

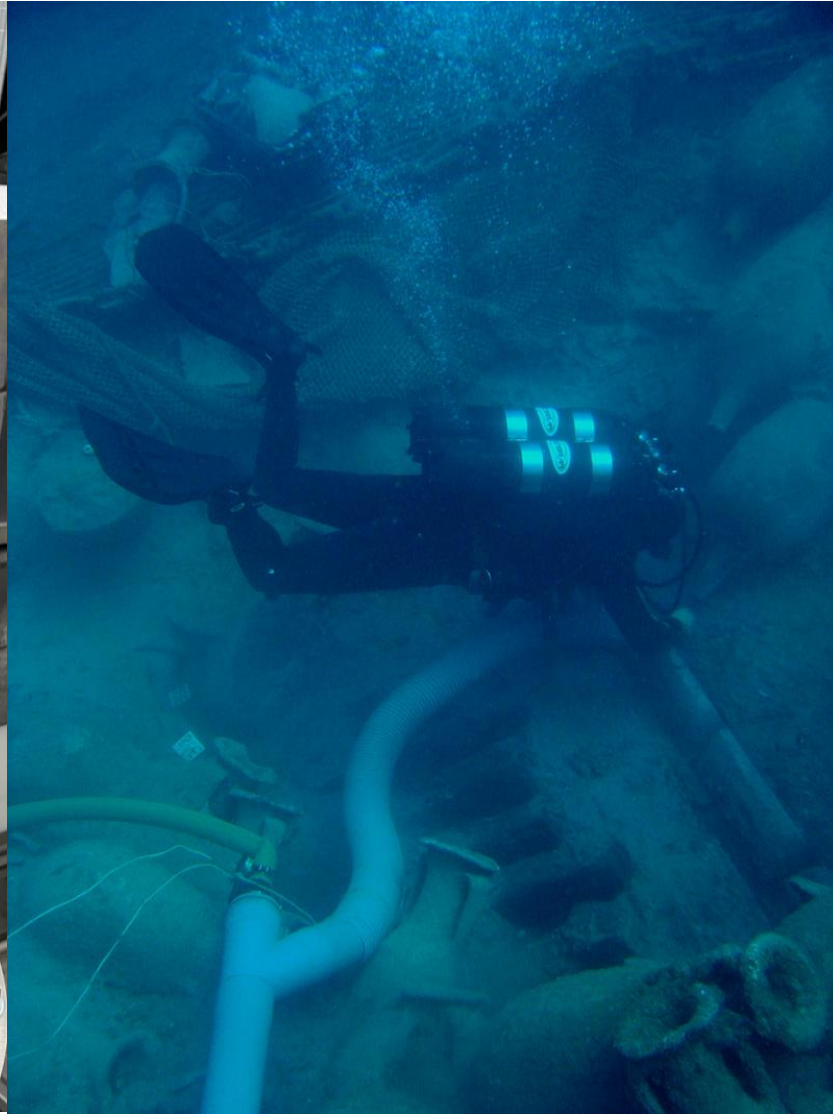
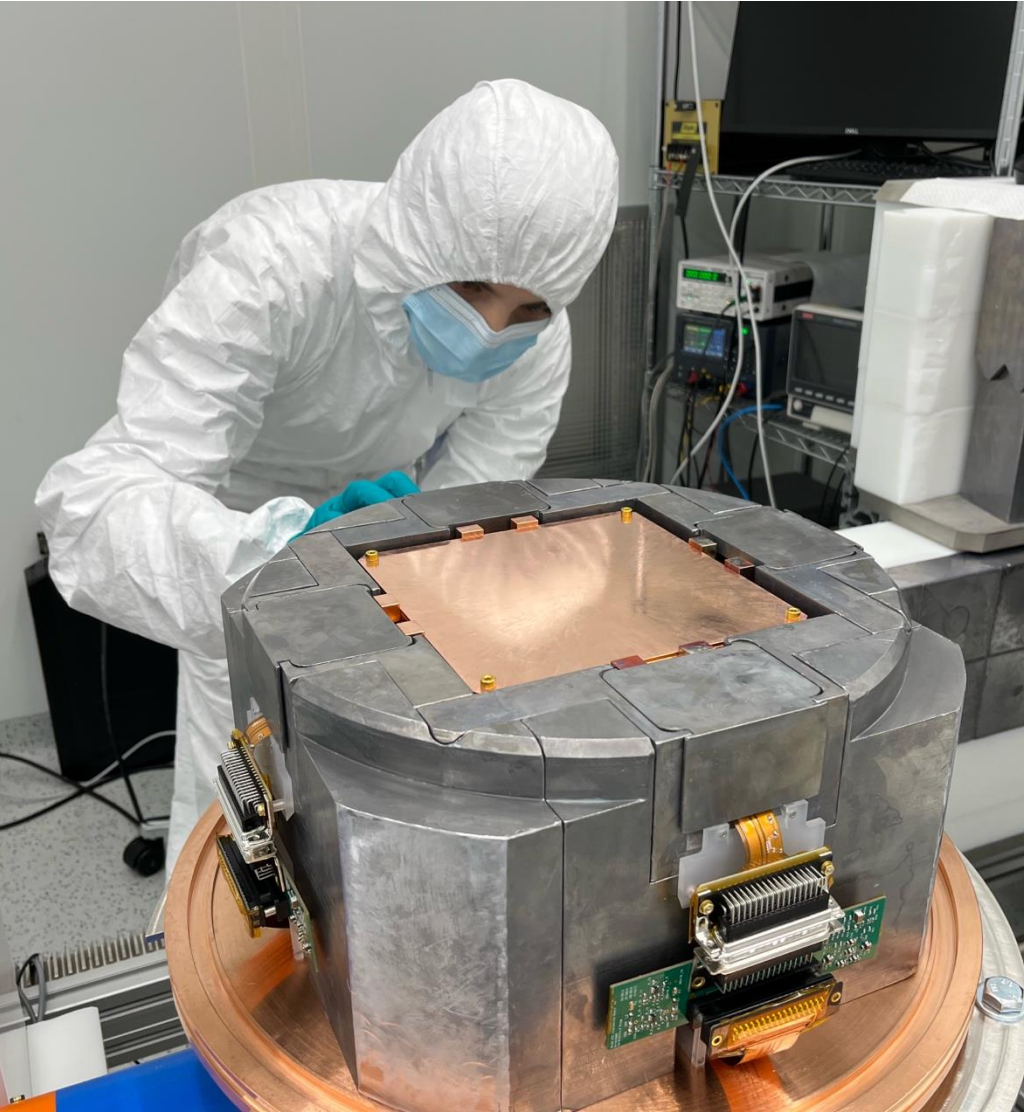
PlomBOX

Lead poisoning in drinking water

Xavier Bertou

(for the PlomBOX collaboration)

Lead 210 and Dark Matter



Lead is toxic

to multiple body systems, such as our central nervous system and brain; reproductive system; kidneys, cardiovascular system, blood and immune system.

Lead exposure is especially dangerous to children's developing brains and can result in



Reduced intelligence quotient (IQ) and attention span



Impaired learning ability



Increased risk of behavioral problems

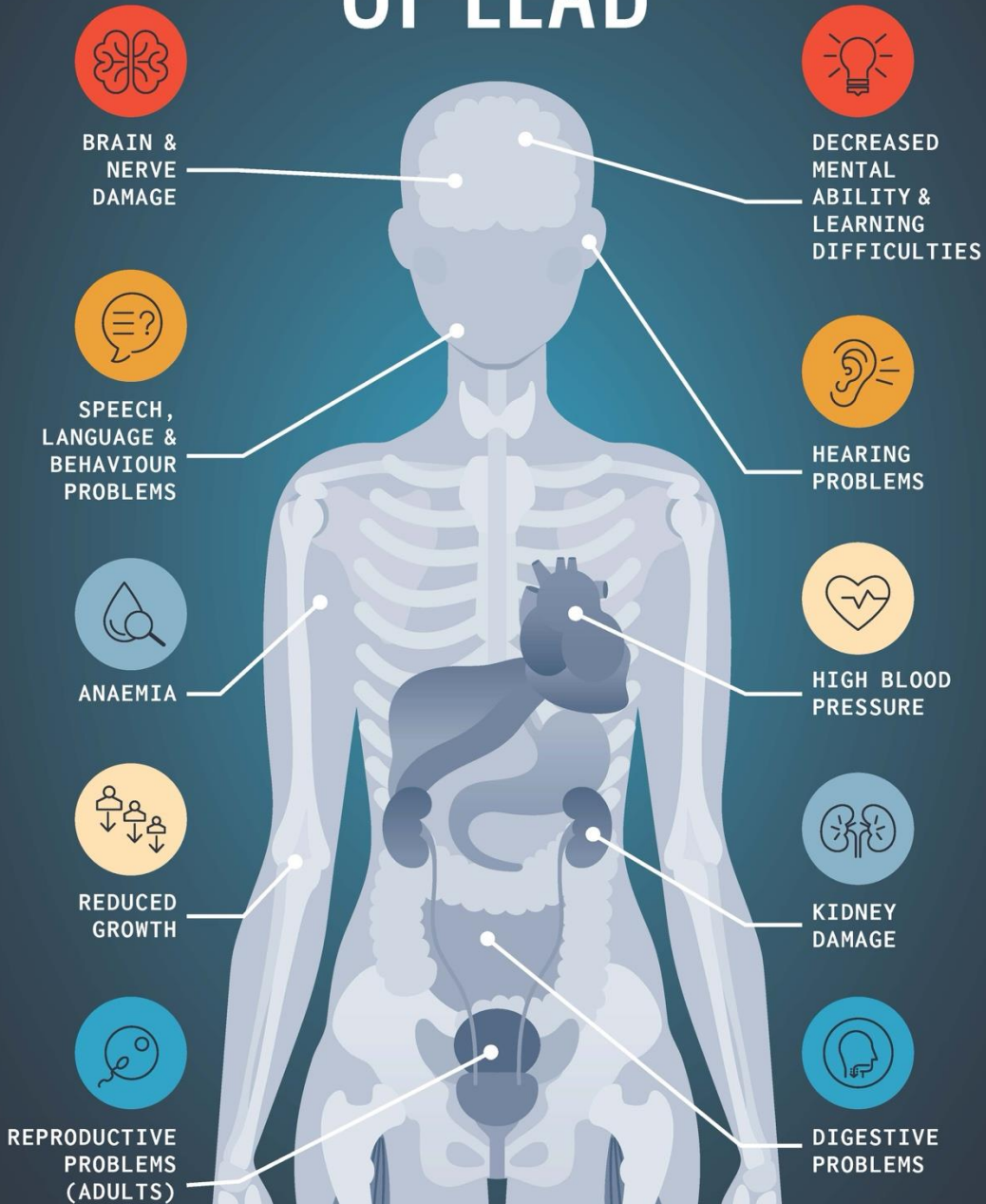


World Health Organization



BAN LEAD PAINT

THE TOXIC EFFECTS OF LEAD

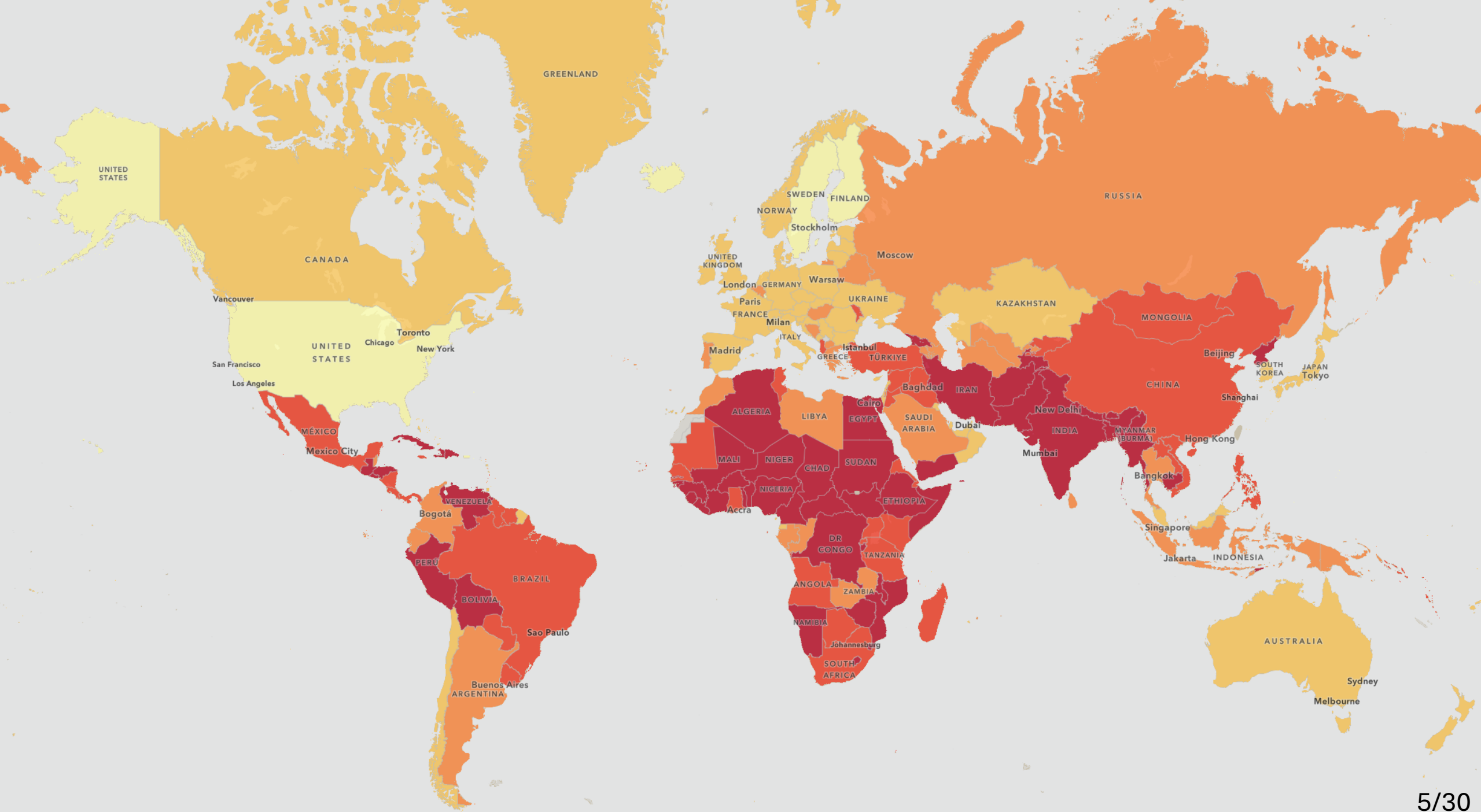


LEAD EXPOSURE CAN OCCUR THROUGH...

#BanLeadPaint



There is no safe level of lead exposure



Lead contamination

10 years after Flint, the fight to replace lead pipes across the U.S. continues

APRIL 26, 2024 · 3:00 AM ET

By Emily Kwong, Pien Huang, Rachel Carlson, Rebecca Ramirez

 13-Minute Listen

[+ PLAYLIST](#)



RÉOUVERTURE PLOMBÉE

« Reconstruire Notre-Dame de Paris avec du plomb, de la splendeur au désastre »

Par Annie Thébaud-Mony



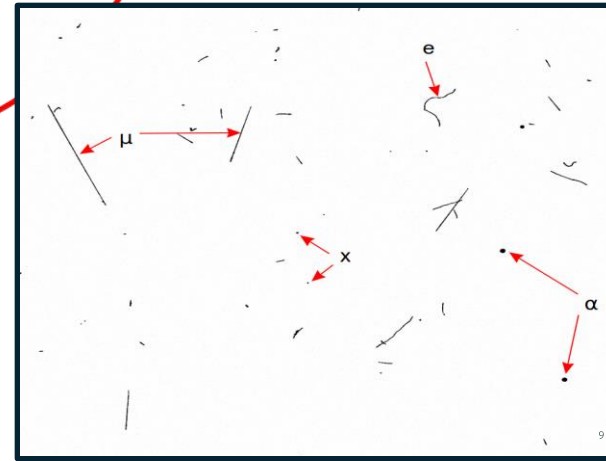
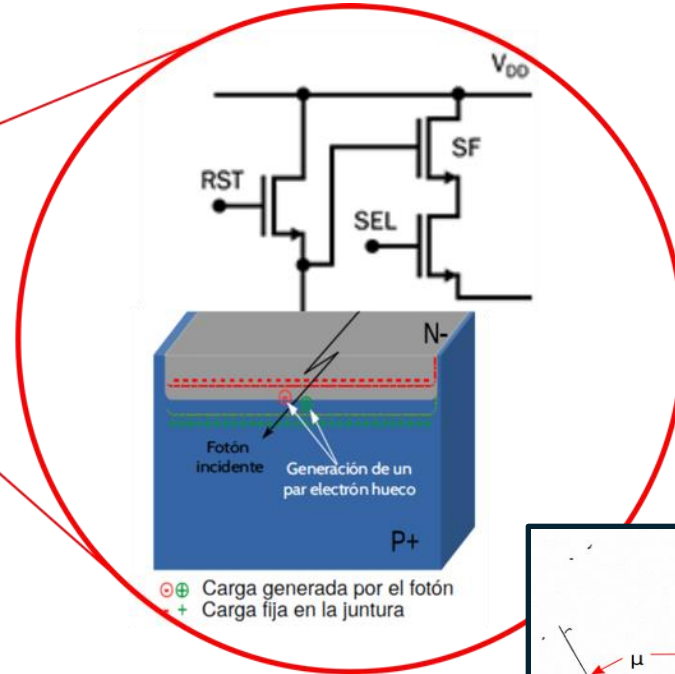
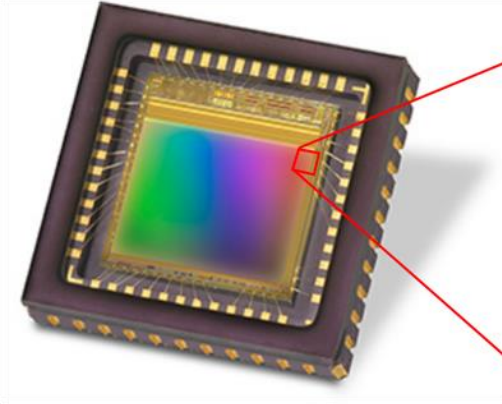
The Flint River water starts flowing to Flint, Mich. on April 25, 2014. Without corrosion control, lead leached from the pipes.

Brett Carlsen/Getty Images

Lead controlled at production

- Lead (and other contaminants) tested at water production plants (at least in developed countries)
- Contamination can however come during water transport, or at home
 - In France, buildings older than 1950 may have lead in their pipe system
- Testing usually done in laboratories
 - Can be expensive, and even if free it is a tedious process
- Ideally, one would like to take a picture of a glass of water with a phone and know if it is drinkable or not...

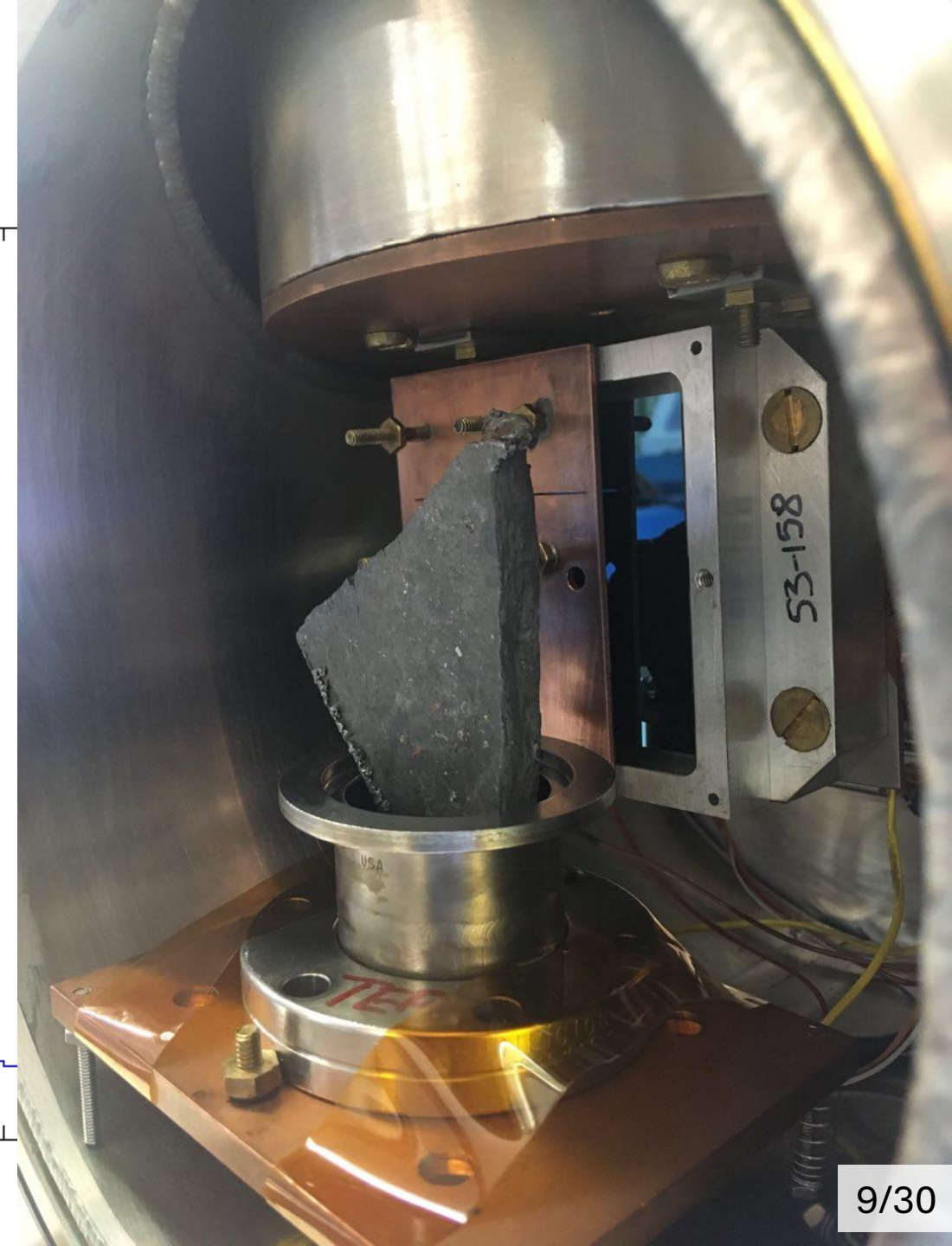
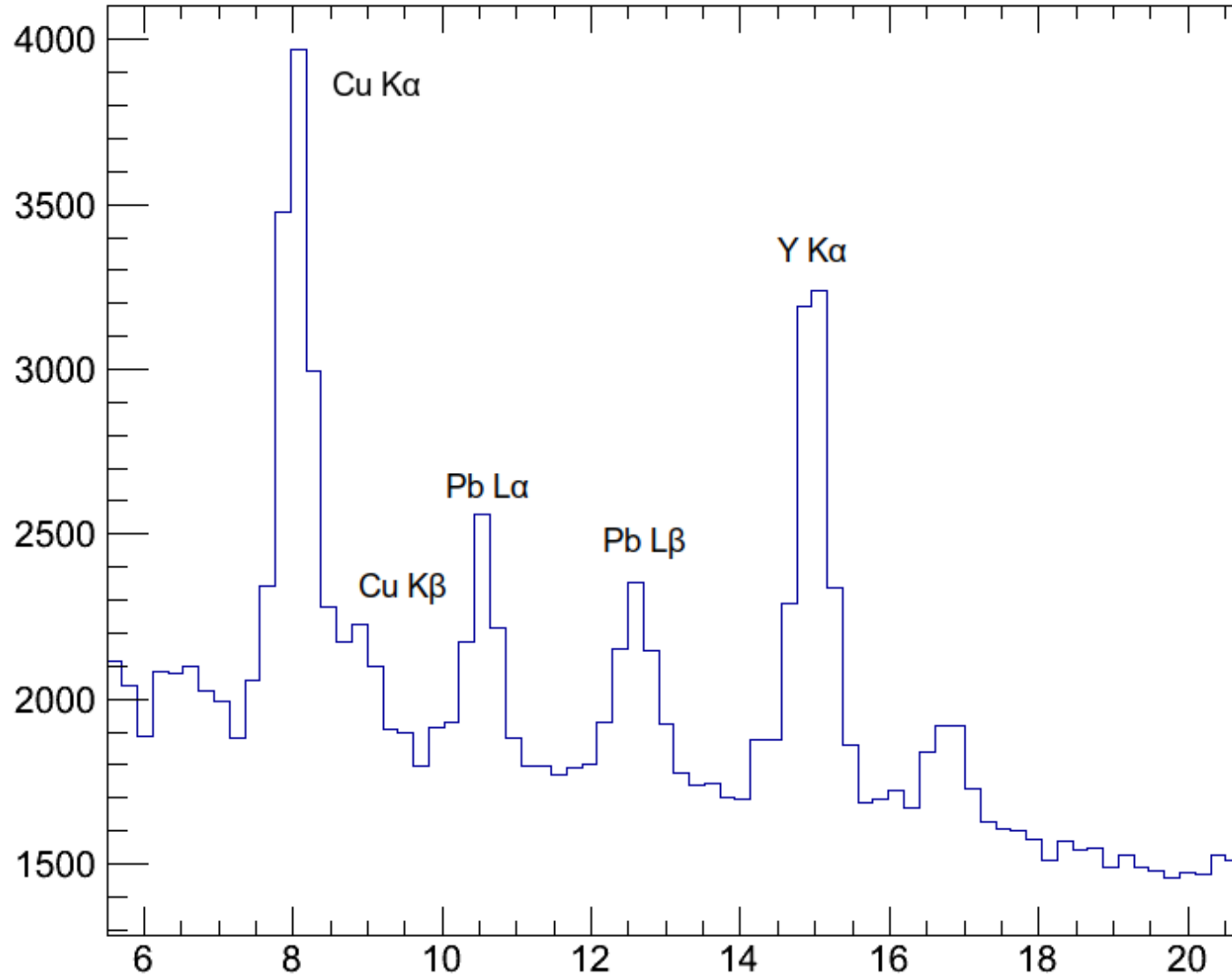
What if we could measure it precisely for cheap?



Area of investment and support



Looking for lead with a CCD



Seems to work

- But...
 - Cooled with liquid nitrogen to 100K
 - This should only impact energy resolution, maybe not too bad

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 - Can we go for a plan B and design our own sensors, or use silicon photodiodes?

Seems to work

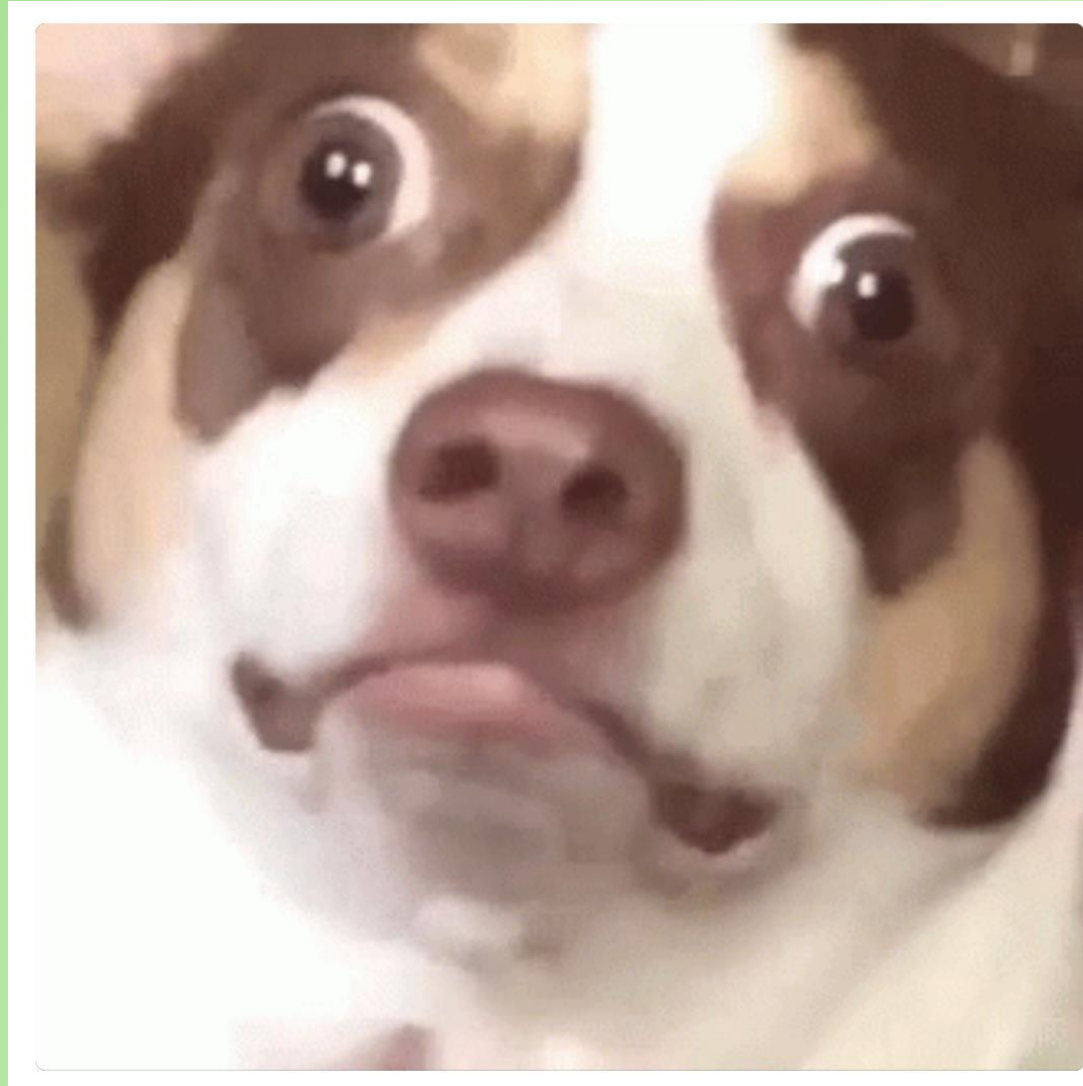
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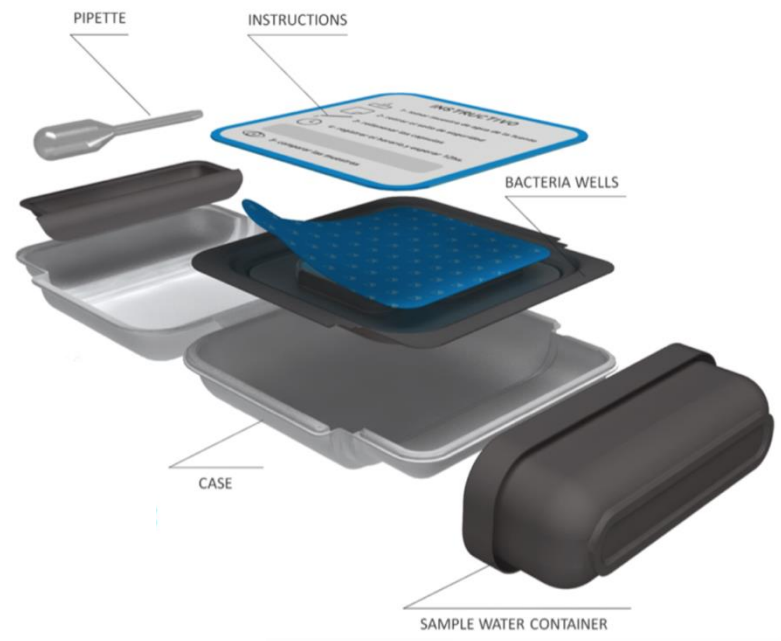
Then I met a biologist colleague in Buenos Aires

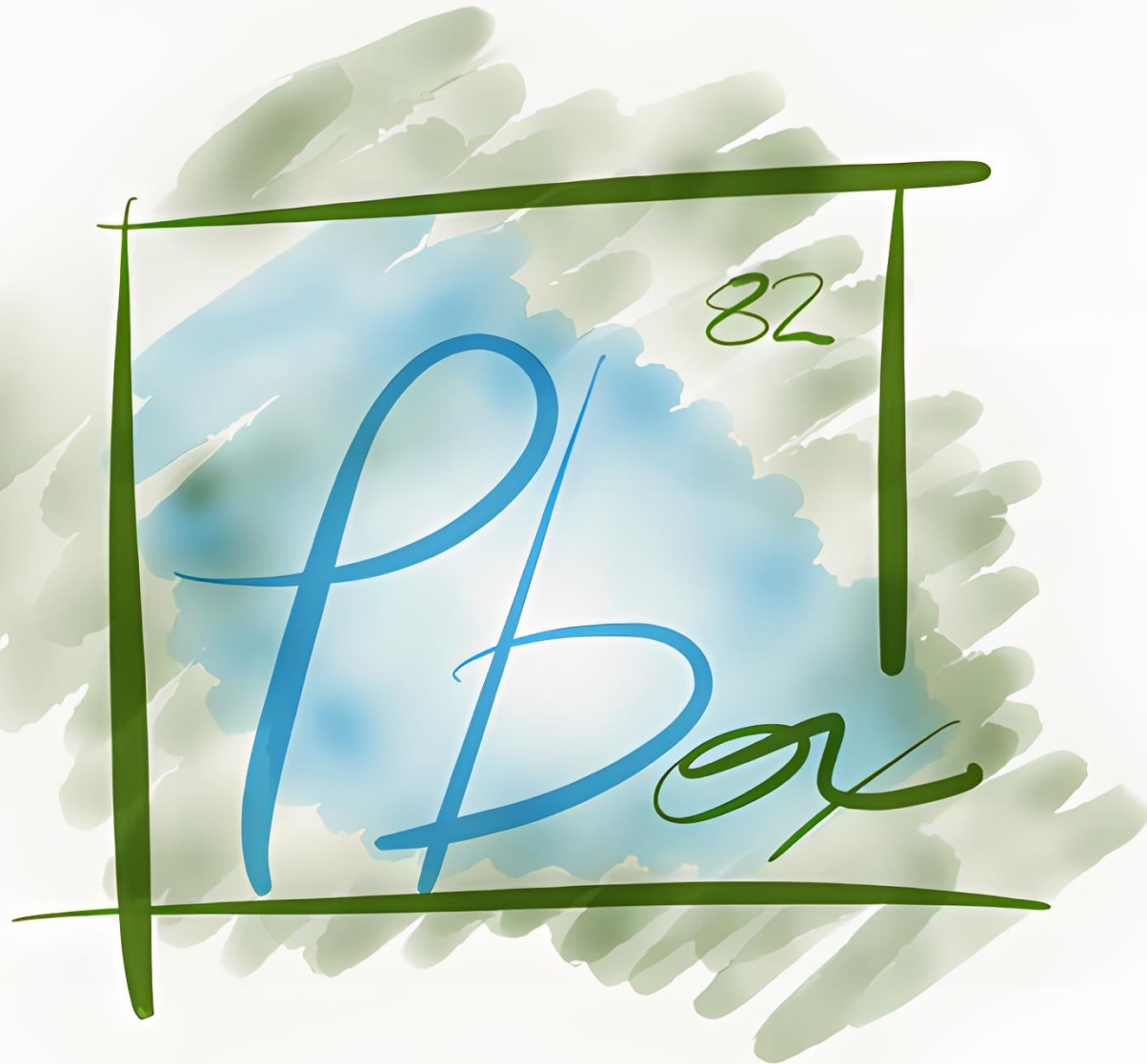
Plan C: bio-sensors





SensAr: An arsenic biosensor for drinking water





PlomBox

Water Sample



WP4: Integration and field tests

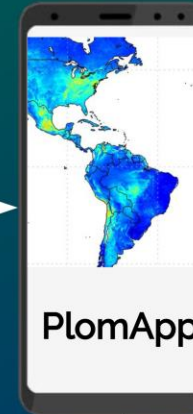
OTS Optical device & electronics

WP2: Light measurement, electronics

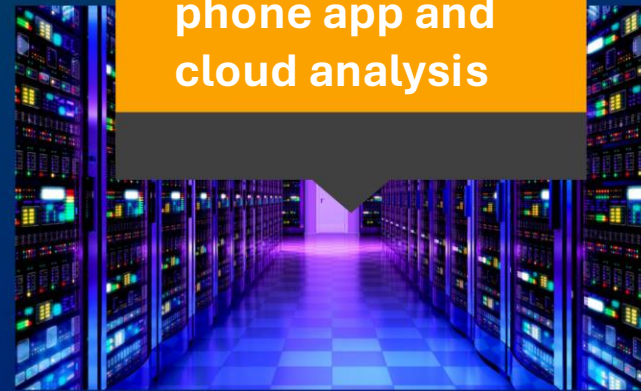
Lead responsive bacteria

WP1: Biology, lead reactive bacteria development

Own developed PlomBOX APP



WP3: DAQ, phone app and cloud analysis



Own Cloud Data Server

GCRF-II award

- Royal Holloway University of London (UK)
- Boulby Underground Laboratory (UK)
- Comisión Nacional de Energía Atómica (AR)
 - (DFM+DPT+DDS+DBT+DFF)@GAIYANN
- Universidad de Buenos Aires (AR)
 - iB3-FBMC@FCEyN
- Universidad Nacional Autónoma de México (MX)



EPSRC

Engineering and Physical Sciences
Research Council

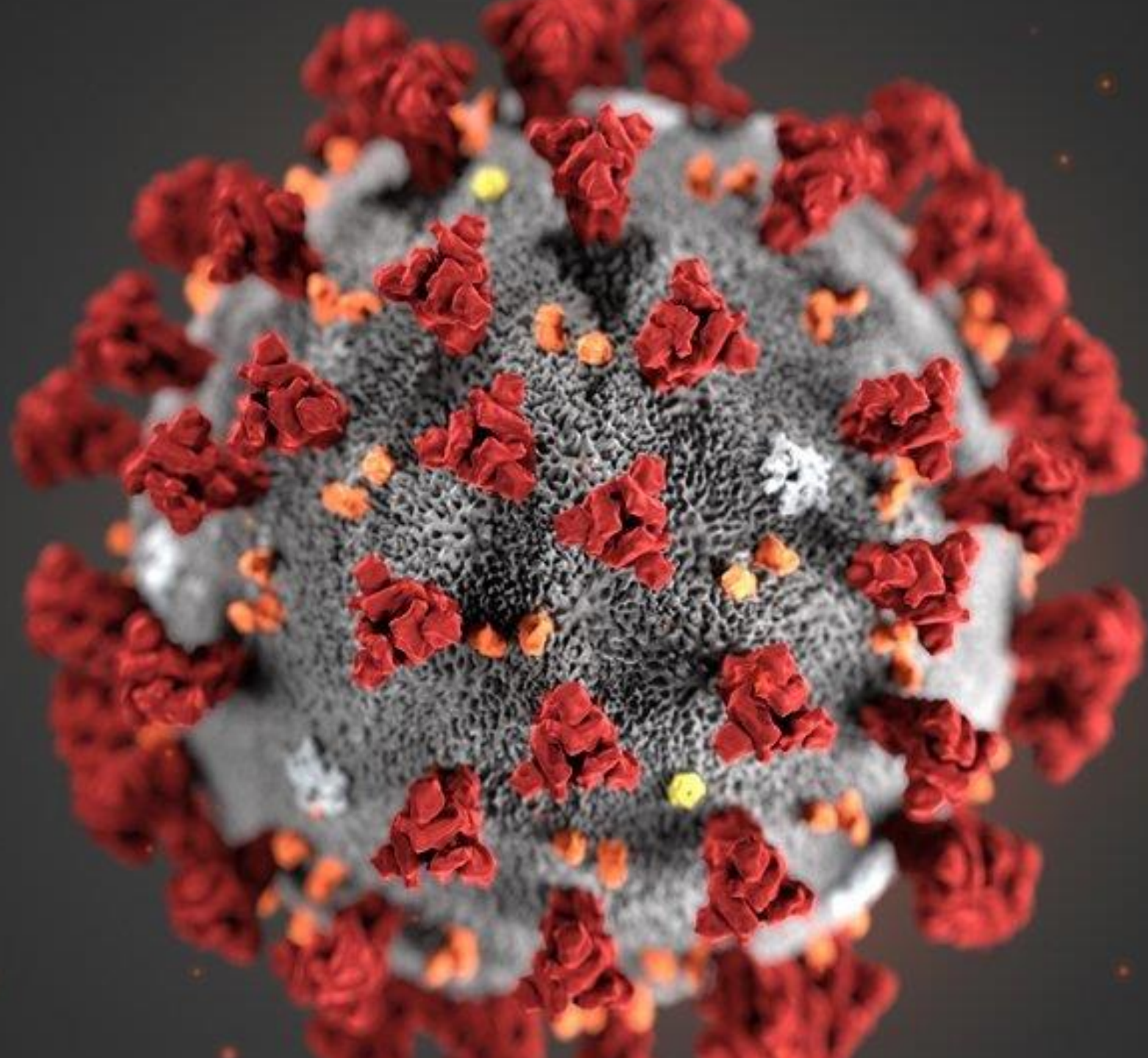
882 806 £
awarded Oct 1, 2019
for 18 months,
signed by all parties
on March 11, 2020



Comisión Nacional
de Energía Atómica

CONICET







Mariano Gómez Berisso



Hernan Gonzalo Asorey



Luciano Marpegan



Jocelyn Monroe



Alejandro Daniel Nadra



Gonzalo Rumi



José Francisco Favela Pérez



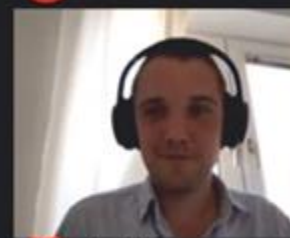
Jaime Octavio Guerra



Alexis Aguilar



Horacio Arnaldi



Deisting



Adriana



Willy Pregliasco



Daniel Marin



Xavier Bertou



Macarena Alvarez



Yami Gándola



Mauricio Mtz



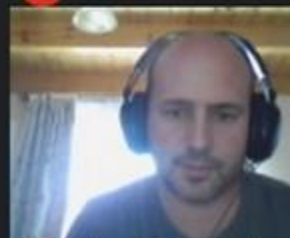
Estela Garces



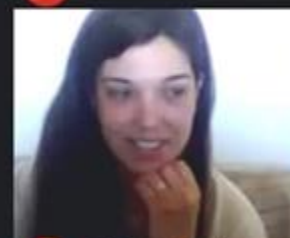
Adiv Gonzalez



Eric Vazquez Jauregui



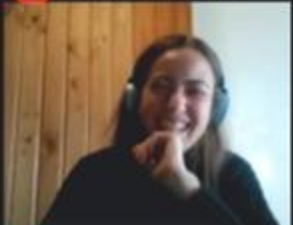
José Lipovetzky



Silvina Gutierrez



Melisa Tallis



María Belén



Ariana Rossen



J. Gasulla

COVID-19 lockdowns by country

From Wikipedia, the free encyclopedia

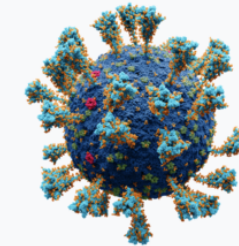
Countries and territories around the world enforced **lockdowns** of varying stringency in response to the **COVID-19 pandemic**.

Some included total movement control while others enforced restrictions based on time. In many cases, only essential businesses were allowed to remain open. **Schools, universities and colleges closed** either on a nationwide or local basis in 63 countries, affecting approximately 47 percent of the world's student population.^{[1][2]}

Beginning with the first **lockdown in China's Hubei province**^[3] and **nationwide in Italy** in March 2020, lockdowns continued to be implemented in many countries throughout 2020 and 2021. On 24 March 2020, the entire 1.3 billion population of India was ordered to stay at home during **its lockdown**, making it the largest of the pandemic.^[4] The world's longest continuous lockdown lasting 234 days took place in **Buenos Aires, Argentina**, in 2020. As of October 2021, the city of **Melbourne, Australia**, and **certain cities in Peru** and **Chile** spent the most cumulative days in lockdown over separate periods, although measures varied between these countries.^{[5][6]}

A few countries and territories did not use the strategy, including **Japan**, **Belarus**, **Nicaragua**, **Sweden**, **South Korea**, **Hong Kong**, **Taiwan**, **Tanzania**, Uruguay, two states in **Brazil** and **certain United States states**.

Part of a series on the
COVID-19 pandemic



COVID-19 (disease) · **SARS-CoV-2 (virus)**
Cases · **Deaths**

Timeline [\[show\]](#)

Locations [\[show\]](#)

International response [\[show\]](#)

Medical response [\[show\]](#)

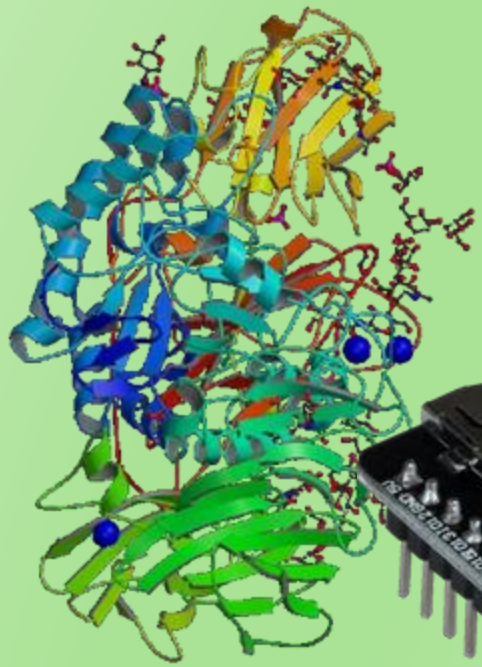
Variants [\[show\]](#)

Economic impact and recession [\[show\]](#)

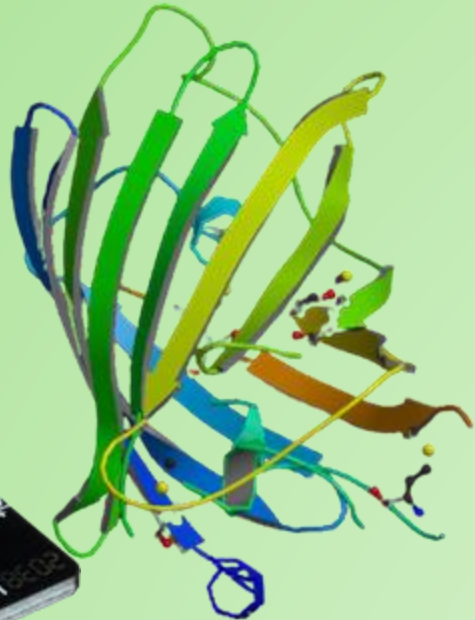
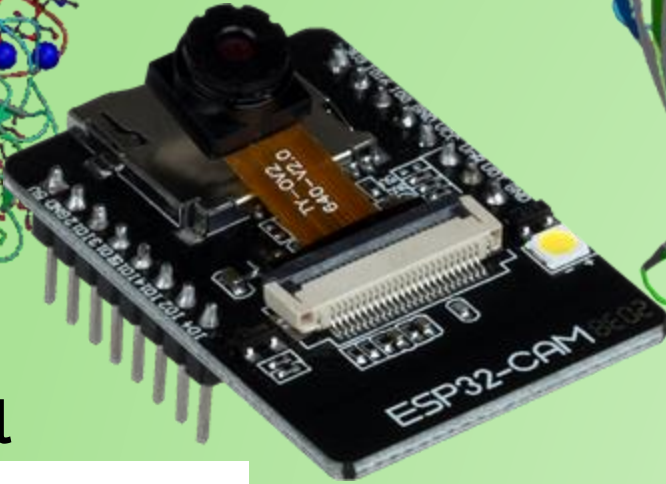
Impacts [\[show\]](#)

 **COVID-19 portal**

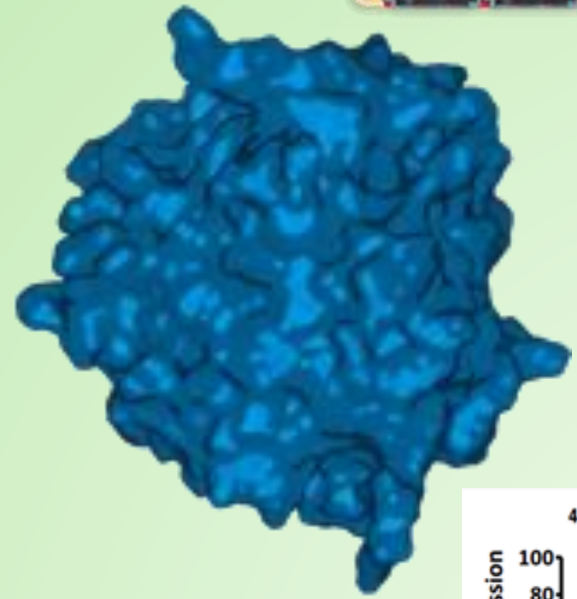
Possible tracers and sensors



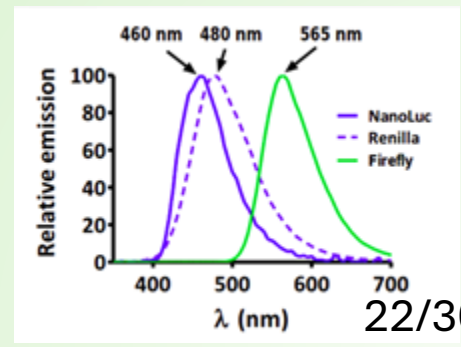
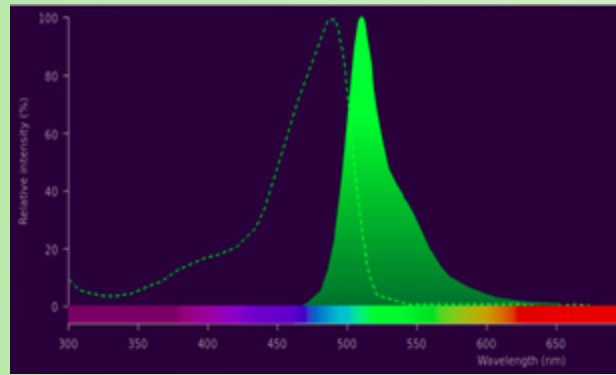
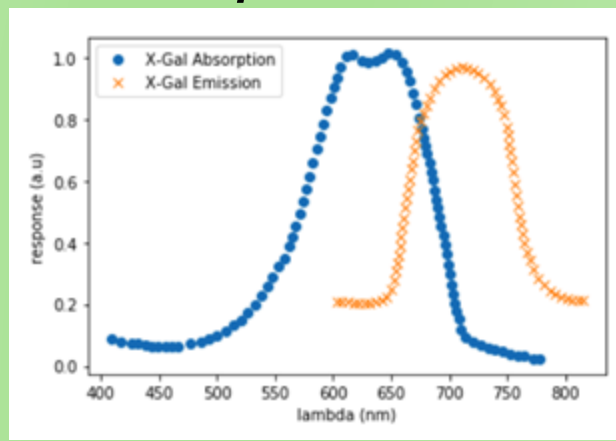
β -Gal

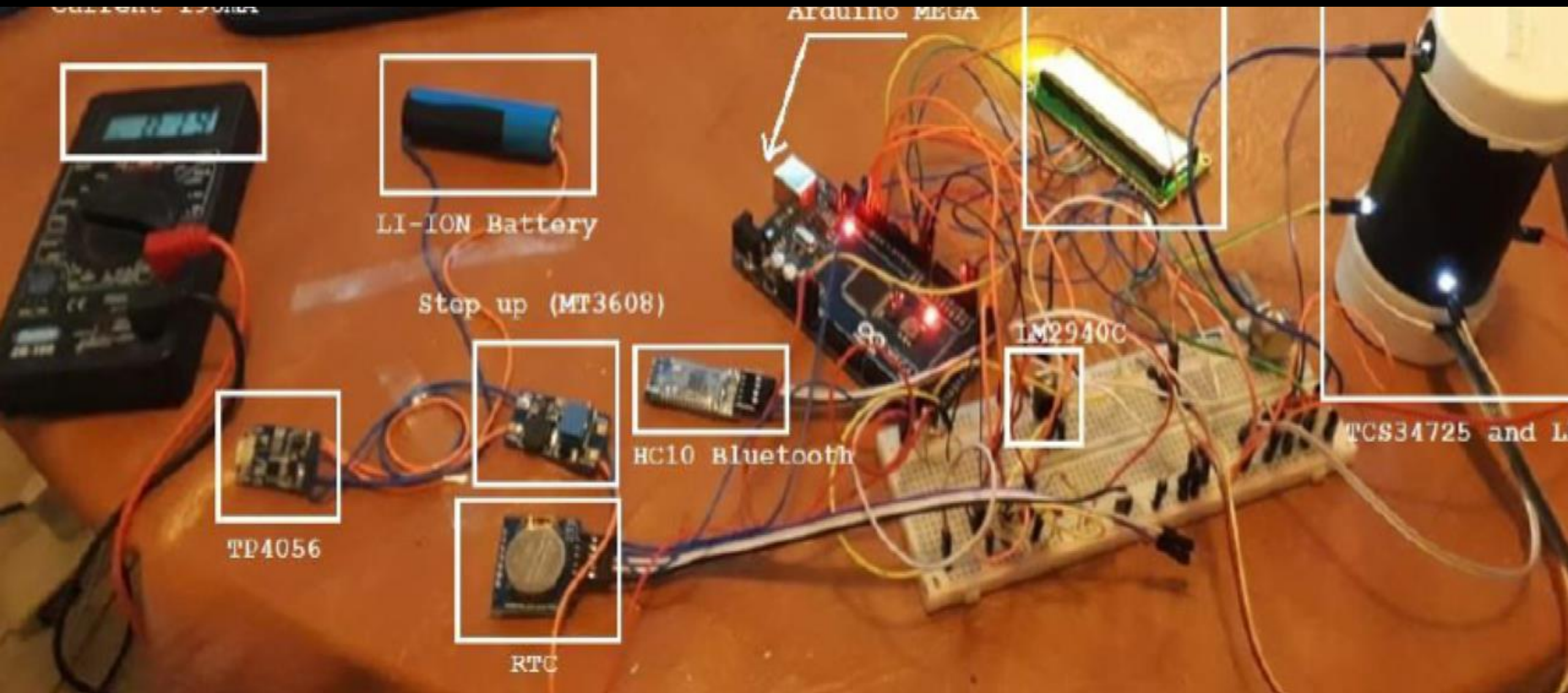


GFP

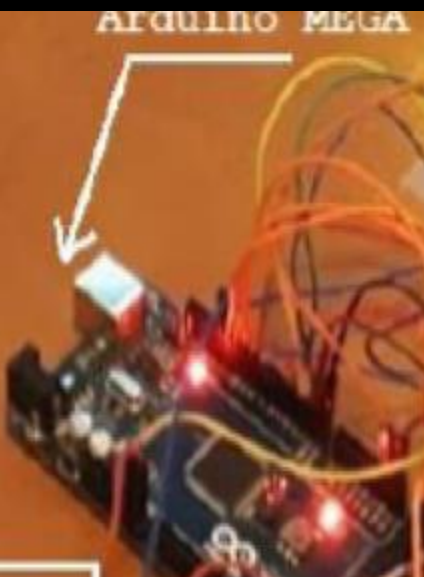


Luciferasa





LI-ION Battery



ARDUINO MEGA



TP4056

Step up (MT3608)



HC10 Bluetooth

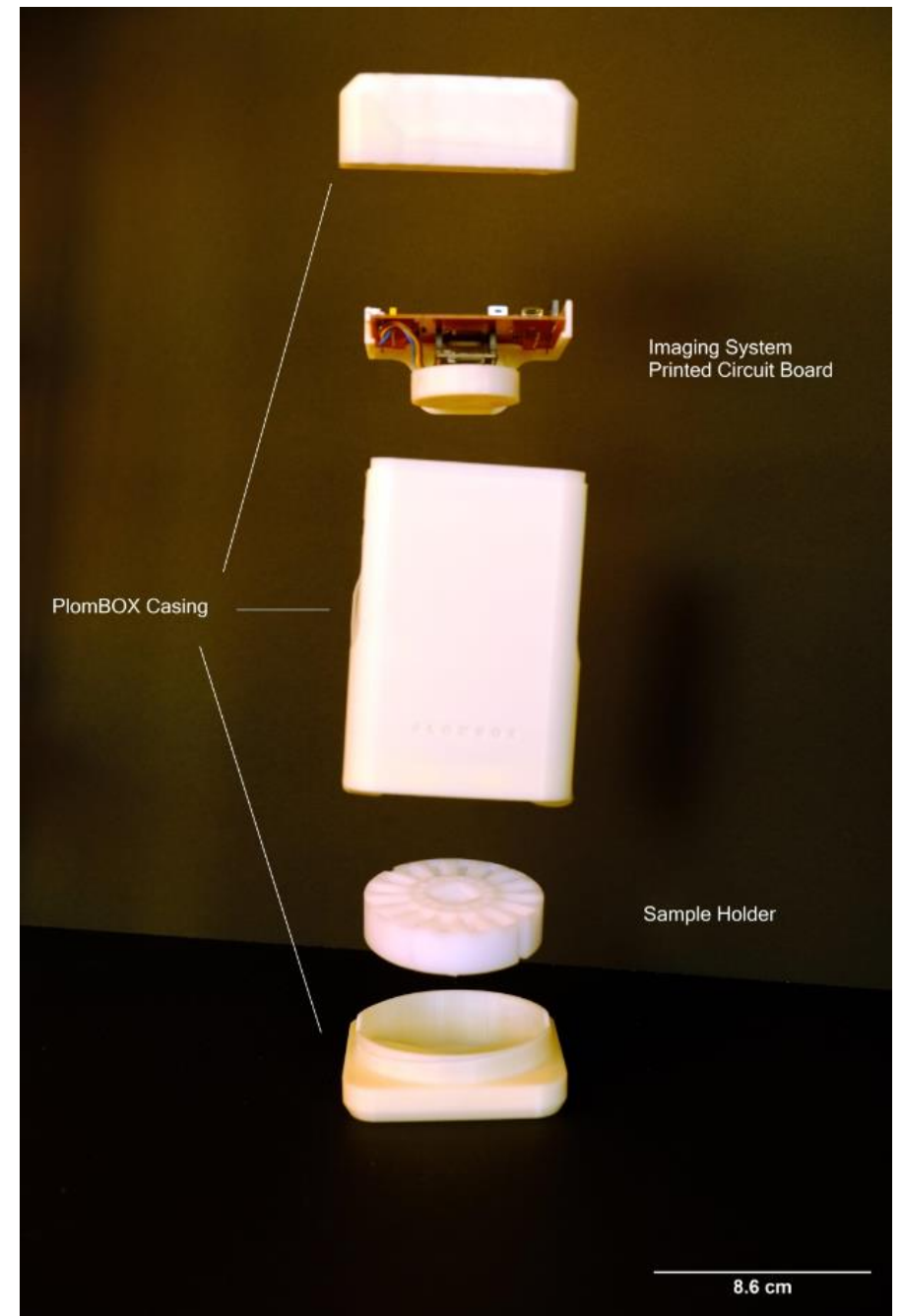
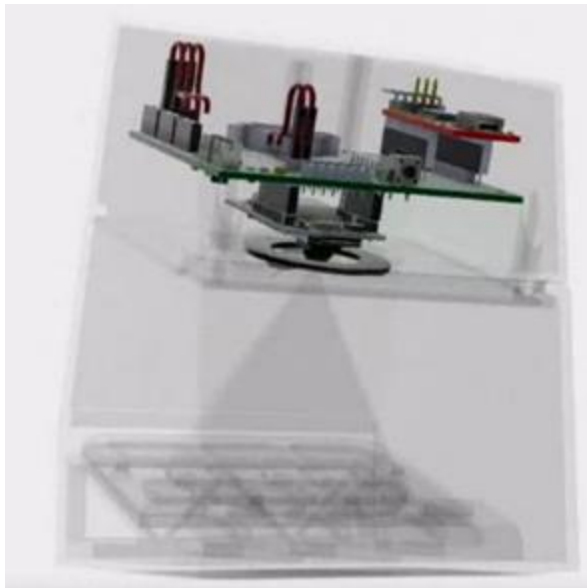
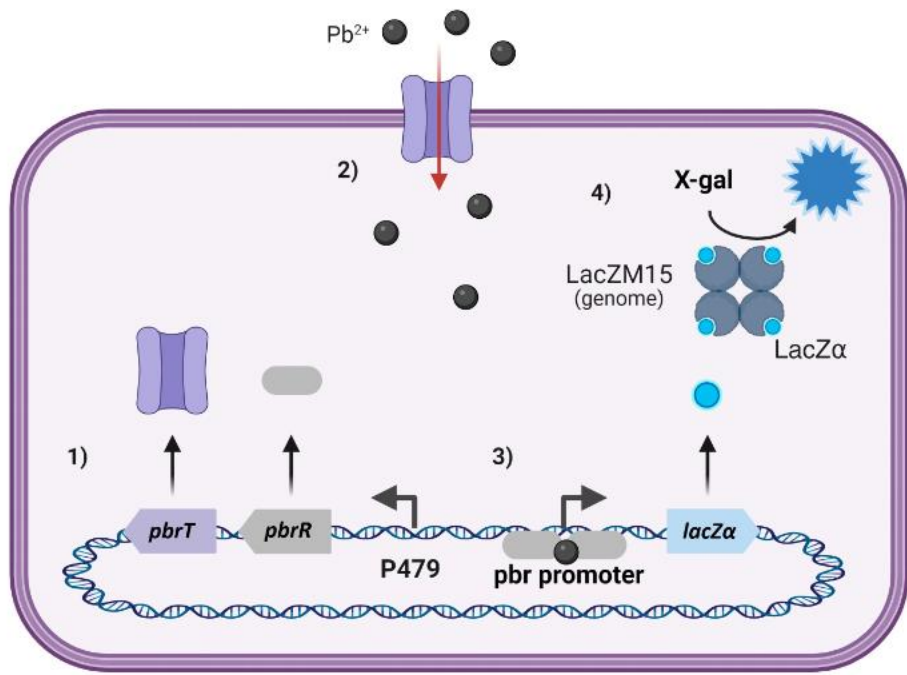
LM2940C

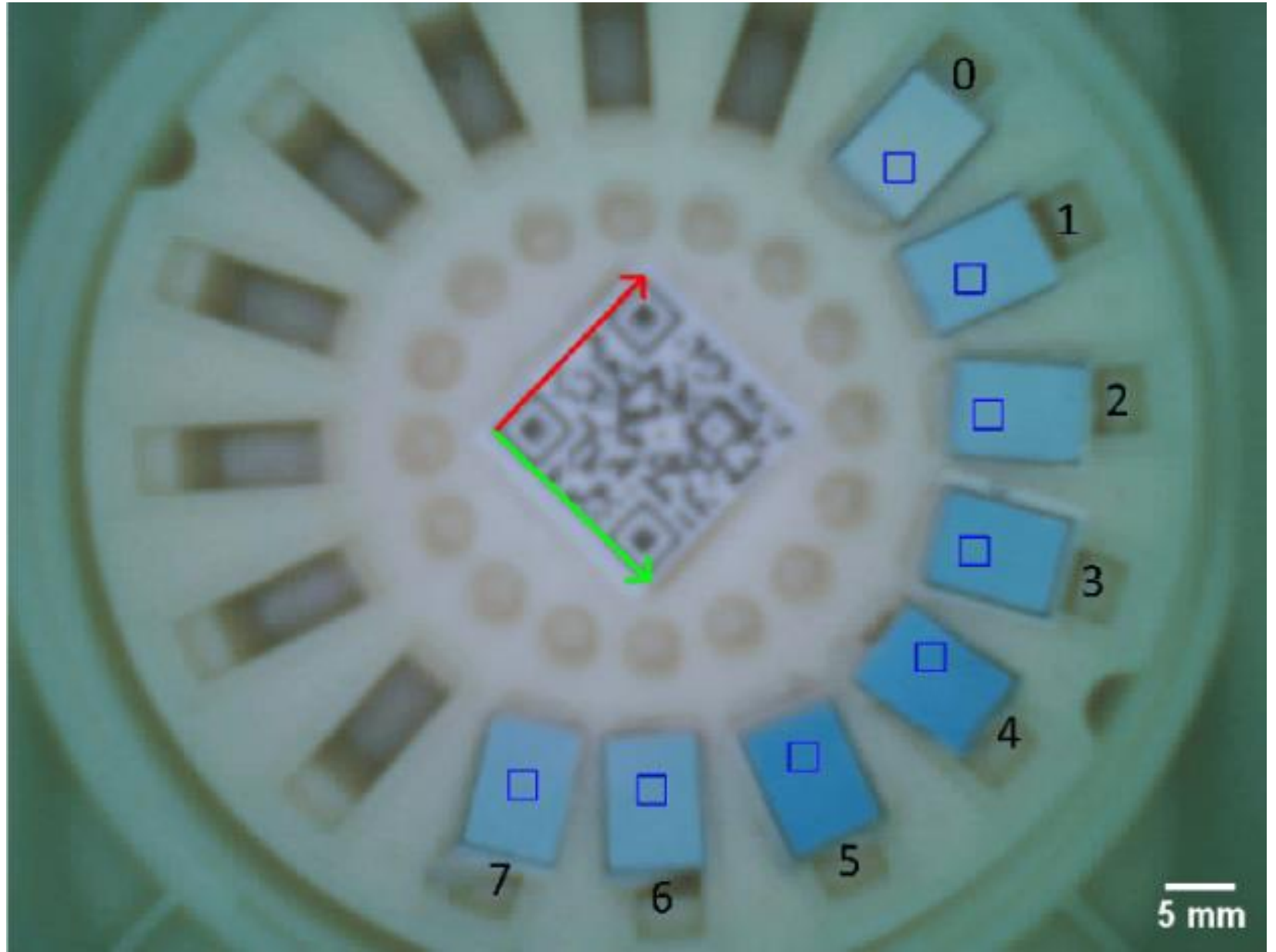
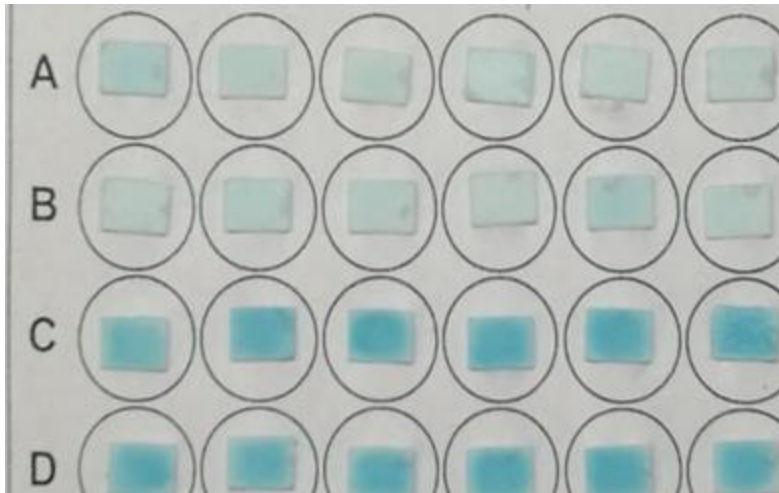
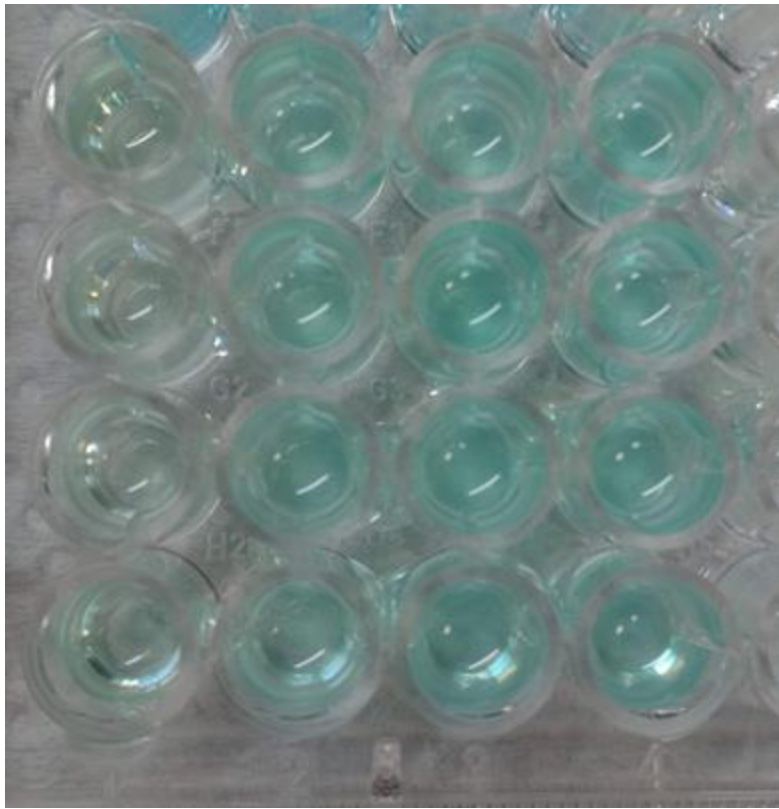


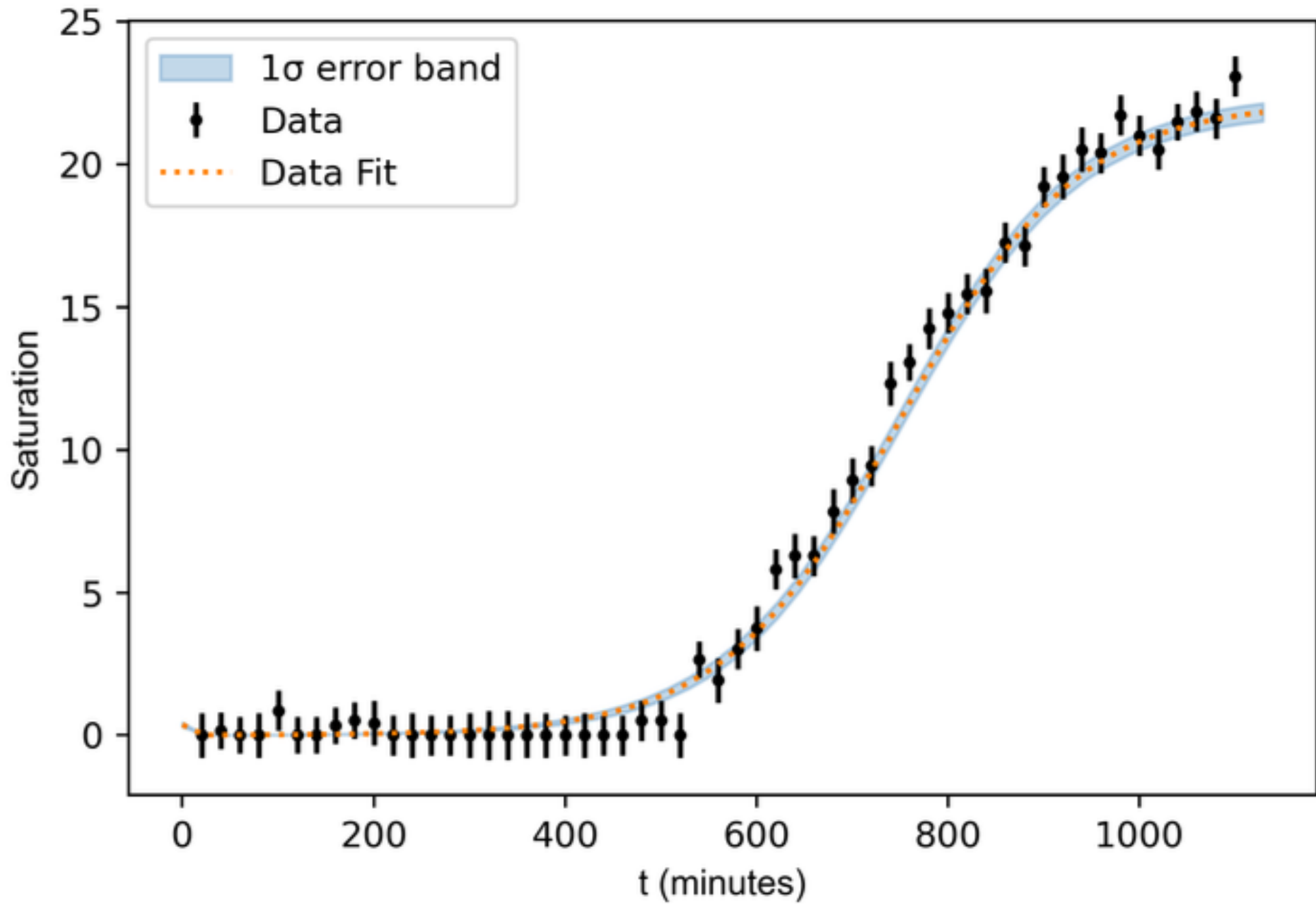
RTC

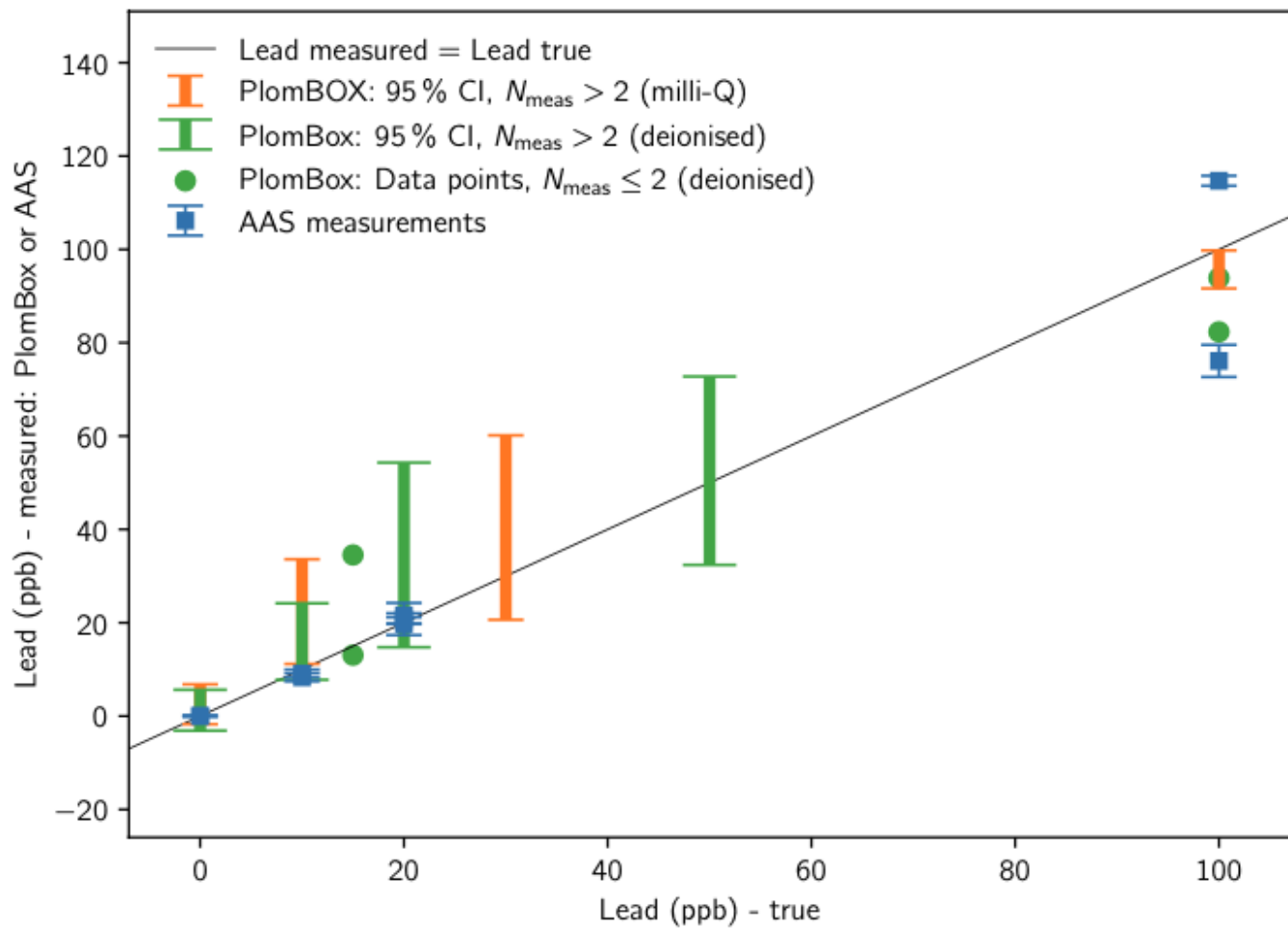


TCS34725 and L

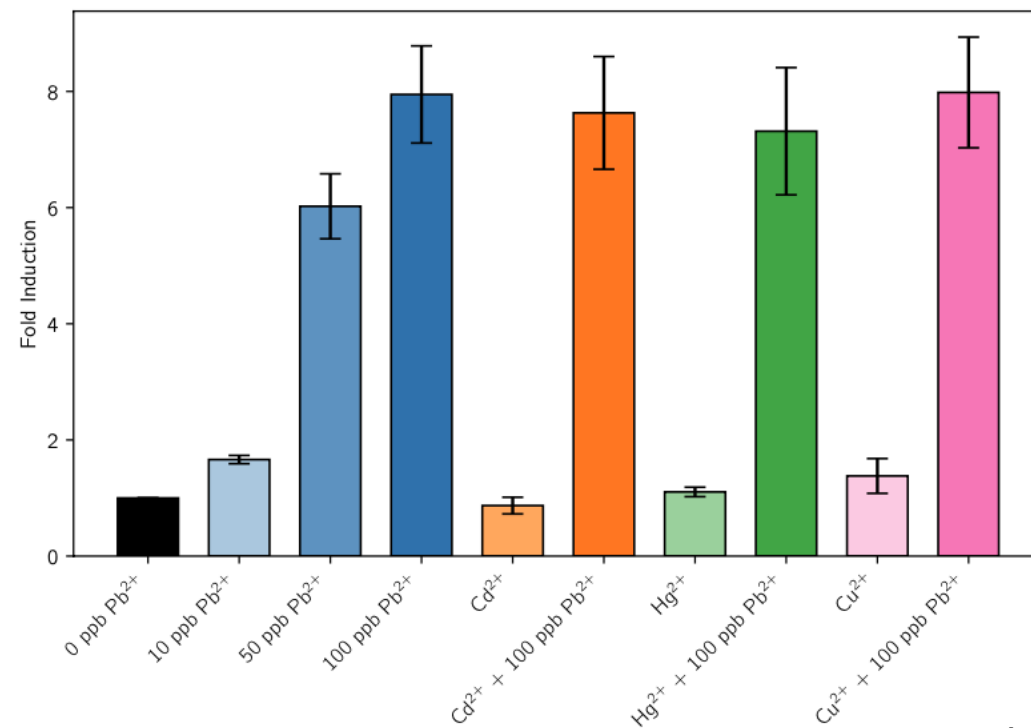








Should be out soon (next weeks)
(in Nature Communications Engineering)





What next?

- Phase 1 (CMOS particle detection) 2017-2019: failed
- Phase 2 (bio-sensors) 2020-2024: done
- Phase 3 2025+:
 - Improve measurement (self-calibration method, adding a reporter for bacteria growth?)
 - Replace bacteria by some other biological piece?
 - Automate system (heating, bacteria cleaning,...)
 - Large scale measurement with local institutions
 - <https://www.paris.fr/pages/comment-paris-lutte-contre-l-exposition-au-plomb-22152>
 - Make it user friendly – sell-able
 - Do that next phase with colleagues from PlomBOX (in Argentina and UK) and groups here (multidisciplinary, health...) and local biologists experts

Who's interested?