



The OPCW Science & Technology Monitor

A sampling of Science & Technology
relevant to the Chemical Weapons Convention

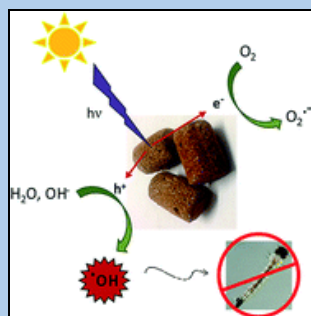
31 December 2014

Volume 1, Number 7

Featured Content:



Smartphone biosensors
(image from [Lab Chip](#),
2014,14, 3159-3164)



The International Year of
Light and photocatalysis
for degradation of
(bio)chemicals (image
from [RSC Adv.](#), 2014,4,
63650-63654).

Science Fun:

With the holiday season
not quite over, here are
some [holiday science
projects](#), an [introduction
to the science of
Christmas](#), and [suggested
gifts for chemistry
lovers](#), just in case...

Welcome

Welcome to our seventh issue of *The OPCW Science and Technology Monitor*, an occasional bulletin to provide updates on developments in science and technology across a broad spectrum of topics relevant to the CWC. Previous issues are hosted on the OSP portal.

As we prepare to welcome the new year, we wish you a happy 5th of January. In 2015, this day marks the 350th Anniversary of the first issue of the [Journal des Sçavans](#), the first European science journal.

Thanks to all who have supported and contributed to our S&T Monitoring project in 2014. Special mention goes to Thomas Cummings, Lisa Bergstrom, and Johannes Niemeier for bringing the *S&T Monitor* project to life. Stay tuned, we're reviewing all your feedback and will roll out some new ideas in 2015!

The S&T Puzzle

Congratulations to Joe Ballard (VER) for identifying Maridia, the fictional country, located in Jordan, where the 2014 CTBTO on-site investigation exercise took place. Quiz winning stats stand at VER: 2, OCS: 1. In the spirit of friendly competition, is there another division that can step up and challenge the VER winning streak?

For the next puzzle, we've been requested to make it harder, so here goes: one of our colleagues (someone with ties to two TS units) is featured in several places in one of the links. Who is this individual, which units are we referring to, and how many times is he or she featured in the linked report?

To the first person to solve the puzzle, we offer your choice of choosing a featured topic, designing a puzzle or a gift of a beverage selected by the Science Policy Adviser. The individual who is the subject of this issues puzzle is not eligible for prizes (apologies and we will make it up to you!).

In this issue:

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[The Year of Light and Light-Based Technologies](#)

News, Updates, and the Best in Science of 2014

In anticipation of the technological advances yet to be reported in 2015, consider [13 of the boldest ideas in science](#) and how in 2014 a number of [technologies thought of as “science fiction” moved closer to becoming a reality](#). You may also wish to reflect back on some of [the things that science taught us in 2014](#) (and as a second puzzle, can you identify which of these lessons previously appeared in *Science Fun?*).



New Years Eve is often celebrated with noise on the ground and fire in the sky. For those who prefer to read about chemistry rather than listen to it (or be blinded or otherwise injured by it), we offer an [overview](#) and an [infographic](#) about firework chemistry.

[Personnel use drones](#) have become popular gifts this holiday season. For those that are not comfortable with having these devices flying around, there are [high-tech](#) and biological ([ground](#) and [aerial](#) based) countermeasures...

Curious about the prevalence of the use of these drones? Look [here](#). In the USA, proliferation of personnel use drones has resulted in a holiday-themed “[know before you fly](#)” campaign.

Recently published newsletters and reports:

In anticipation of more features that include patents, the [2014 World Intellectual Property Indicators](#) and the [World Intellectual Property Organisation \(WIPO\) Intellectual Property \(IP\) Facts and Figures](#) reports may be of interest.

The [final report](#) from the [Science Advice for Governments Conference](#) held in August 2014 is now available.

[Innovation: Managing Risk and Not Avoiding it](#) from the Chief Science Advisor of the United Kingdom.

[The PORT Annual Report](#) describes their “[hackathon](#)”.

[Slides and materials](#) from the [IAEA](#) Symposium on International Safeguards, held from 20-24 October 2014 in Vienna, Austria.

Issue 25 of Dstl’s [Insight](#). The new issue includes a [video about the unexpected science of chemical agent detecting plants](#).

Communication technologies continue to evolve and find new applications - including diplomacy. Here are [the best digital diplomacy articles of 2014](#) (and a [2015 Cyber Security Calendar](#)).

Making news in chemistry:

[from 14 - 20 December 2014](#) and [21 - 27 December 2014](#);

a [round up of the cutting edge of chemistry in 2014](#) courtesy of the Royal Society of Chemistry; and

the year [2014 in chemistry](#) from *Chemical and Engineering News*

The best of science and technology from 2014:

the [top 25 science stories of the year](#) from *Science News*;

[2014 in science](#) and [what to expect in 2015](#) from *Nature*;

the [top 10](#) from *Scientific American* (and top 10 from their [readers](#));

the [top 10 breakthroughs](#) from *Science Magazine* and the [people’s choice scientific breakthrough of the year](#);

[top technology stories of 2014](#) and the year in [biomedicine](#), [artificial intelligence](#) and [materials science](#) from the *MIT Technology Review*;

[top 2014 innovations for social good](#);

and finally, enjoy some of the [award-winning](#) and best science [images](#) and [visualisations](#) of 2014.

19th Conference of States Parties

We conclude this edition of *Science Fun* with a [champagne toast](#) to the New Year. Did you know that [champagne](#) is a [beverage](#) whose [bubbles can have different chemical signatures than the liquid itself](#)? For the curious amongst us, here is a method to measure [the number of bubbles in your glass](#).

Crowdsourcing:

Seeker is looking for the “next generation” of [chemical agents for rodent control](#).

Have ideas on how to use publicly available data to find social inequality and aid the disadvantaged? Sign up for the [SBP15 Grand Data Challenge](#).

[Here is your chance to name craters on the planet Mercury](#) (open until 15 January 2015).

Upcoming S&T Related Events:

28 - 29 January 2015
5th Meeting of the Scientific Advisory Board’s Temporary Working Group on Verification. The Hague

4 - 6 February 2015
[The Unmanned Systems Expo 2015](#). The Hague.

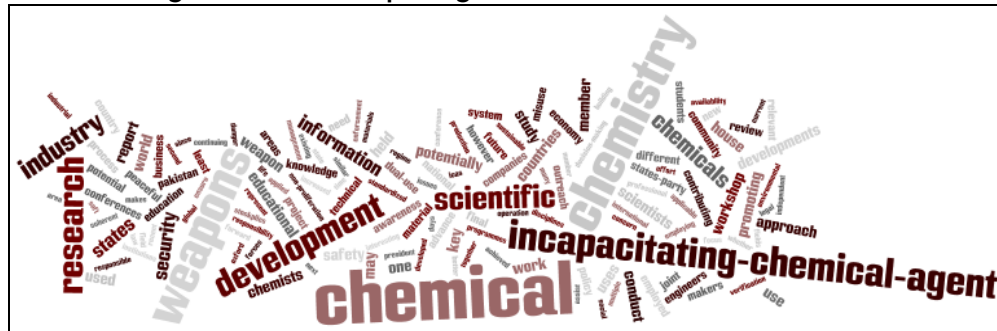
12 - 16 February 2015
[AAAS Annual Meeting 2015: Innovations, Information, and Imaging](#).
San Jose, CA, USA

The [19th Conference of States Parties](#) (CSP-19) was held from 1-5 December 2014 in The Hague. While S&T was not a specific [agenda](#) item, it was brought out in many areas of discussion. References to S&T and the Scientific Advisory Board (SAB) can be found in paragraphs 23 - 27 and 103 - 108 of the [Director-General’s statement](#) (see also paragraphs 109 - 111 on education and outreach). S&T was mentioned in 19 of the statements from the States Parties in the [General Debate](#) (out of 55 posted online); the General Debate also included statements from the [International Union of Pure and Applied Chemistry](#) (IUPAC) and the [International Council of Chemical Associations](#) (ICCA); and S&T was mentioned in 5 of the 14 statements from the NGOs. See the CSP-19 report [here](#).

Word cloud* generated from General Debate statements of CWC States-Parties:



Word cloud* generated from opening statements of NGOs:



*removed “science and technology”, “S&T”, and “chemical Weapons Convention” from results for clarity.

The following side events included S&T relevant discussions:

The delegation of Switzerland presented the results of Spiez Laboratory CONVERGENCE workshop and released the [workshop report](#).

The delegation of Australia discussed the [weaponisation of central nervous system acting chemicals for law enforcement purposes](#).

The technical Secretariat was joined by Dr Henrike Gebhardt of [Evonik Industries](#) for the Science for Diplomats event on the “Science of the Bioeconomy”. Presentation materials are available from the OSP portal (or by request).

21 - 26 March 2015
[249th American Chemical Society \(ACS\) National Meeting & Exposition](#).
Denver, Colorado, USA.

During ACS Board of Directors meeting, the OPCW will be honoured for its work in finding peaceful applications of chemical sciences worldwide.

21 - 26 June 2015
[2015 Gordon Research Conference on Chemistry Education Research and Practice](#).
Lewiston, ME, USA

22 - 26 June 2015
[CTBT Science and Technology Conference \(SnT2015\)](#).
Vienna, Austria

14 - 26 July 2015
[19th Annual Green Chemistry and Engineering Conference](#).
Bethesda, ML, USA.

19 - 22 July 2015
[12th World Congress on Industrial Biotechnology](#).
Montreal, Canada.

14 - 18 August 2015
[Biological Weapons Convention Meeting of Experts](#).
Geneva, Switzerland.

6 - 13 August 2015
[IUPAC 2015](#)
48th General Assembly
45th World Chemistry Congress. Busan,
Republic of Korea.

27 September - 1
October 2015
[ECCE10 \(10th European Congress of Chemical Engineering\)](#)

[ECAB3 \(3rd European Congress of Applied Biotechnology\)](#)

[EPIC5 \(5th European Process Intensification Conference\)](#)

Nice, France.

2014 Biological Weapons Convention Meeting of States Parties

In parallel to CSP-19, the [2014 Biological Weapons Convention Meeting of States Parties](#) (BWC MSP) was held from 1-5 December 2014 in Geneva. Topics on the agenda included ‘Cooperation and assistance, with a particular focus on strengthening cooperation and assistance under Article X’; ‘Review of developments in the field of science and technology related to the Convention’; ‘Strengthening national implementation’; and ‘How to strengthen implementation of Article VII. [Daily reports from the BWC MSP meeting are available from the BioWeapons Prevention Project \(BWPP\)](#)).

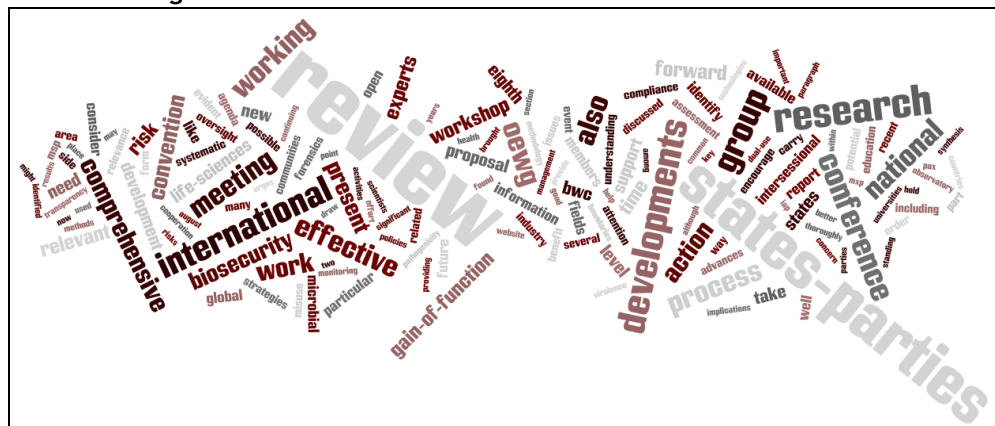
S&T was mentioned in 31 of the 43 statements from the States Parties and 7 of the 8 statements from the NGOs in the General Debate ([all statements are online](#)). Statements from the actual discussion on developments in S&T are available from [Switzerland](#), [Pakistan](#), and [Ukraine](#). The [final report](#) summarises the S&T discussions in paragraphs 31-40 and paragraphs 12-23 of Annex I.

The word clouds below highlight the S&T relevant statements.

Word cloud* generated from statements of BWC States-Parties:



Word cloud* generated from statements of NGOs:



*removed “science and technology”, “S&T”, and “biological Weapons Convention” from results for clarity.

The following side events included S&T relevant discussions:

5 - 8 October 2015
[SOLVE](#).
Cambridge, MA, USA.

18 - 21 November 2015
[16th Asian Chemical Congress](#).
Dhaka, Bangladesh.

Contact:

Questions, comments, suggestions, contributions? Or to be added to the mailing list, please contact the [Science Policy Adviser](#) in the Office of Strategy and Policy

“[Building a Web of Prevention: Progress to Date](#)” with presentations on [education and awareness raising in Ukraine](#), the [OPCW TWG on education and outreach](#), the [Biochemical Security 2030 Project](#), and the [BioWeapons Monitor 2014](#). Key messages can be found [here](#).

The “[threat of manufactured disease](#)” (see [also](#)) and the launch of a report on [Confidence and Compliance with the Biological Weapons convention](#).

“[Enabling technologies to benefit treaty implementation](#)” with presentations on [collecting \(bio\)chemical data](#), [public information analysis](#), and [tacit knowledge](#).

The delegation of Switzerland presented the results of the Spiez Laboratory CONVERGENCE workshop and distributed the [workshop report](#) (this presentation was also given at CSP-19).

Science and the Smartphone

With about [2.7 billion world-wide Smartphone subscriptions](#) in 2014 (and an estimated 6.1 billion by 2020), these devices are a familiar part of day to day life; they are also enabling tools for science!

For [studying chemistry with Smartphones](#), take a look at some of the available [chemistry apps](#). Mobile apps can also enable [cheminformatics workflows](#) (details [here](#)). One can even [convert a Smartphone into a microscope](#) (some versions require [3D printed parts](#)); given that image analysis software is already good enough to [produce fingerprints from photographs](#), the obtainable magnification should be adequate for many applications.

For chemical detection, [Smartphone gas sensors](#) have been reported (details [here](#)) and there are many examples of devices that combine [mobile phone technology with lab-on-a-chip](#). Biosensor applications include [quantitative immunoassays](#), [colorimetric assays](#), [biochemiluminescence assays](#), [nucleic acid detection](#) (including [commercially available devices that target specific diseases](#)) and even [single molecule DNA imaging](#) (details [here](#)).

As a point-of-care medical device, there are applications for [ophthalmology](#), [monitoring patients with chronic conditions](#), [monitoring breathing](#), and in the [diagnosis of ear-infections](#).

Mobile phone users also generate data wherever they go, allowing [dynamic population mapping](#), [the revealing of patterns of food consumption](#) (details [here](#)) and [tracking the spread of disease](#). There is, however, a [potential for hidden bias](#) from this kind of data that should be always considered (details [here](#)). Then there is the discussion of privacy, something that might require more space than we have available in this issue of the *S&T Monitor*...

Smartphones represent another type of mobile analytical tool. While current applications may have limits, recall how [hand-held Raman devices were originally viewed, how they developed](#), and that they

were recently used by OPCW inspectors during the removal of chemicals from the Syrian Arab Republic.

As the capabilities of mobile technologies continue to develop, a new generation of miniaturised sampling and analysis tools might be "[wearable](#)".

In conclusion, we leave you with the [chemistry](#) of a Smartphone.

International Year of Light and Light-Based Technologies

The United Nations (UN) General Assembly 68th Session proclaimed 2015 as [the International Year of Light and Light-based Technologies](#) (IYL 2015). IYL 2015 is focused on raising global awareness on how light-based technologies can promote sustainable development and help solve global challenges related to energy, education, agriculture and health.

Light based technologies also have relevance to the CWC, photocatalytic degradation of chemicals using nanoparticles has been demonstrated for [pollutants](#) (details [here](#)) and [chemical warfare agents](#). Taking inspiration from the [plant world](#), [photosynthetic methods can be used to control chemical processes](#) (details [here](#)) and produce chemicals such as [butanol \(as demonstrated by an early phase start-up company\)](#). [Photocatalysis can also aid in the eradication of disease spreading organisms](#) (details [here](#)).

How about a [solar powered Smartphone assisted molecular diagnostic device](#)? (Details [here](#)).

In the field of energy (a focus of IYL 2015), progress in the continuing [quest for conversion of sunlight to electricity with over 40% efficiency](#) was [recently achieved](#). [Spray on quantum dots](#) can be used to produce solar cells (details [here](#)) in [unconventional shapes](#). Other types of materials used in solar energy applications include [polymers](#), [perovskites](#), [two-dimensional atomic crystals](#) and [mesoporous single crystals](#). Combining these materials with [Blu-ray disks can improve solar panel performance](#). Sunlight can also be converted into fuels using [algae based](#) (details [here](#)) and [inorganic](#) processes (details [here](#)).

Of course 2015 is not all light; the Food and Agriculture Organization of the United Nations (FAO) have been nominated to implement 2015 as the "[International Year of Soils](#)" (IYS 2015). We look forward to a convergence of light, soil, and technology that will further benefit our world! Happy New Year!

The links to articles, papers, reports, websites or other materials incorporated herein are being provided for information purposes only. The views and opinions expressed in the aforementioned materials are those of the authors and do not necessarily reflect the views of the OPCW. These items are cited as a service to readers and do not imply endorsement by the OPCW. The OPCW does not provide any guarantee, express or implied, that the information presented is accurate or timely, and does not contain inadvertent technical or factual inaccuracies. The OPCW is not responsible for the content of third party websites.