



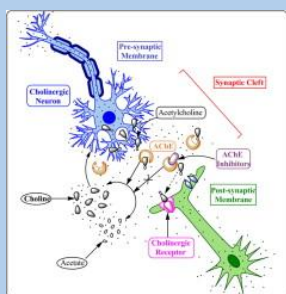
The OPCW Science & Technology Monitor

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

10 October 2014

Volume 1, Number 3

Featured Content:



(From [Eur. Journal of Med. Chem.](#), 70, 2013, 165-188)

Acetylcholine esterase inhibitors: nerve agents and Alzheimer's Disease treatment.



A drone with radiation detection capability from [Research International](#).

Science Fun:

In honour of both the Indian [Mars Orbiter Mission \(MOM\)](#) and the NASA [MAVEN](#) mission reaching the red planet, we dedicate this issue of science fun to the convergence of chemistry and astronomy

Can molecular [building blocks of life](#) be found in interstellar space? ([technical details are available here](#))

Welcome

Welcome to our third 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.

This week we congratulate Eric Betzig, Stefan Hell and William E. Moerner for receiving the 2014 Nobel Prize In Chemistry "[for the development of super-resolved fluorescence microscopy](#)."

In this issue:

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[Diagnostic Platforms for Bioanalytical Applications](#)
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Nerve Agents - Effects and Medical Countermeasures

Understanding biological function and how it is impacted by exposure to toxins is critical for developing effective medical countermeasures. In the case of organophosphorus nerve agent exposure, there are cascades of biological pathways that are harmed beyond the immediate consequences of the inhibition of acetylcholinesterase (including irreversible [neurological damage](#) and inducing [neurological disorders](#) in survivors of nerve agent poisoning).

Even with the well-documented best practices that are available (see for example reports from the OPCW [Scientific Advisory Board](#) and the [World Health Organisation](#)), our more familiar countermeasures are not always adequate to mitigate secondary effects of exposure; research thus continues to look for more effective solutions.

Recent reports on medical countermeasures include

The use of caramiphen edisylate as an [optimal antidote against organophosphate poisoning](#) and as an [adjunct to standard therapy to attenuate soman-induced seizures and cognitive deficits](#);

The use of [LY293558](#) to prevent soman-induced pathophysiological alterations in the basolateral amygdala and the development of [anxiety](#); and

[Isotopic ratios](#) reveal that half of Earth's water is older than the Sun ([technical details are available here](#))

[Chemical analysis for recognising life](#) on other worlds ([technical details are available here](#))

And for those of you who always wanted to decorate with space-craft, planets, asteroids, and other symbols of space exploration, now you can [3D-print them](#). [Comets](#) available too!

Upcoming S&T Related Events:

10 October 2014
Science for Diplomats (2) - Biomedical Sample Analysis (side event at EC-77)

13:30-15:00, Ooms Room

19 - 21 November 2014
[Biological and Chemical Security in an Age of Responsible Innovation](#); Organised by the Biochemical Security 2030 Project at the Royal Society, London

28 November 2014
Science and Technology Breakout Discussion as part of the 16th Annual Meeting of National Authorities, The Hague, 9:00 - 12:30.

[Ketamine combinations for the field treatment of soman-induced self-sustaining status epilepticus](#).

And sometimes there are [medical reasons to want to inhibit acetylcholinesterase](#)

Diagnostic Platforms for Bioanalytical Applications

With the multitude of electronic devices and informatics capabilities available, researchers are finding clever ways to build low cost diagnostic platforms and augment the capability of more sophisticated analytical tools. For example:

A [PCR machine powered by heat from a computer's CPU](#) could lower the cost of disease detection in developing countries. ([technical report available here](#));

A bioanalytical assay platform based on [inkjet printing and DVD/Blu-Ray Optical Drives](#);

Use of [open-source electronics](#) to enable a robotics-assisted mass spectrometry assay platform; and

Combining [lab-on-a-chip devices with mass spectrometry](#) for bioanalytical applications.

To appreciate why bioanalytical devices (another example of convergence of chemistry and biology) are so important, [read about how chemical analysis of biological materials \(e.g. DNA\) was employed in response to the West African Ebola outbreak](#) ([technical report available here](#)).

Drones

Drones, both aerial and ground-based varieties, are being adapted for a wide range of [applications](#), many of which could be relevant to non-proliferation and emergency response.

The UN Office for the Coordination of Humanitarian Affairs (UNOCHA) released a report on [Unmanned Aerial Vehicles in Humanitarian Response](#). Many other reports highlight humanitarian applications and [search and rescue capabilities](#) of drones.

In agriculture, [aerial drones with imaging and sensing capabilities combined with informatics can improve harvest yields](#), while [ground and aerial](#) unmanned vehicles can spray fertilizer and pesticides with precision.

It should come as no surprise that sampling and analysis capabilities are actively being incorporated onto unmanned vehicles, [environmental monitoring](#) (including [hyperspectral imaging](#) and [biological measurements](#)) and CBRNe detection capabilities have been reported. In the CBRNe context, military drones have been

1 - 5 December 2014
Biological Weapons
Convention Meeting of
States Parties;
Geneva, Switzerland

5 December 2014
Science for Diplomats
(3) - Biomediated
chemical production
(side event at CSP-19,
tentative)

Details TBD

11 - 12 December 2014
New Technologies and
Approaches for Informa-
tion Analysis to
Support Non-Prolifer-
ation and Disarm-
ament Verification;
Vienna Center for Dis-
armament and Non-
Proliferation (VCDNP)
and the James Martin
Center for Non-
proliferation Studies
(CNS), Vienna, Austria

Contact:

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

fitted with [chemical and biological sensors](#) and a “[flying UAV laboratory](#)” has been demonstrated that can detect up to 20 chemical warfare agents and toxic industrial gasses, along with nuclear and biological materials.

3D Printable drones with applications for bomb diffusion are also a subject of interest as seen in this [crowdsource challenge](#).

Additional information on the development of civilian use drones, can be found at these links:

[A handbook on UAV's](#)

[Unmanned aerial systems for photogrammetry and remote sensing: A review](#)

Chemistry Education

The Scientific Advisory Board's Temporary Working Group on Education and Outreach in Science and Technology relevant to the Chemical Weapons Convention held its fourth and final meeting from 24 to 25 September 2014. As we look forward to their forthcoming final report, we look at a series of science education resources available online and as mobile apps.

Remember your childhood chemistry kit? [ChemCrafter](#) is a free app for the iPad from the Chemical Heritage Foundation. It lets users run their own virtual chemistry lab without the dangers. Watch the video [here](#).

For those that enjoy virtual laboratory work, the [Aspirin Screen Experiment](#), from the Royal Society of Chemistry, lets users perform aspirin synthesis.

This list of [Science Apps](#) compiled by the American Association for the Advancement of Science (AAAS) includes everything from the periodic table to virtual frog dissection.

Nature offers the [Toolbox](#), a collection of scientific software, apps and online tools.

For those of you that would like to learn more chemistry, the American Chemical Society's [Chemistry Education Resources](#) page provides learning tools for aspiring chemists of all levels.

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