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**Meeting of the States Parties to the Convention  
on the Prohibition of the Development,  
Production and Stockpiling of Bacteriological  
(Biological) and Toxin Weapons and on Their  
Destruction**

20 July 2012

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**2012 Meeting**

Geneva, 10–14 December 2012

**Meeting of Experts**

**Geneva, 16–20 July 2012**

Item 6 of the agenda

**Standing agenda item:**

**review of developments in the field of science  
and technology related to the Convention**

**The Convergence of Chemistry and Biology:  
Implications for the Review of Developments in the Field of  
Science related to the Convention**

**Submitted by Australia**

1. The Seventh BWC Review Conference decided that the 2012 to 2015 process would include a Standing Agenda Item on the review of developments in the field of science and technology related to the Convention.<sup>1</sup> The Review Conference also noted the increasing convergence of biology and chemistry and its possible challenges and opportunities for the implementation of the Convention.<sup>2</sup> As emphasised in the Australian submission to the Seventh Review Conference on scientific and technological developments, the implications of the convergence of biology and chemistry on the BWC will warrant particular attention during this intersessional process.<sup>3</sup>

2. A number of different issues are included under the general umbrella term of ‘convergence’, including: the increasing use of biologically mediated processes (catalysts, naturally occurring organisms and genetically modified organisms) for the production of chemicals (biosynthesis); the more recent development of the chemical synthesis of replicating organisms; and recombinant DNA technology that allows replacement of the original genome in bacterial cells with synthetically produced genomes, to produce bacteria with new capabilities (synthetic biology).

3. In recent years, the scientific community associated with the Chemical Weapons Convention (CWC) has also become increasingly interested in the implications of the rapid advances in the life sciences, including the convergence of biology and chemistry. For

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<sup>1</sup> BWC/CONF.VII/7 Part III paragraphs 22-23.

<sup>2</sup> BWC/CONF.VII/7 Part II paragraph 49.

<sup>3</sup> BWC/CONF.VII/INF.3/Add.3.

example, the implications of the convergence of chemistry and biology were considered at the workshop co-hosted by the International Union of Pure and Applied Chemistry (IUPAC) and the Organisation for the Prohibition of Chemical Weapons (OPCW) in Zagreb in 2007<sup>4</sup> in advance of the Second CWC Review Conference, and again at the IUPAC/OPCW meeting in February 2012 in Spiez which considered more recent developments in S&T in advance of the Third CWC Review Conference, to be convened in April 2013.

4. The convergence of chemistry and biology was also one of the scientific and technological developments highlighted in the international workshop, Trends in Science and Technology Relevant to the Biological Weapons Convention, held in Beijing in November 2010 in advance of the Seventh BWC Review Conference. The Beijing Report highlighted the diffusion of research capacity and knowledge, and the growing numbers of international collaborations in S&T, as well as the increasing integration and convergence of multiple scientific disciplines, including chemistry and biology.<sup>5</sup>

5. As outlined in the Australian submission to the Seventh Review Conference, these advances promise many benefits to humankind, including more efficient food production, improvements to medicines and to health care, the generation of renewable energy sources, and the enhancement of pollution management.

6. There are also many potential benefits of the convergence of chemistry and biology (and related aspects of nanotechnology) for the BWC, including developments in detection of pathogens and toxins (biosensors), medical countermeasures, decontamination, and laboratory analysis and identification techniques, including bioforensics. However, it is also recognised that these developments could potentially be misused, including an increased potential for misuse of toxins and bioregulators for hostile purposes.

7. The BWC and CWC are separate legal instruments. However, certain classes of toxic chemicals, including toxins and bioregulators, are covered by the scope of both Conventions. Therefore, the convergence of biology and chemistry has potential implications for the two Conventions. As noted in the Beijing Report, as the life sciences continue to advance rapidly, this 'mid-spectrum' area of overlap between the BWC and CWC may continue to expand in several ways, including the possibility of more molecules being discovered that fall within the mid-spectrum, the possibility of the production of toxins and bioregulators in quantities that may be suitable for large scale use for hostile purposes, and more feasible delivery systems for these types of chemicals.<sup>6</sup>

8. A number of articles published about the implications of the rapid advances in life sciences for the BWC and CWC have tended to discuss the potential future implications from a theoretical perspective, and there appears to be limited information available as to what is realistically possible to achieve with the current state of development of science and technology. This led to the view by the Director-General of the OPCW that the convergence of biology and chemistry warrants further study at the practical level, and that additional advice should be sought, including from stakeholders in industry and academia.<sup>7</sup>

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<sup>4</sup> M Balali-Mood et al, Impact of Scientific Developments on the Chemical Weapons Convention, (IUPAC Technical Report), *Pure Appl. Chem.*, Vol. 80, No.1, pp.175-200 (2008).

<sup>5</sup> National Research Council, Life Sciences and Related Fields: Trends Relevant to the Biological Weapons Convention, National Academies Press, 2011, pp. 81-92.

<sup>6</sup> National Research Council, Life Sciences and Related Fields: Trends Relevant to the Biological Weapons Convention, National Academies Press, 2011, pp. 88-90.

<sup>7</sup> Note by the Director-General, Report of the Scientific Advisory Board on Developments in Science and Technology, OPCW-RC-2/DG.1 (28 February 2008), Paragraph 2.6.

9. To this end, late last year, the OPCW convened the first meeting of a new Temporary Working Group (TWG) on the convergence of chemistry and biology, which had been requested to examine what this convergence means in practical terms to the OPCW. Participants at the meeting included experts from the life sciences and the biotechnological industry. The group discussed advances in the life sciences, the extent of biologically mediated synthesis of chemicals, the application of chemical DNA synthesis for the production of toxins, bioregulators and peptides, and other aspects of convergence relevant to the CWC.<sup>8</sup>

10. The TWG concluded that there has been a recent trend towards the commercial production of an increasing number of chemicals using biological processes, and that the capacity for the synthesis / production of toxins, bioregulators and peptides is rapidly evolving and is being driven by advances in systems and synthetic biology. The group recommended the continued monitoring of these developments, including through surveys and technical feasibility analysis. To achieve these objectives, the group recommended the establishment of a structured process to continue monitoring the convergence of chemistry and biology, including, for example, by convening meetings of experts in chemistry and biology, including through the CWC and BWC meeting processes.

11. The TWG recommendation of convening meetings of experts in chemistry and biology, including through the CWC and BWC meeting processes, accords with the report of the Advisory Panel convened in 2011 by the OPCW, which notes that the convergence between chemistry and biology calls for closer interaction in the implementation of the CWC and BWC, including through exchanges of experience and joint technical reviews.<sup>9</sup> These issues will be further considered at the second meeting of the TWG, which will take place in September 2012.

12. Australia recommends the continued monitoring of these scientific and technological developments, including through surveys and technical feasibility analysis, and for the monitoring of the convergence of chemistry and biology to continue through appropriate processes. Australia also sees considerable merit in greater interaction between the BWC scientific community and the CWC scientific community, including informal meetings of experts from both communities.

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<sup>8</sup> Report of the First Meeting of the SAB Temporary Working Group on the Convergence of Biology and Chemistry, The Hague, The Netherlands (15-16 November 2011), Annex 2 to Report of the Seventeenth Session of the Scientific Advisory Board, SAB-17/1, (23 November 2011).

<sup>9</sup> OPCW, Report of the Advisory Panel on Future Priorities of the Organisation for the Prohibition of Chemical Weapons, Office of the Director-General, S/951/2011, p.20.