

Science for Diplomats at EC-86

Innovation

and

the **C**hemical **W**eapons **C**onvention:

The **S**cientific **A**dvisory **B**oard's Report on
Emerging Technologies



Tuesday, 10 October 2017

Ooms Room 13:30-14:45

LIGHT LUNCH AVAILABLE AT 13:00



OPCW

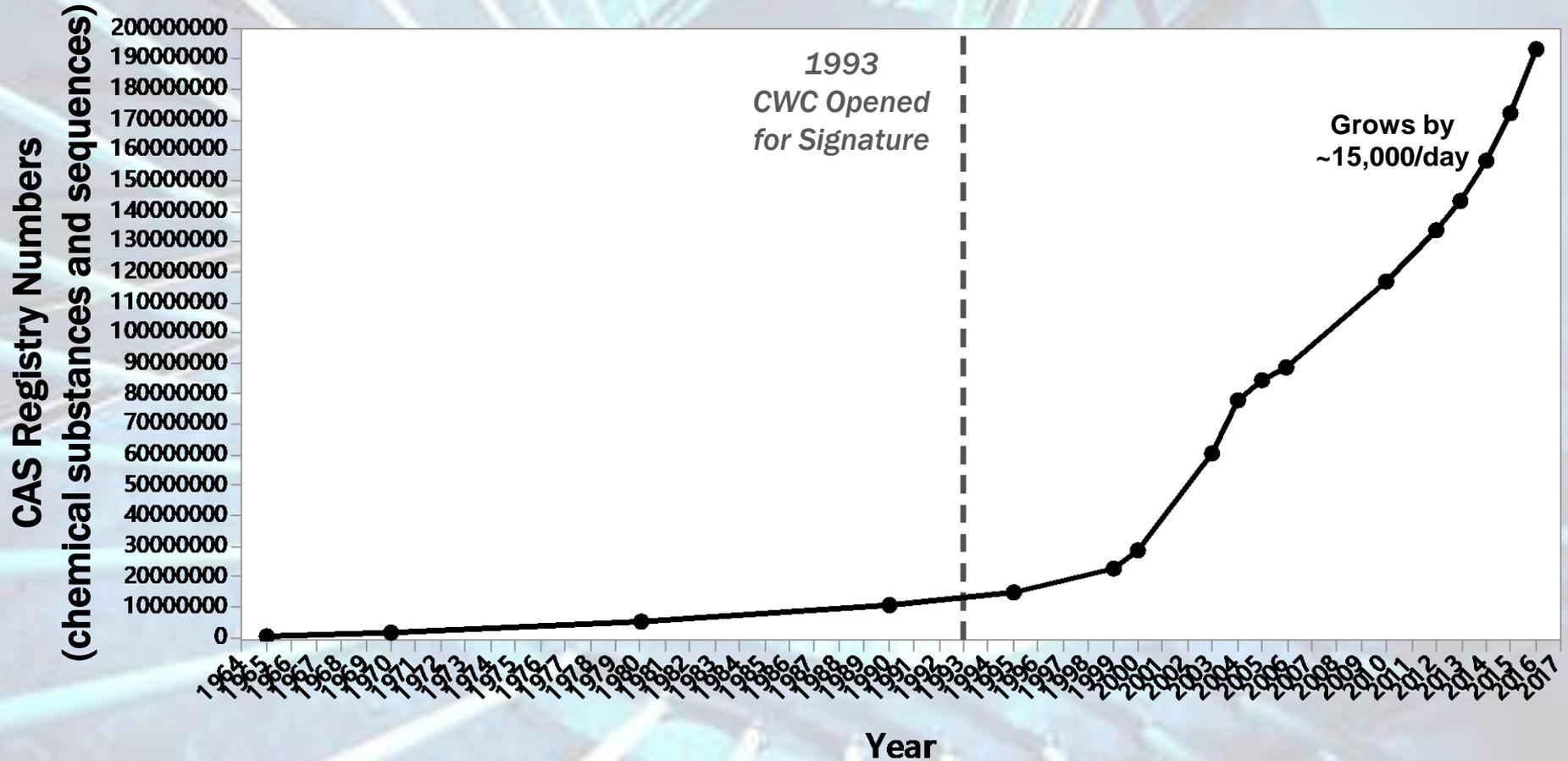
1997-**20**17
YEARS





OPCW

Understanding the Impact of Science on Security is a Challenge





OPCW

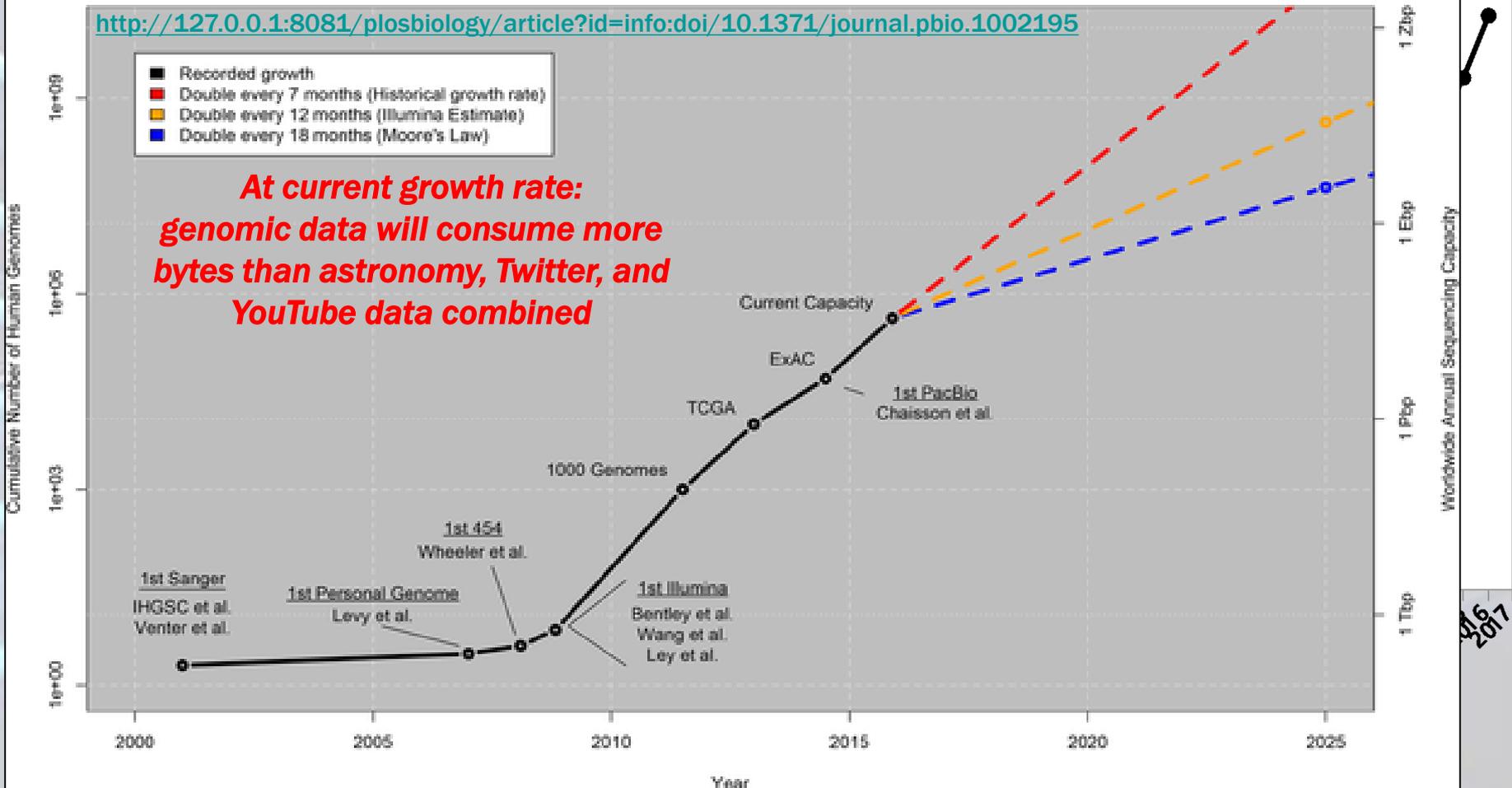
Understanding the Impact of Science on Security is a Challenge

Growth of DNA Sequencing

<http://127.0.0.1:8081/plosbiology/article?id=info:doi/10.1371/journal.pbio.1002195>

- Recorded growth
- Double every 7 months (Historical growth rate)
- Double every 12 months (Illumina Estimate)
- Double every 18 months (Moore's Law)

**At current growth rate:
genomic data will consume more
bytes than astronomy, Twitter, and
YouTube data combined**

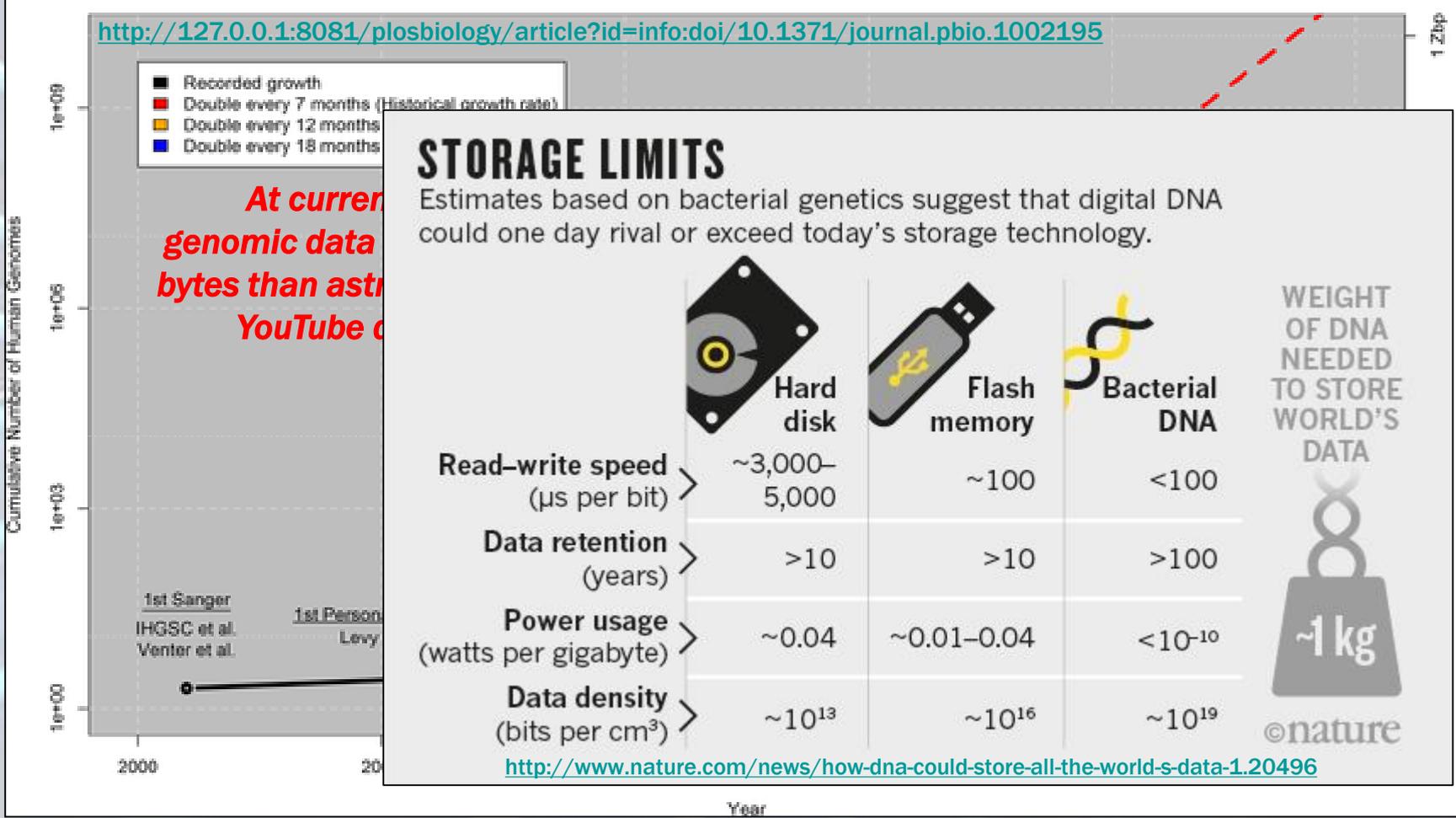


2016
2017

Understanding the Impact of Science on Security is a Challenge

Growth of DNA Sequencing

<http://127.0.0.1:8081/plosbiology/article?id=info:doi/10.1371/journal.pbio.1002195>



STORAGE LIMITS

Estimates based on bacterial genetics suggest that digital DNA could one day rival or exceed today's storage technology.

	 Hard disk	 Flash memory	 Bacterial DNA
Read-write speed (µs per bit)	~3,000–5,000	~100	<100
Data retention (years)	>10	>10	>100
Power usage (watts per gigabyte)	~0.04	~0.01–0.04	<10 ⁻¹⁰
Data density (bits per cm ³)	~10 ¹³	~10 ¹⁶	~10 ¹⁹

WEIGHT OF DNA NEEDED TO STORE WORLD'S DATA



©nature

<http://www.nature.com/news/how-dna-could-store-all-the-world-s-data-1.20496>

Worldwide Annual Sequencing Capacity

2016
2017



OPCW

Understanding the Impact of Science on Security is a Challenge



International cooperation: This is good right?

<http://olihb.com/2014/08/11/map-of-scientific-collaboration-redux/>

Computed by David H. Bustreche and SCImago Lab; data by Elsevier Scopus



<http://www.nature.com/news/how-dna-could-store-all-the-world-s-data-1.20496>

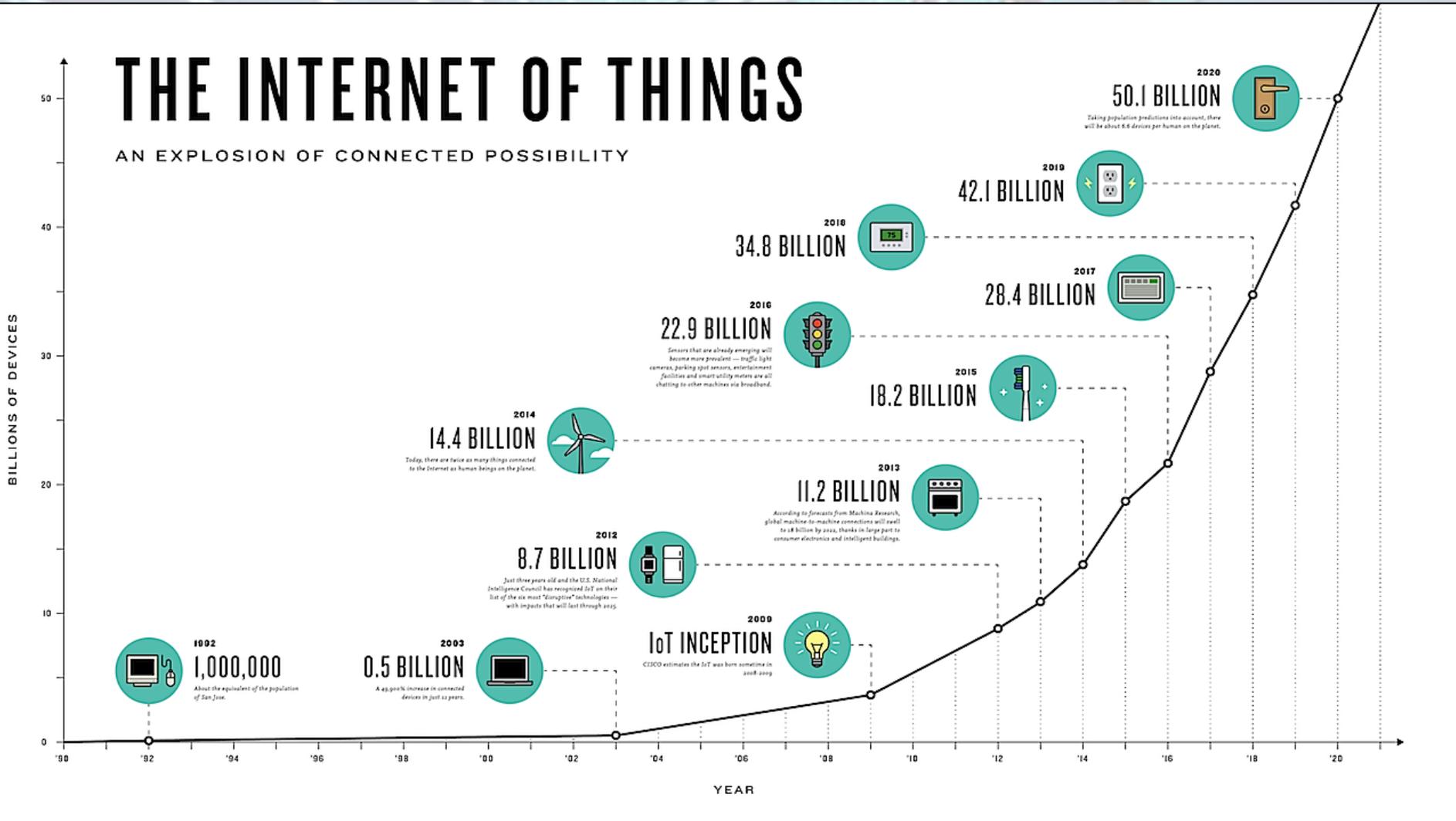


OPCW

Understanding the Impact of Science on Security is a Challenge

THE INTERNET OF THINGS

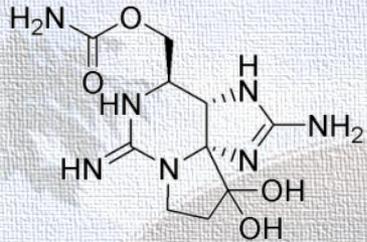
AN EXPLOSION OF CONNECTED POSSIBILITY





OPCW

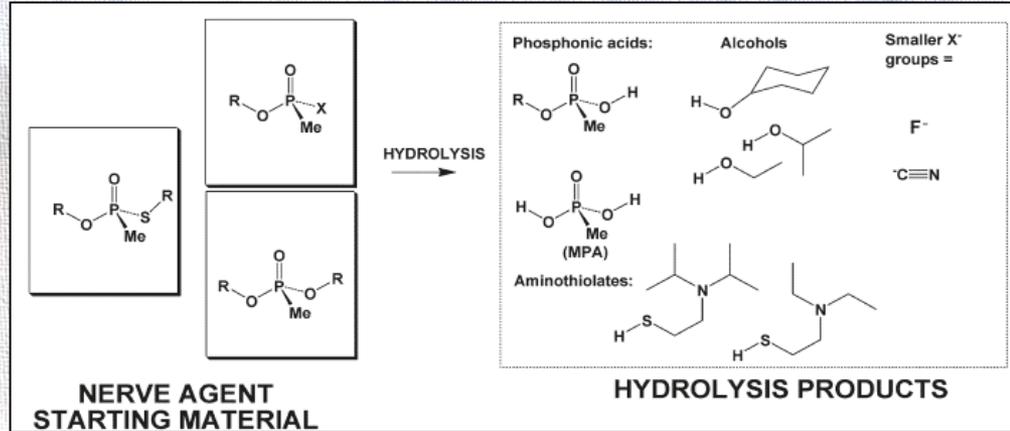
Without Sound Scientific and Technological Capacity There is No Treaty Implementation



Article II



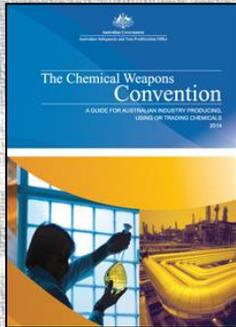
Article III



Articles IV and V



Article VI



Article VII



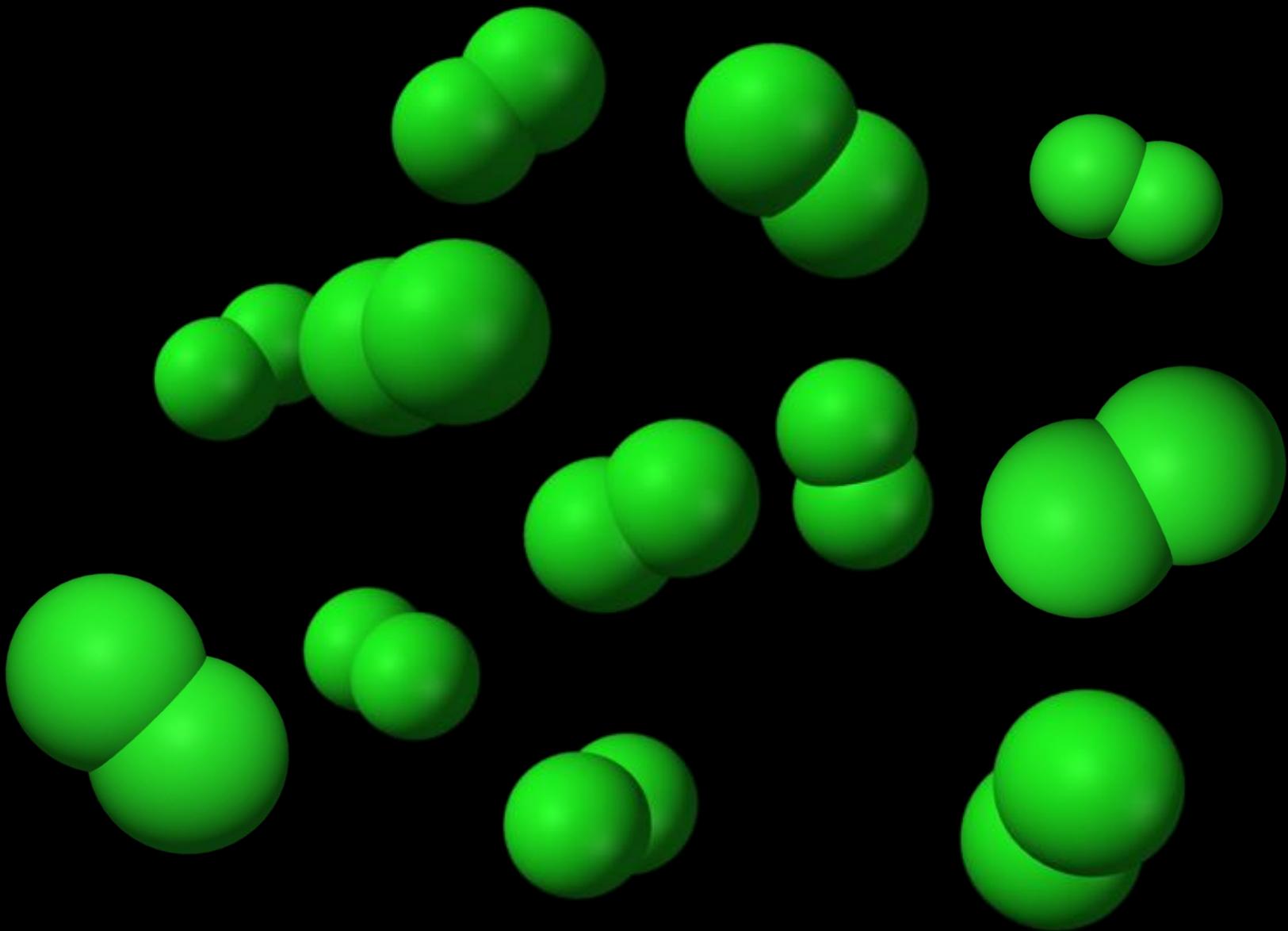
Article VIII



Articles IX and X



Article XI





Chemical analysis to verify chlorine gas exposure?



December 2018: A Time to Review

Third Special Session of the
Conference of the States
Parties to Review the
Operation of the Chemical
Weapons Convention
8 - 19 April 2013
Organisation for the Prohibition of Chemical Weapons



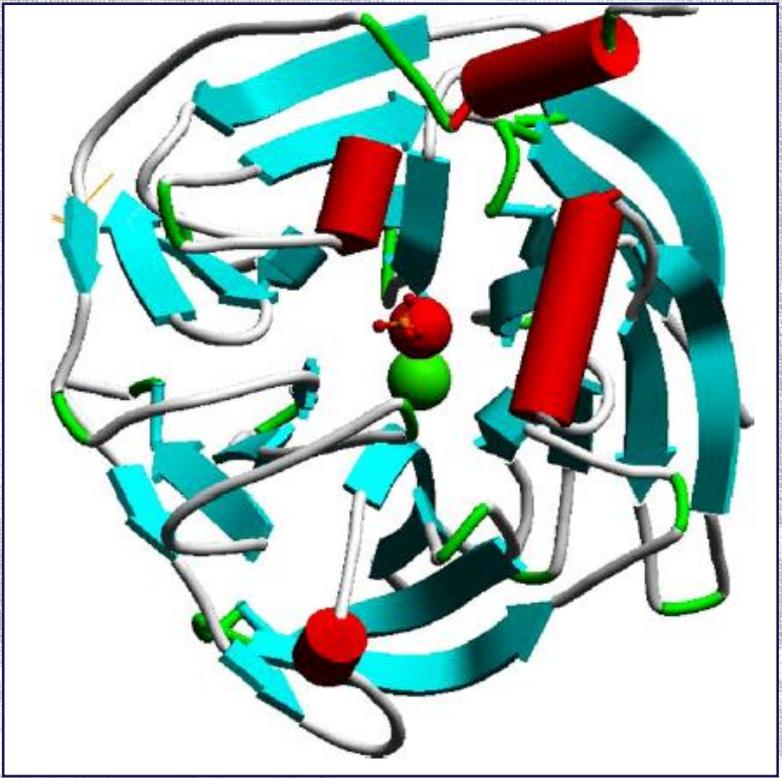


Workshops to Inform SAB Report



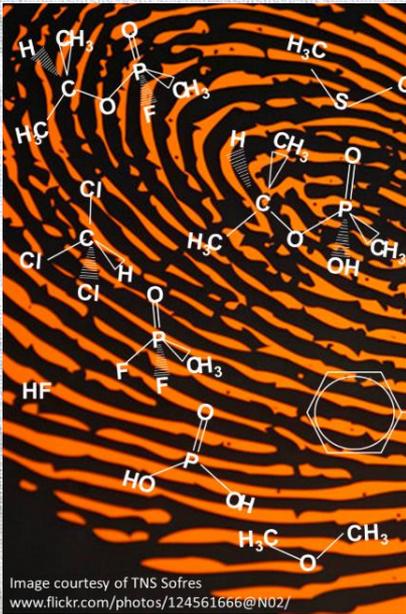
**Chemical Forensics
Helsinki, Finland
June 2016**

**Medical Countermeasures and
Emergency Response
Paris, France, September 2016**





Workshops to Inform SAB Report



**Chemical
Helsinki,
June 2**



1997-2017



The National Academies of SCIENCES ENGINEERING AND MEDICINE



03-05 | JULY - 2017
RIO DE JANEIRO - BRAZIL

INTERNATIONAL WORKSHOP ON INNOVATIVE TECHNOLOGIES FOR CHEMICAL SECURITY

Science for Peace

#ScienceforPeace



1997-2017



INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY

The National Academies of SCIENCES ENGINEERING AND MEDICINE



ACADEMIA BRASILEIRA DE CIÊNCIAS

ORGANISATION FOR THE PROHIBITION OF CHEMICAL WEAPONS
WWW.OPCW.ORG

INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY
WWW.IUPAC.ORG

THE NATIONAL ACADEMIES OF SCIENCES, ENGINEERING, AND MEDICINE
WWW.NATIONALACADEMIES.ORG

BRAZILIAN ACADEMY OF SCIENCES
WWW.ABC.ORG.BR

 opcwonline
 opcw
 opcw_st
 opcwonline

 iupac

 nationalacademies
 thenasem

   abciencias
 academiabrasciencias

es and
se
r 2016





Innovation is Both New Technologies and Repurposing of Existing Technologies

UPmove™



UP2™

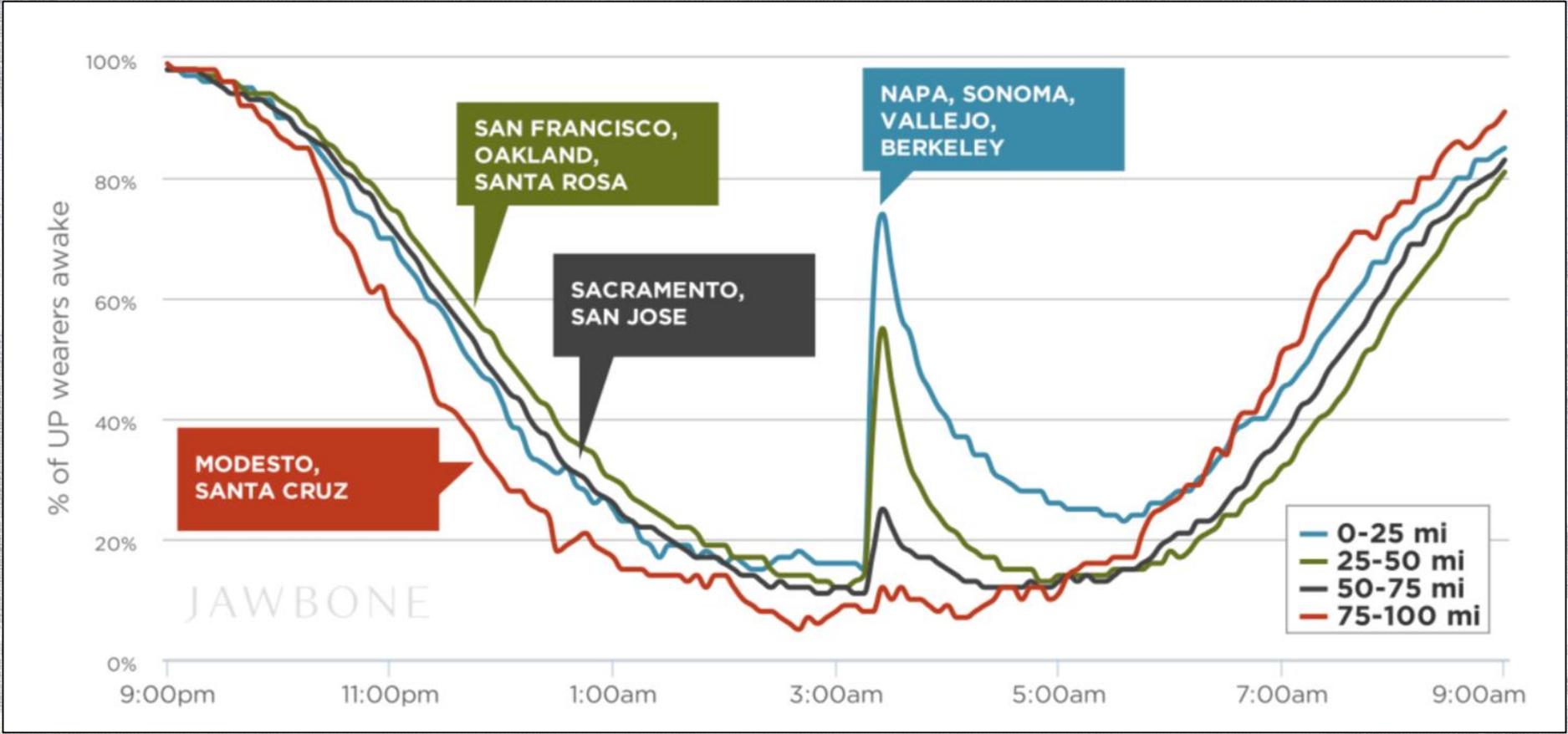


UP3™





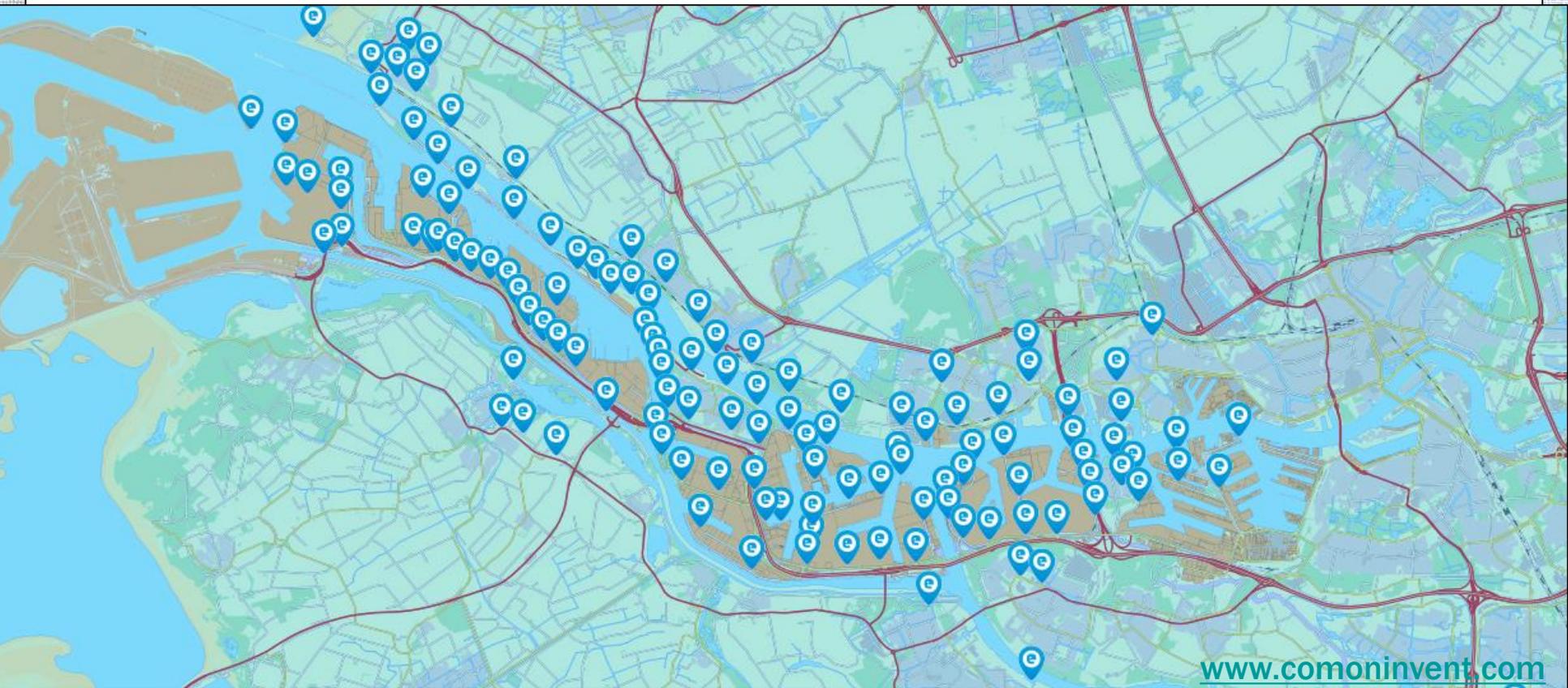
Innovation is Both New Technologies and Repurposing of Existing Technologies





OPCW

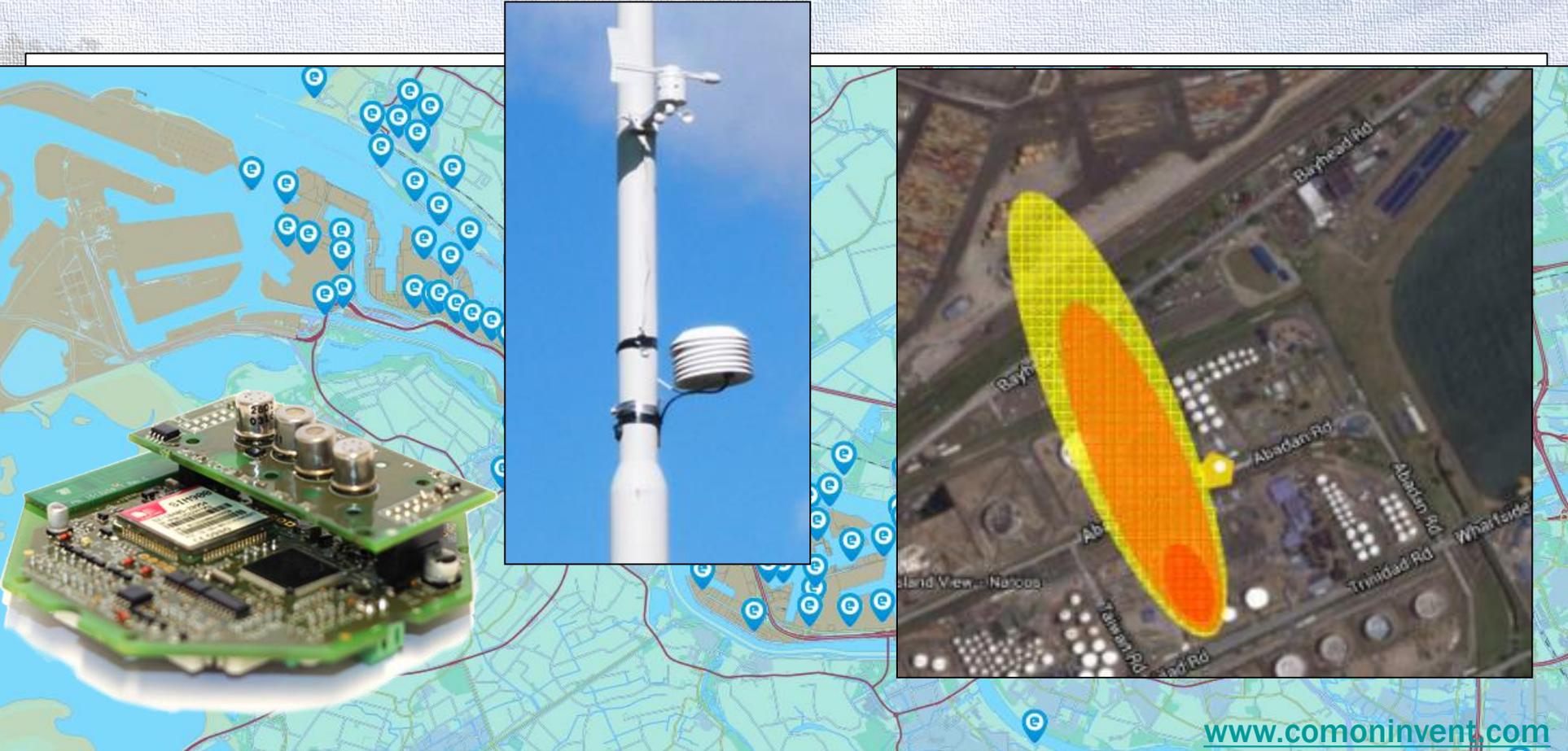
Innovation is Both New Technologies and Repurposing of Existing Technologies





OPCW

Innovation is Both New Technologies and Repurposing of Existing Technologies



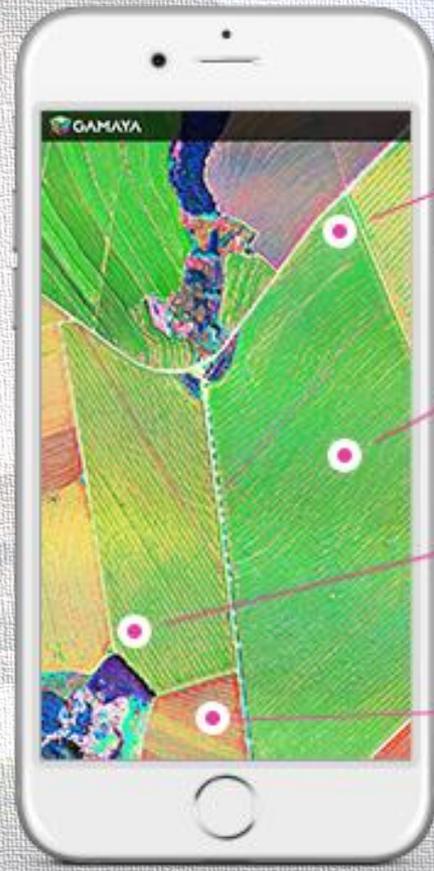


OPCW

The Value is the Data



Data Collection and Integration: The Case of Agriculture



healthy crop



stressed crop



weeds



nutrient deficiency



Data Collection and Integration: The Case of Agriculture

Effects of plant diseases

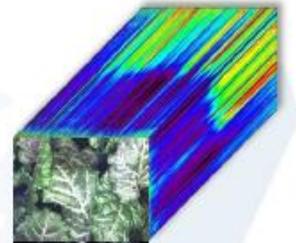
- Changes in the **pigment content**
- Changes in the **water content**
- Accumulation/degradation of **metabolites**
- Changes in the **cell/leaf structure**
- Accumulation of **fungal biomass**
- Changes in the **source-sink relation**

Visible and Indicative Indicators (On-Site Analysis)



Molecular Indicators (Off-Site Analysis)

Physiological and metabolic parameters influence the spectral signature of plants





OPCW

If Plants Could Talk...



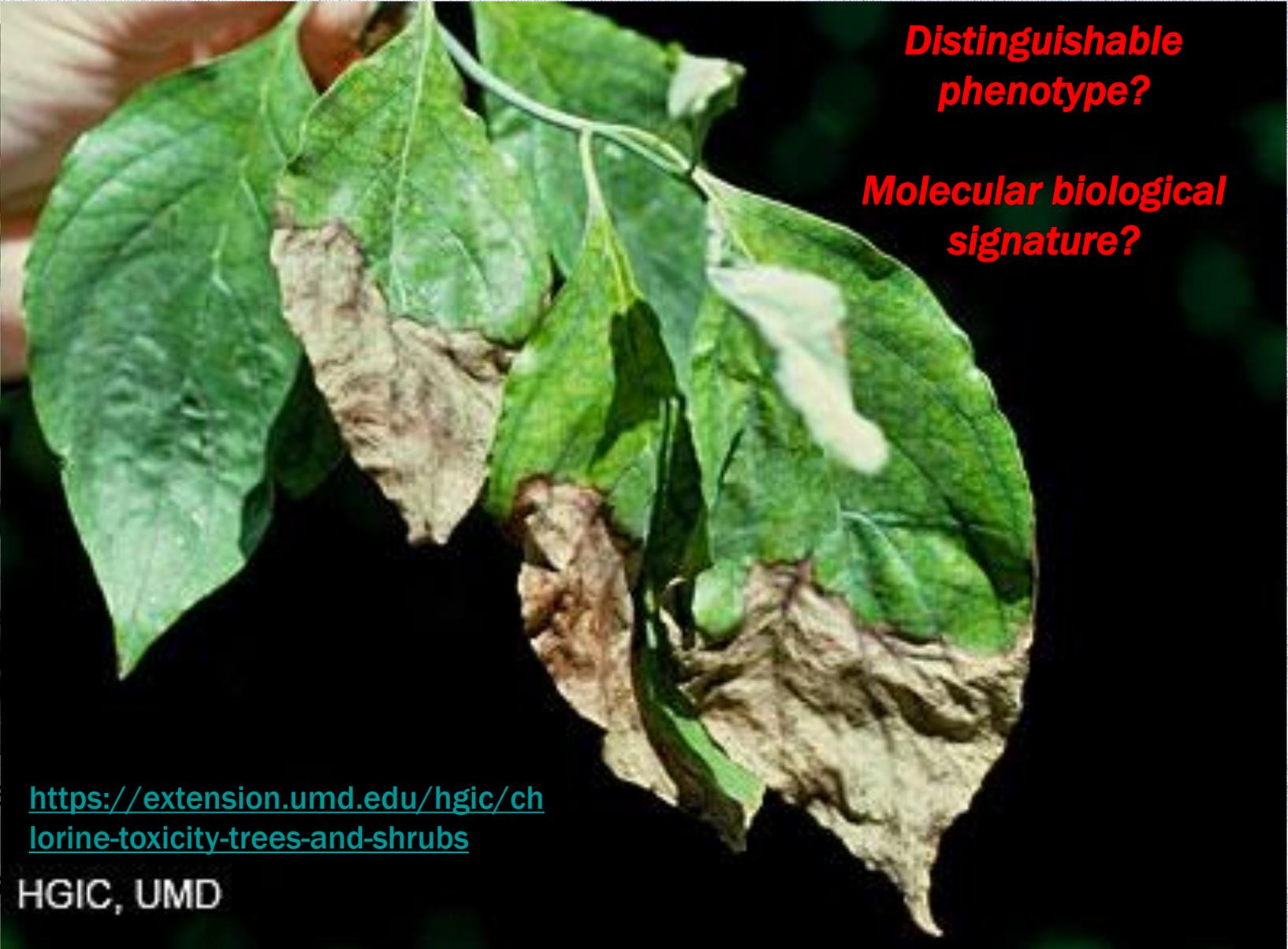
“The signs are that the bombs were made with the windows open but the net curtains taped to the walls to avoid being seen. The fumes had killed off the tops of plants just outside the windows”

- Report of the Official Account of the Bombings in London on 7th July 2005



OPCW

If Plants Could Talk...



**Distinguishable
phenotype?**

**Molecular biological
signature?**

“The
cort
tops
- Rep

<https://extension.umd.edu/hgic/chlorine-toxicity-trees-and-shrubs>

HGIC, UMD



OPCW

Presentation by Dr Christopher Timperley

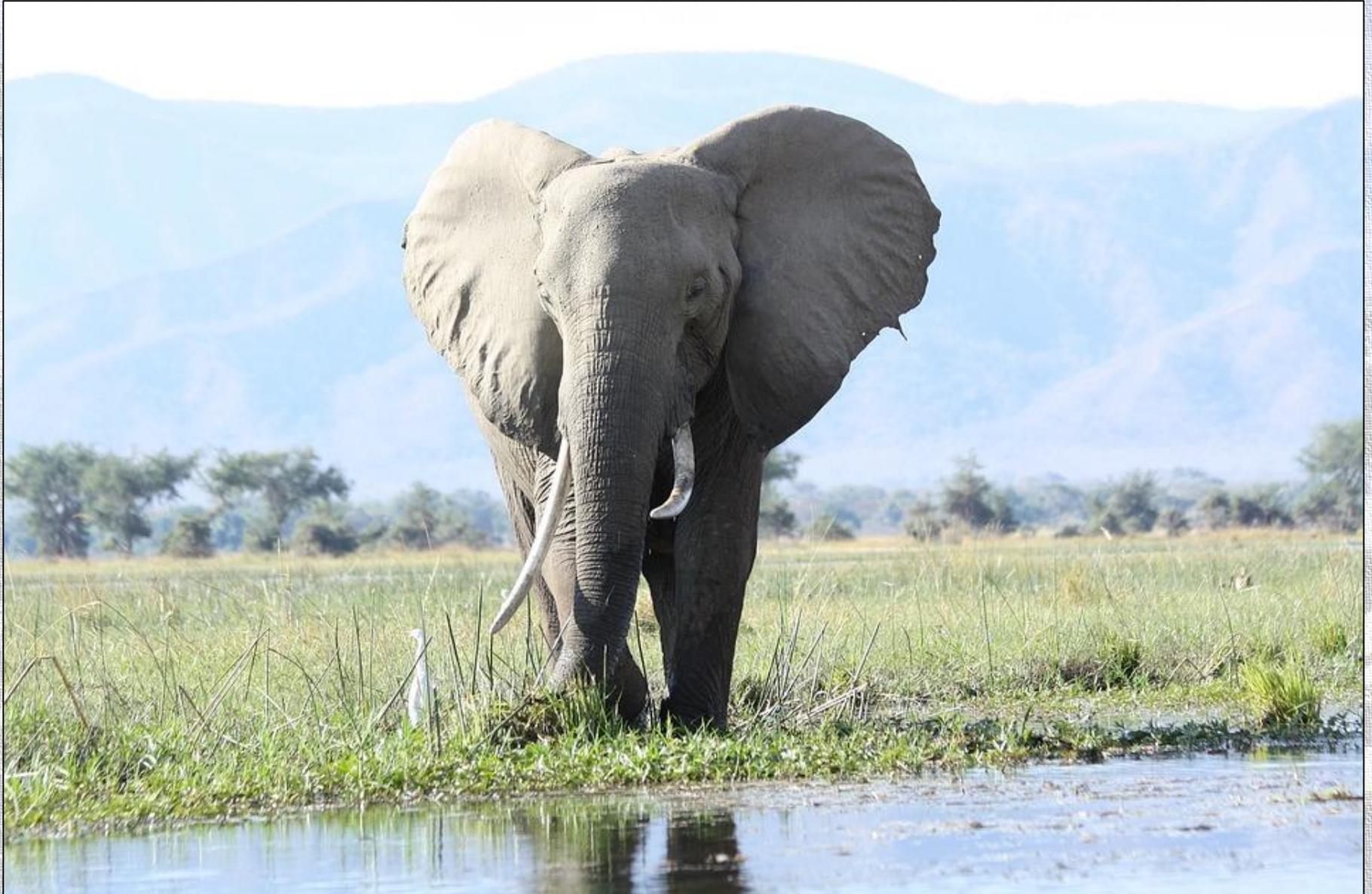
Chairperson OPCW SAB





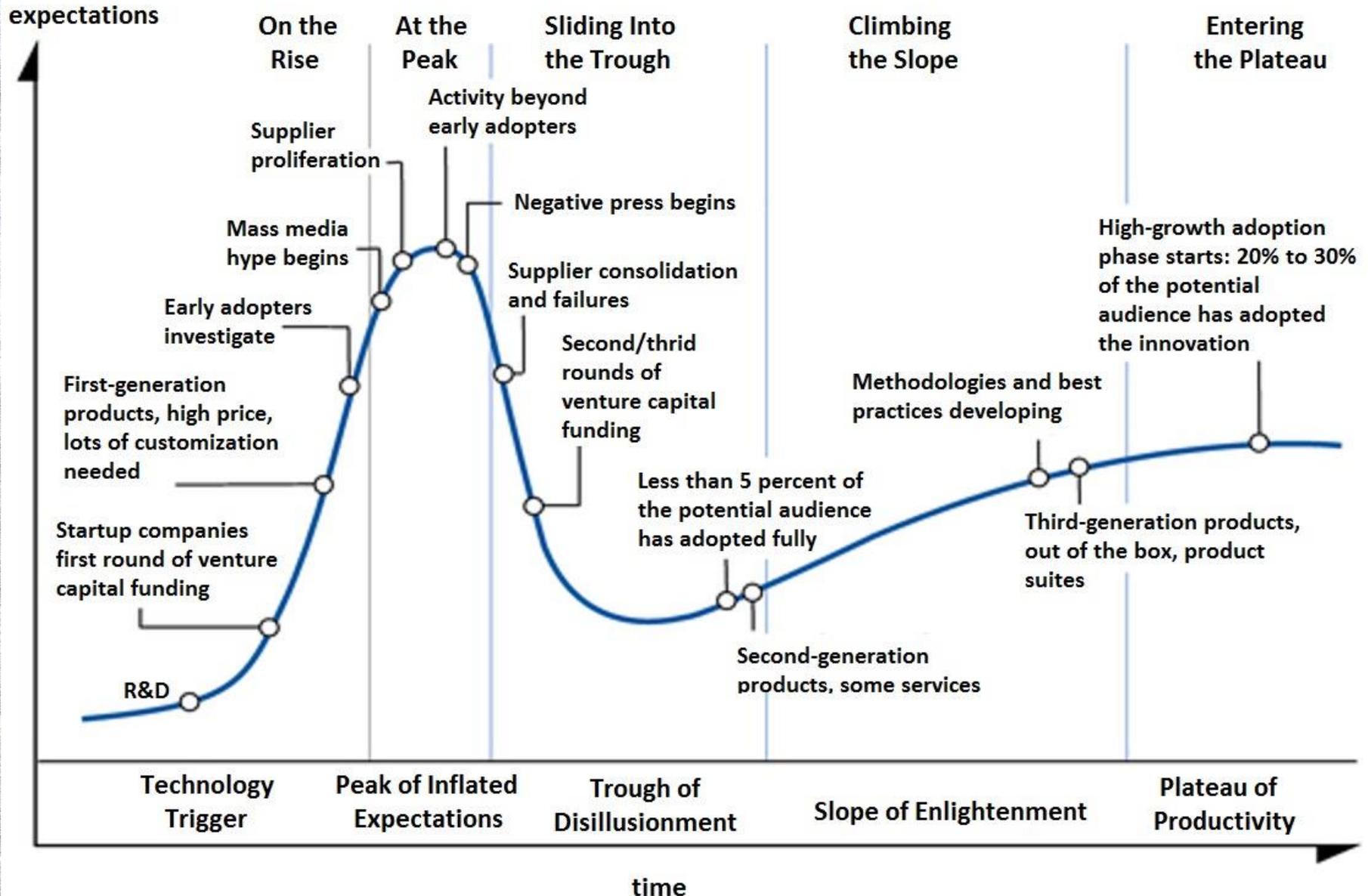
OPCW

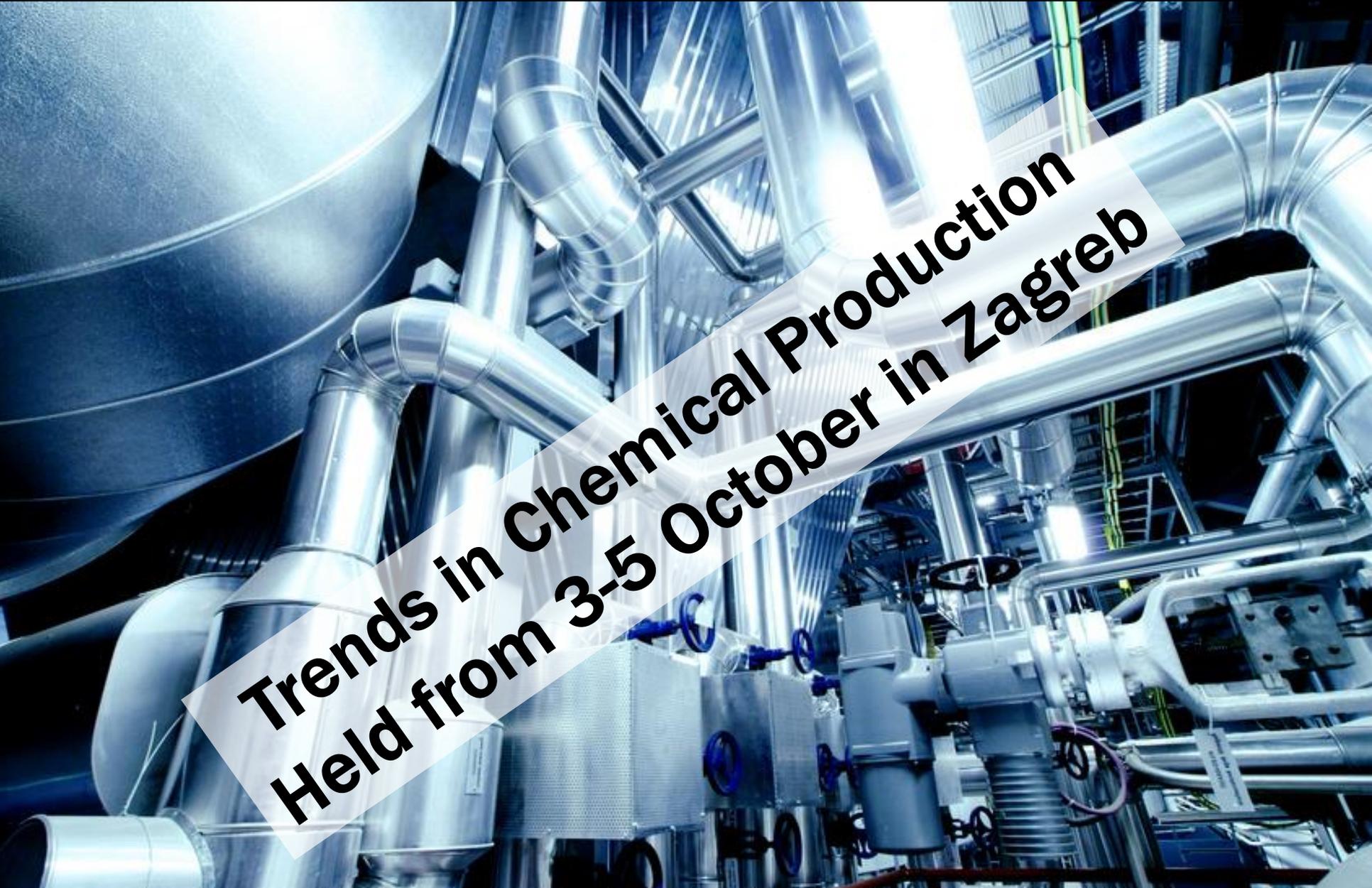
At the End of the Day: Science Advice Must be Practical





At the End of the Day: Science Advice Must be Practical



A photograph of a complex industrial chemical plant with numerous large, shiny metal pipes, valves, and tanks, set against a blue-tinted background.

**Trends in Chemical Production
Held from 3-5 October in Zagreb**

OPCW Scientific Advisory Board Briefing to States Parties



OPCW

1997-**20**17
YEARS

Thursday, 19 October 2017

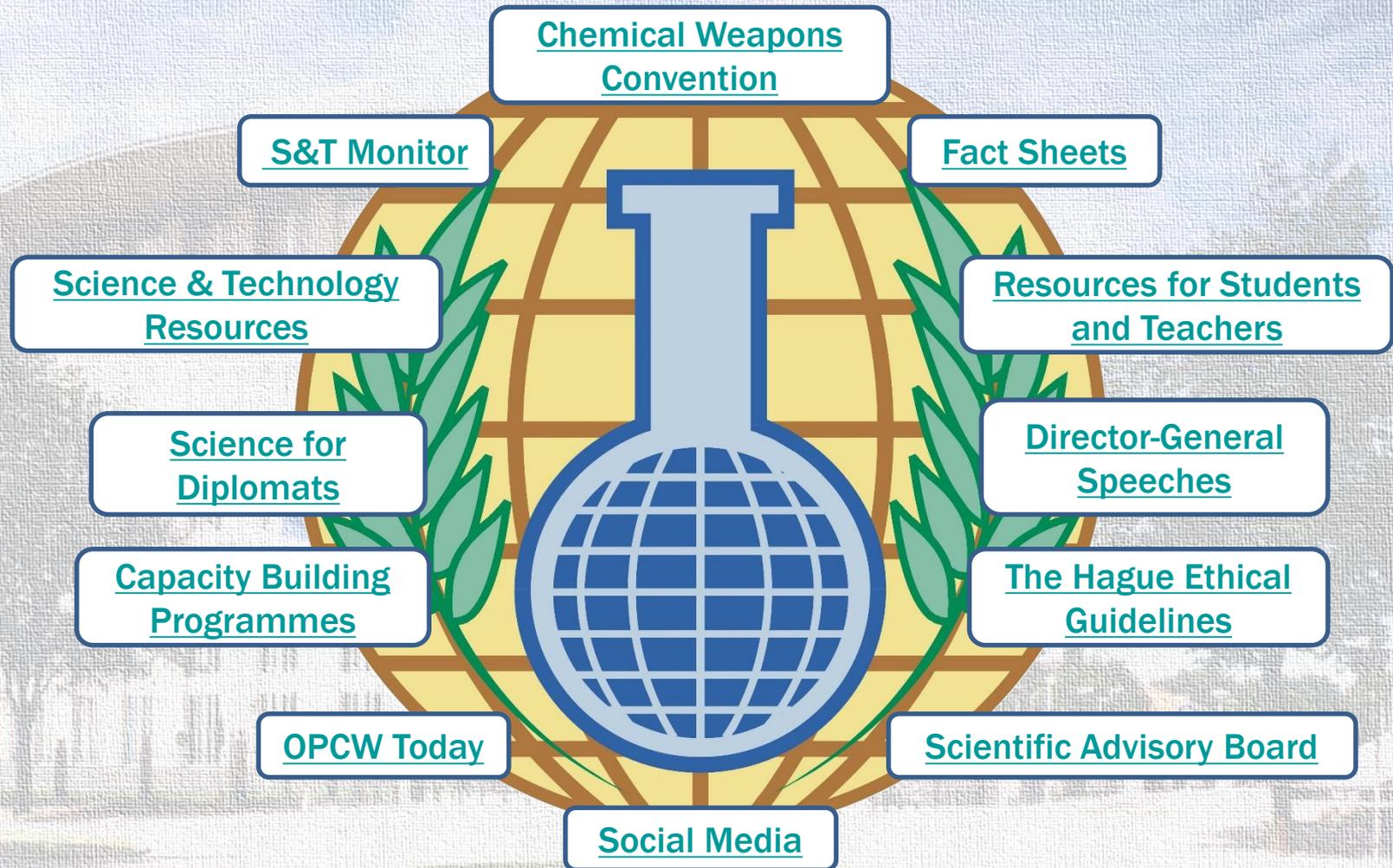
leper Room | 13:30-15:00

Light lunch served at 13:00



OPCW

OPCW Science and Technology Resources





OPCW

OPCW Science and Technology Resources

The OPCW Science & Technology Monitor
Volume 3 Number 3
A sampling of Science & Technology Relevant to the Chemical Weapons Convention
6 July 2016

In this Issue

- Welcome**
Welcome to the OPCW Science and Technology Monitor, an occasional bulletin providing updates on developments in science and technology across a broad spectrum of topics relevant to the CWC. For news and more, see the [Science and Technology section of the OPCW website](#).
- Medicines, Drugs and Pharmaceuticals: CBRN Acting Chemicals**
- Artificial Intelligence**
- The S&T Puzzle**
- SAB, ABFO and OPCW Day reports**

[Send 1](#)
[Send 2](#)
[Send 3](#)
[Send 4](#)
[Send 5](#)

Science for Diplomats at the OPCW 2014 - 2015

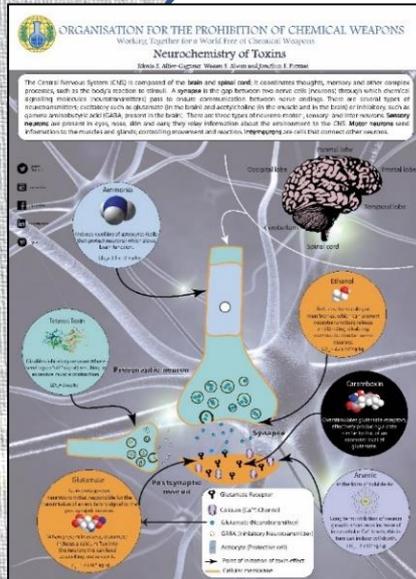
ORGANISATION FOR THE PROHIBITION OF CHEMICAL WEAPONS

Applying the norms of the practice of chemistry to support the Chemical Weapons Convention

THE HAGUE ETHICAL GUIDELINES

ORGANISATION FOR THE PROHIBITION OF CHEMICAL WEAPONS

[@OPCW /OPCW-ST](#)
[/OPCWONLINE](#)
[/OPCWONLINE](#)
[/OPCW/COMPANY](#)
[/OPCW](#)



or
ts
iding
es

PCW Today

Social Media

VERIFICATION

REPORT OF THE SCIENTIFIC ADVISORY BOARD'S TEMPORARY WORKING GROUP

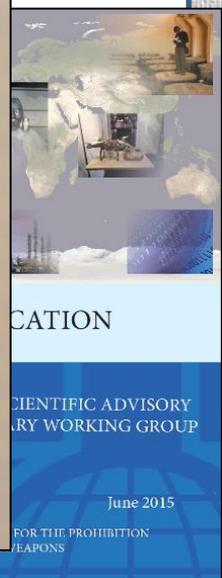
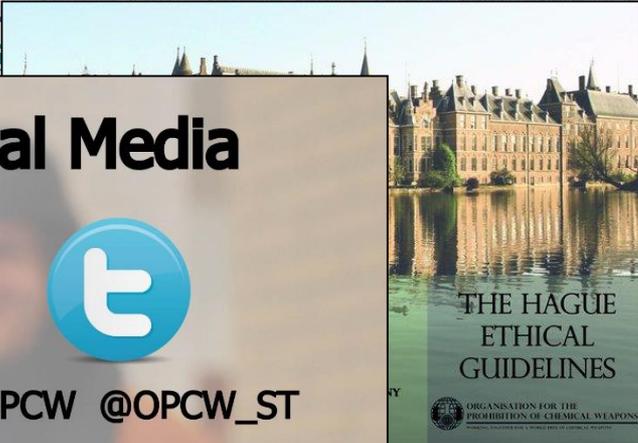
June 2015

ORGANISATION FOR THE PROHIBITION OF CHEMICAL WEAPONS

OPCW Science and Technology Resources



apons



Connect with OPCW Social Media



/OPCWONLINE



@OPCW @OPCW_ST



/OPCW



/OPCW



/COMPANY/OPCW



/OPCWONLINE



/OPCW