of the science and technology underpinning the two treaties.

• Importance of continued monitoring of the advances in S&T, including through OPCW CB Convergence TWG.

• Considerable benefits in experts in biology and chemistry sharing their BWC and CWC experiences..

• Greater interaction between BWC scientific community and CWC scientific community is recommended, including informal meetings of experts from both communities.