

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

0oms Room 13:30-14:45

LIGHT LUNCH AVAILABLE AT 13:00



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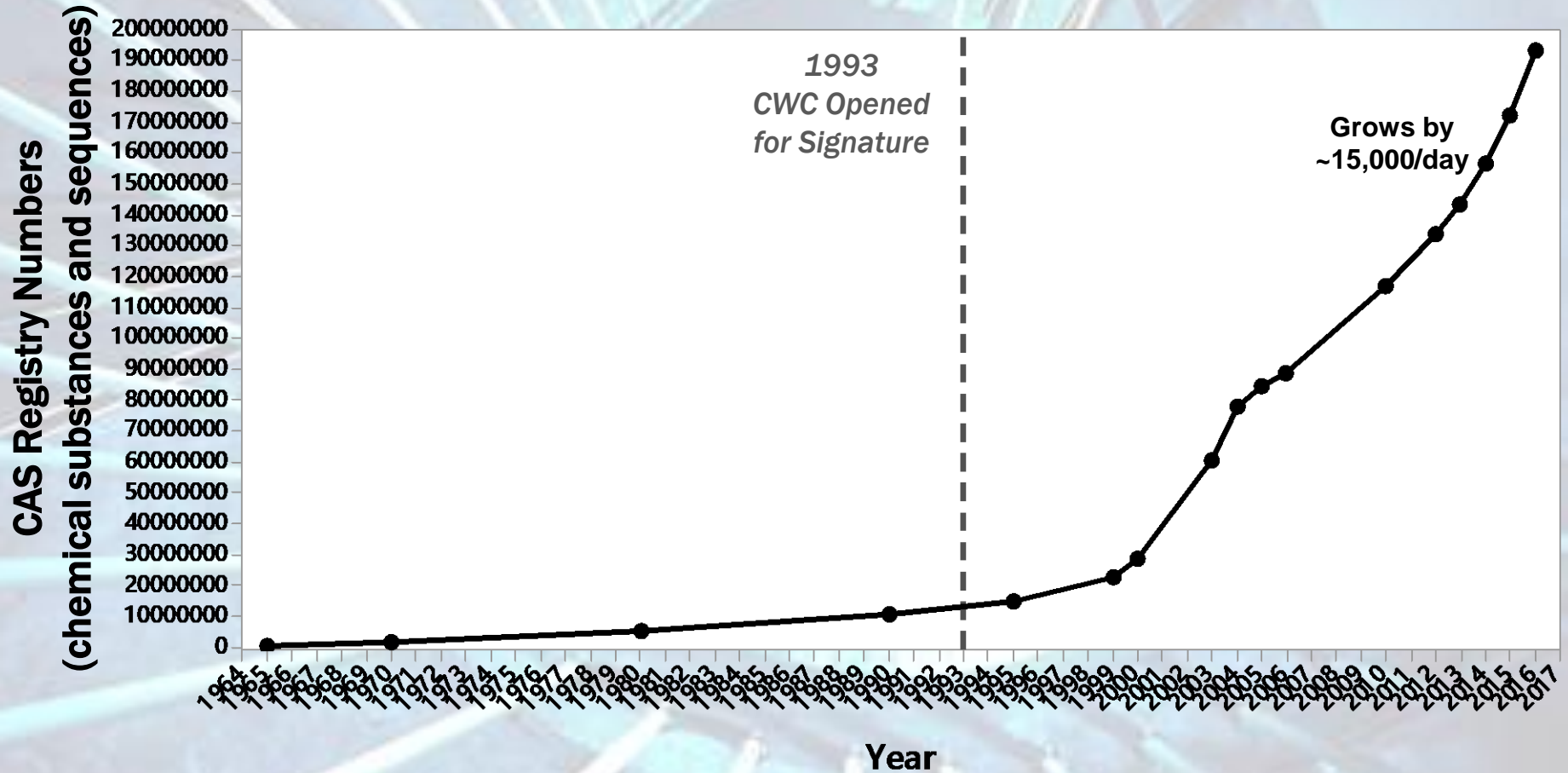
1997-**20**17
YEARS





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Understanding the Impact of Science on Security is a Challenge

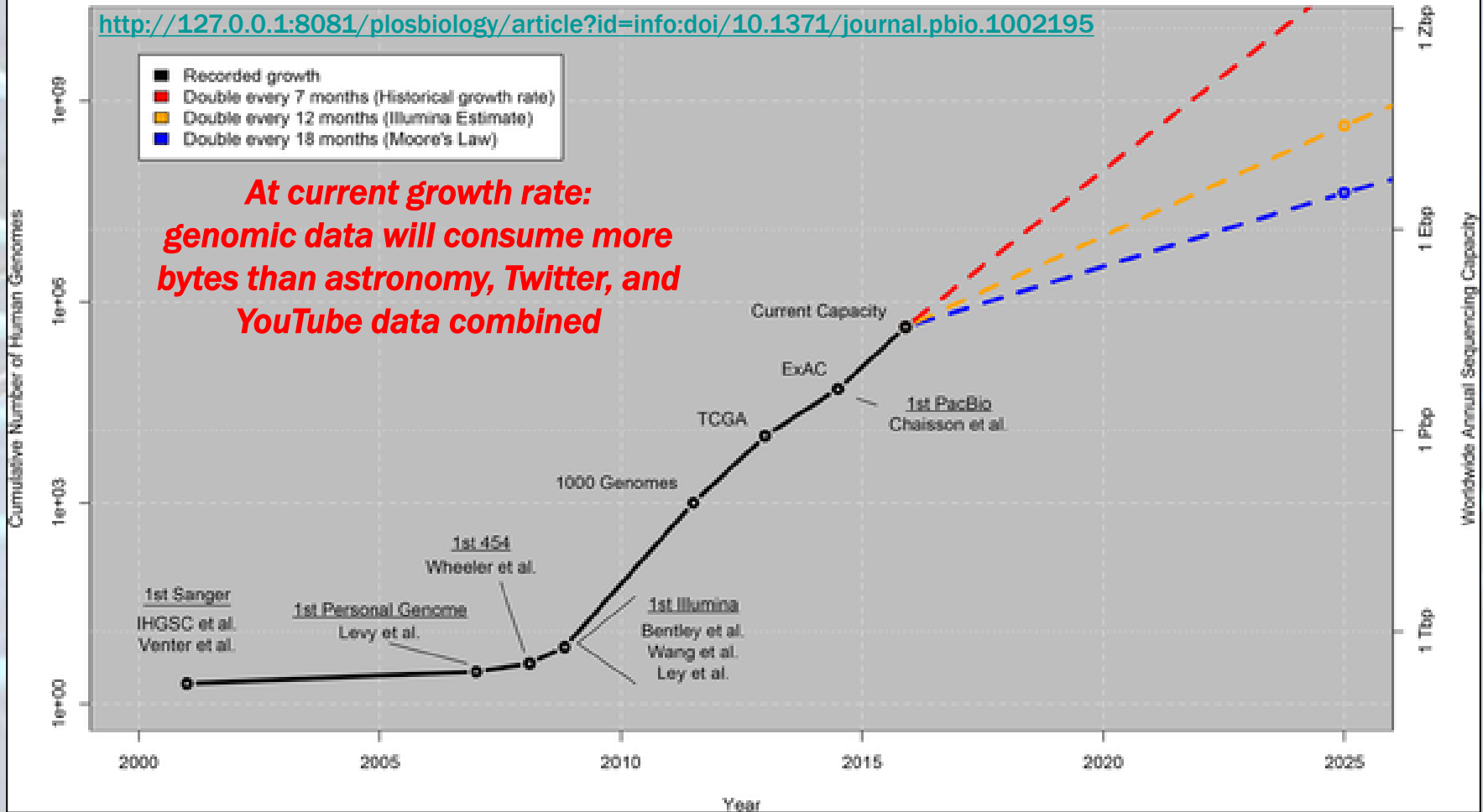




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Understanding the Impact of Science on Security is a Challenge

Growth of DNA Sequencing









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Understanding the Impact of Science on Security is a Challenge

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	WEIGHT OF DNA NEEDED TO STORE WORLD'S DATA  ~1 kg
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	

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

©nature



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Understanding the Impact of Science on Security is a Challenge



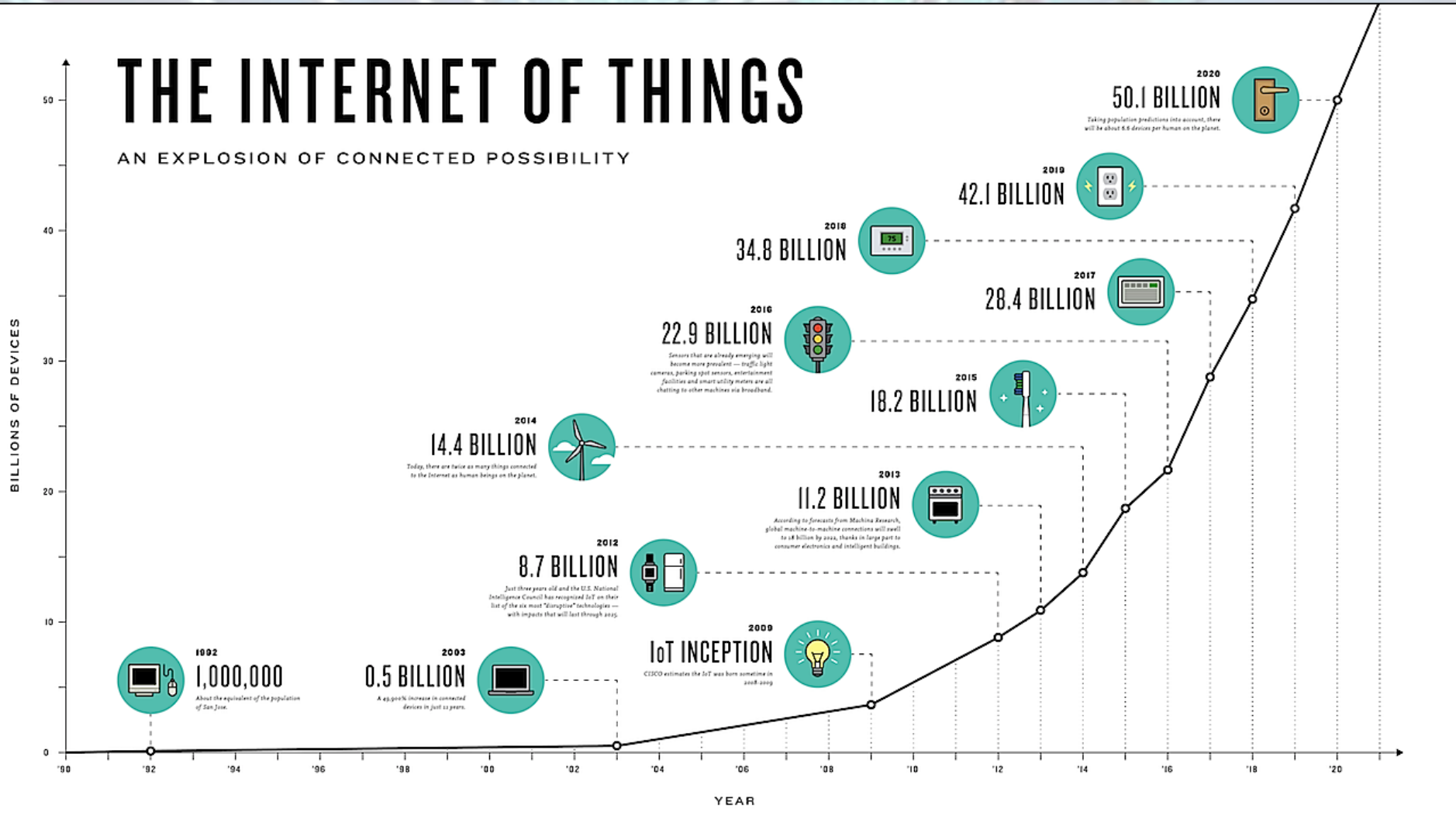


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Understanding the Impact of Science on Security is a Challenge

THE INTERNET OF THINGS

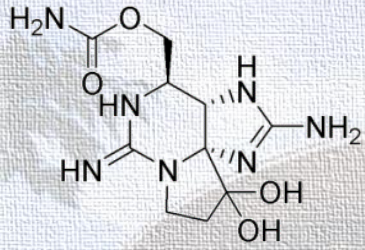
AN EXPLOSION OF CONNECTED POSSIBILITY





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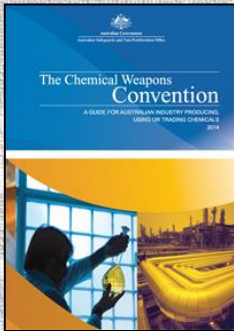
Without Sound Scientific and Technological Capacity There is No Treaty Implementation



Article II



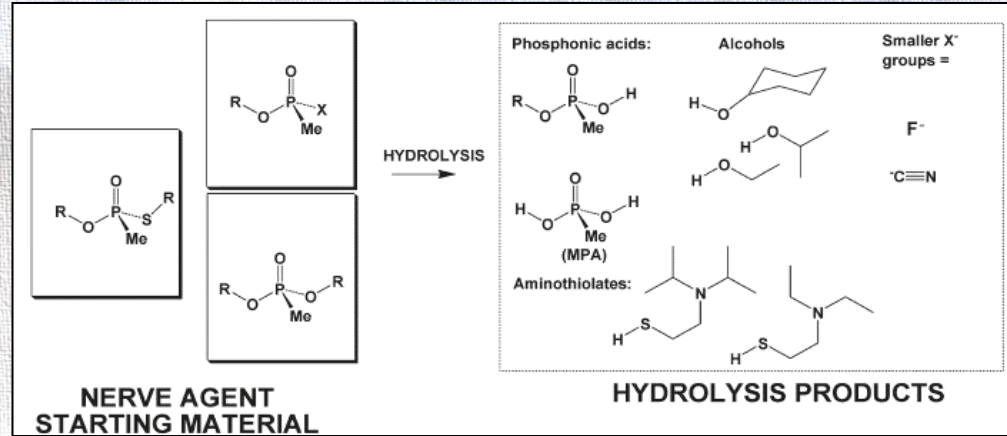
Article VI



Article VII



Article III



Articles IV and V



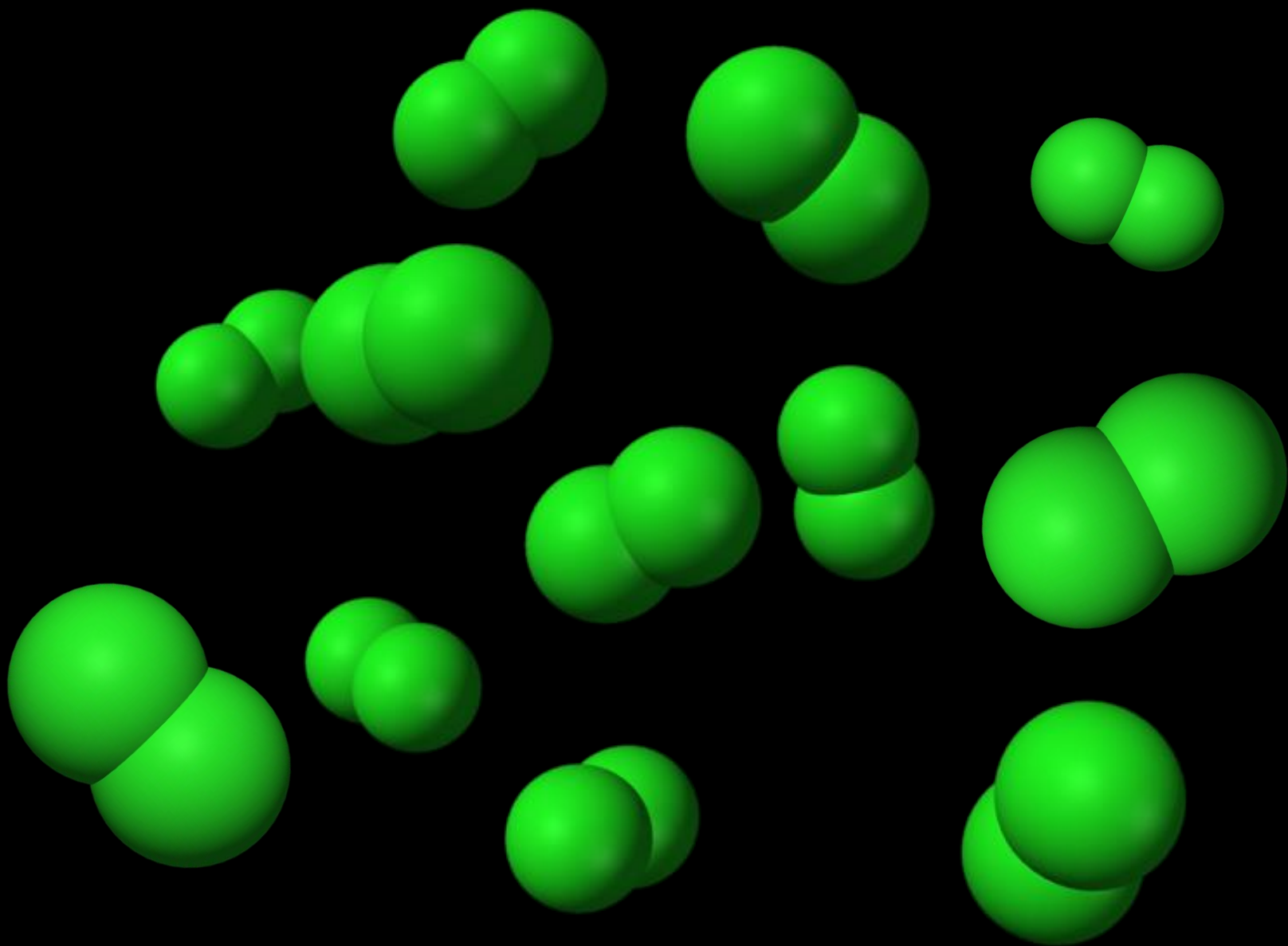
Article VIII



Articles IX and X



Article XI





Chemical analysis to verify chlorine gas exposure?



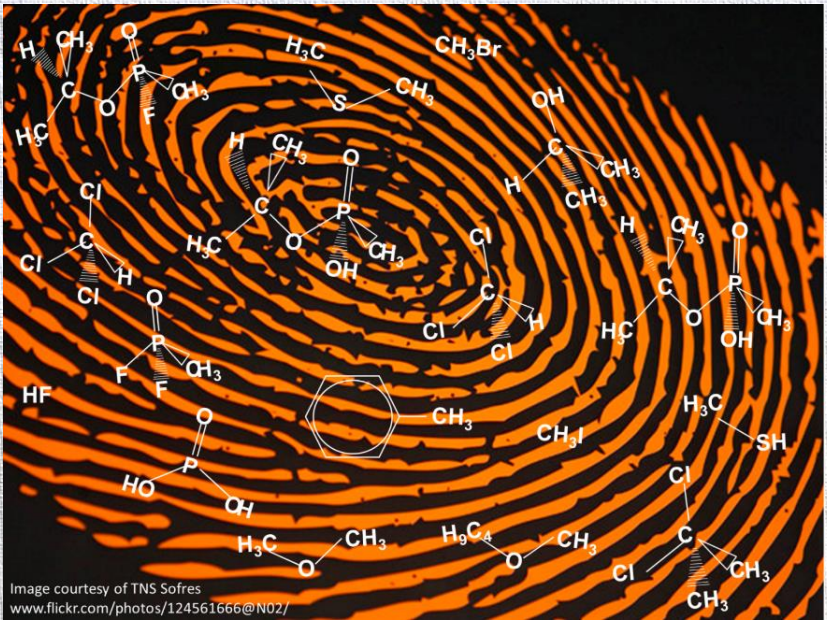
December 2018: A Time to Review

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



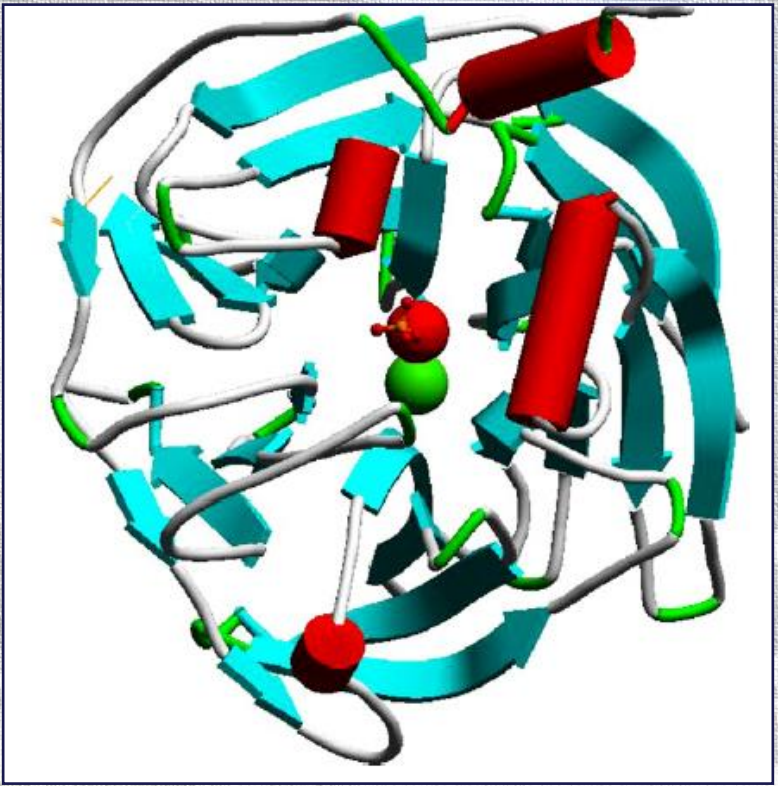


Workshops to Inform SAB Report



**Chemical Forensics
Helsinki, Finland
June 2016**

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





Workshops to Inform SAB Report



1997-2017



The National Academies of SCIENCES ENGINEERING MEDICINE



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

INTERNATIONAL WORKSHOP ON INNOVATIVE TECHNOLOGIES FOR CHEMICAL SECURITY

Science for Peace
#ScienceforPeace



1997-2017



The National Academies of SCIENCES ENGINEERING MEDICINE



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

- opcwonline
- opcw
- opcw_st
- opcwonline

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

- iupac

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

- nationalacademies
- thenasem

BRAZILIAN ACADEMY OF SCIENCES
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Innovation is Both New Technologies and Repurposing of Existing Technologies

UPmove™



UP2™

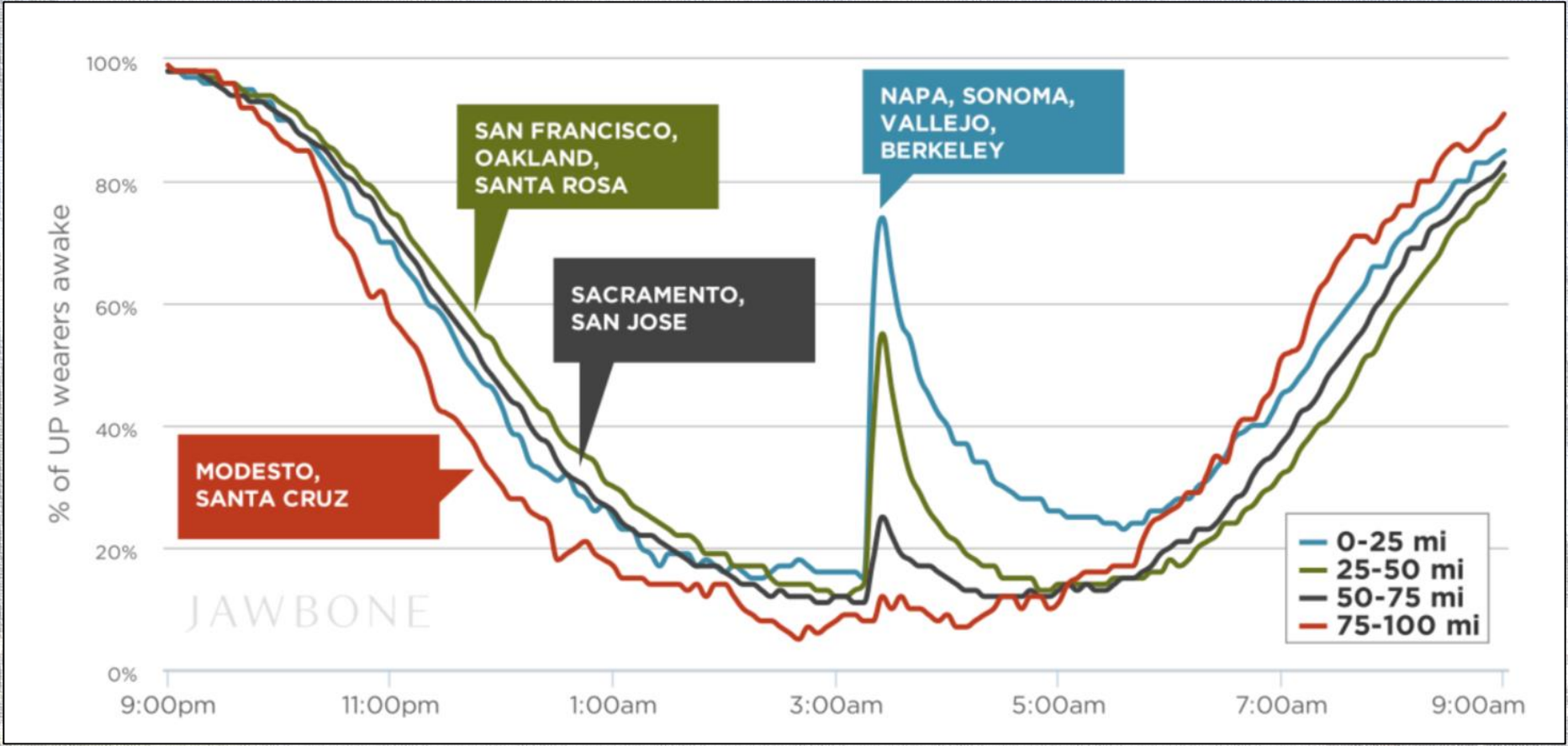


UP3™





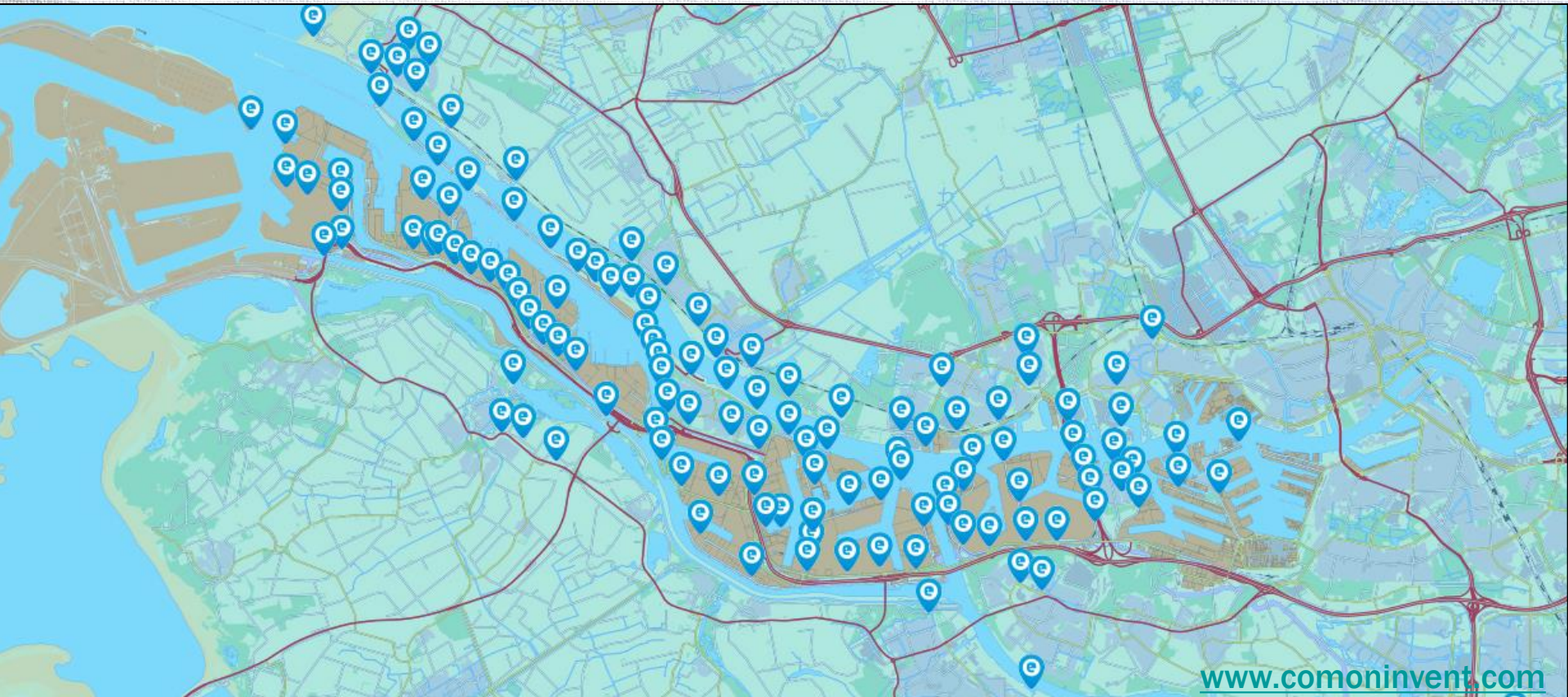
Innovation is Both New Technologies and Repurposing of Existing Technologies





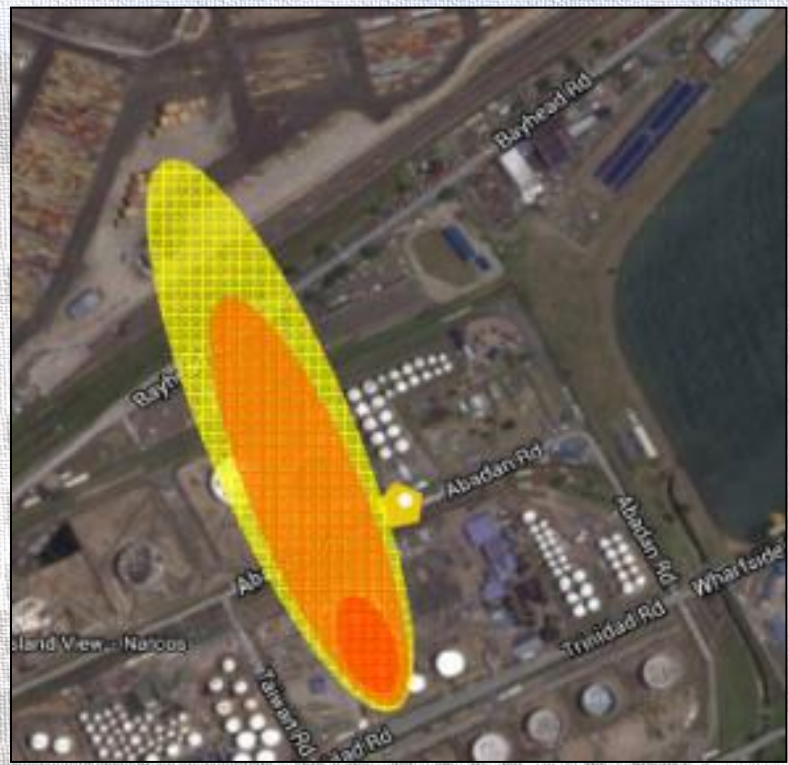
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Innovation is Both New Technologies and Repurposing of Existing Technologies





Innovation is Both New Technologies and Repurposing of Existing Technologies



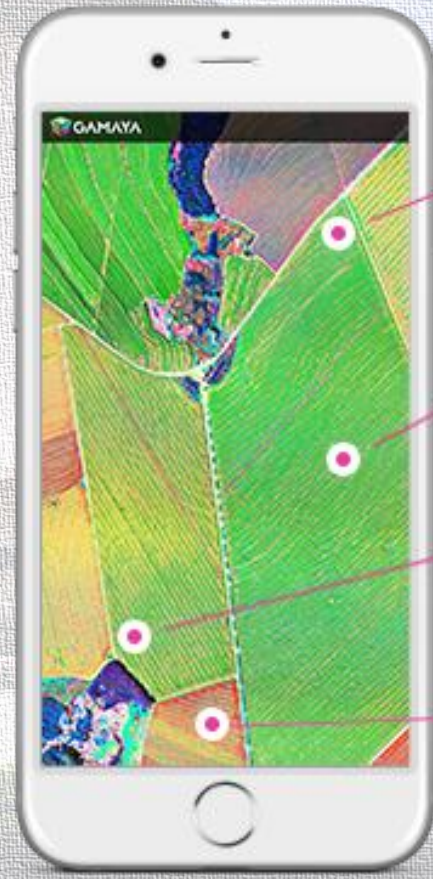


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The Value is the Data



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**

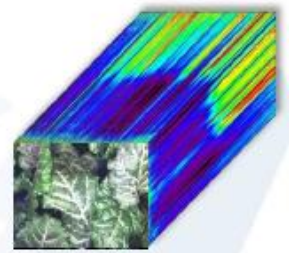
Visible and Indicative Indicators (On-Site Analysis)



Molecular Indicators (Off-Site Analysis)



Physiological and metabolic parameters influence the spectral signature of plants





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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



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If Plants Could Talk...

**Distinguishable
phenotype?**

**Molecular biological
signature?**



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

HGIC, UMD



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

