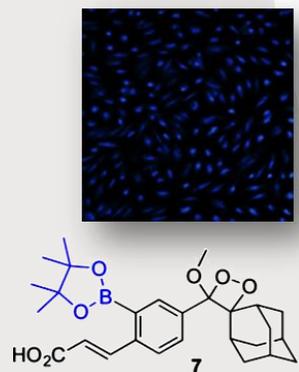


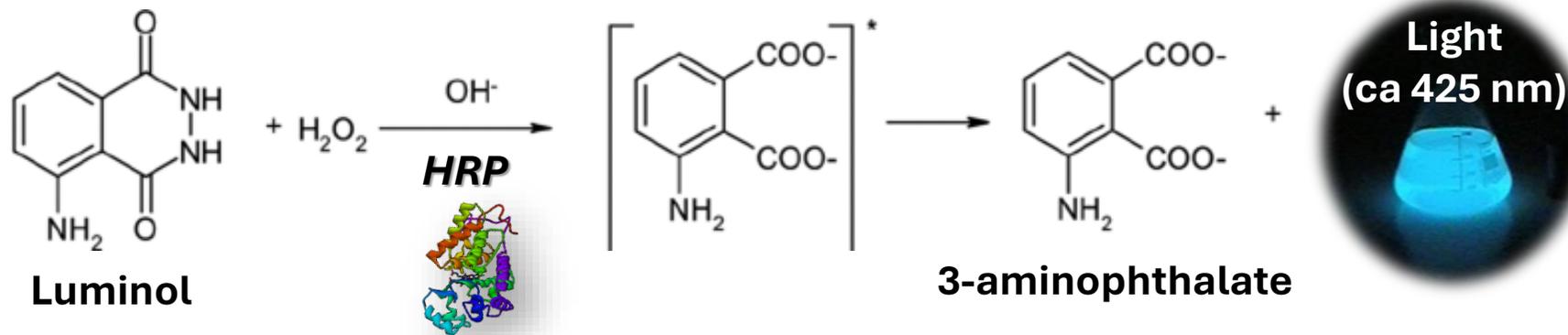
# Attività di Ricerca del Gruppo di Chimica Bioanalitica della Prof Mara Mirasoli

[mara.mirasoli@unibo.it](mailto:mara.mirasoli@unibo.it)



# Chemiluminescence as detection method

Chemiluminescence (CL) is defined as the production of electromagnetic radiation (ultraviolet, visible or infrared) observed when a chemical reaction yields an electronically excited intermediate or product, which either luminesces (direct CL)



**CCD**  
(Charge Coupled Device)



**CMOS**  
(Complementary Metal Oxide Semiconductor)

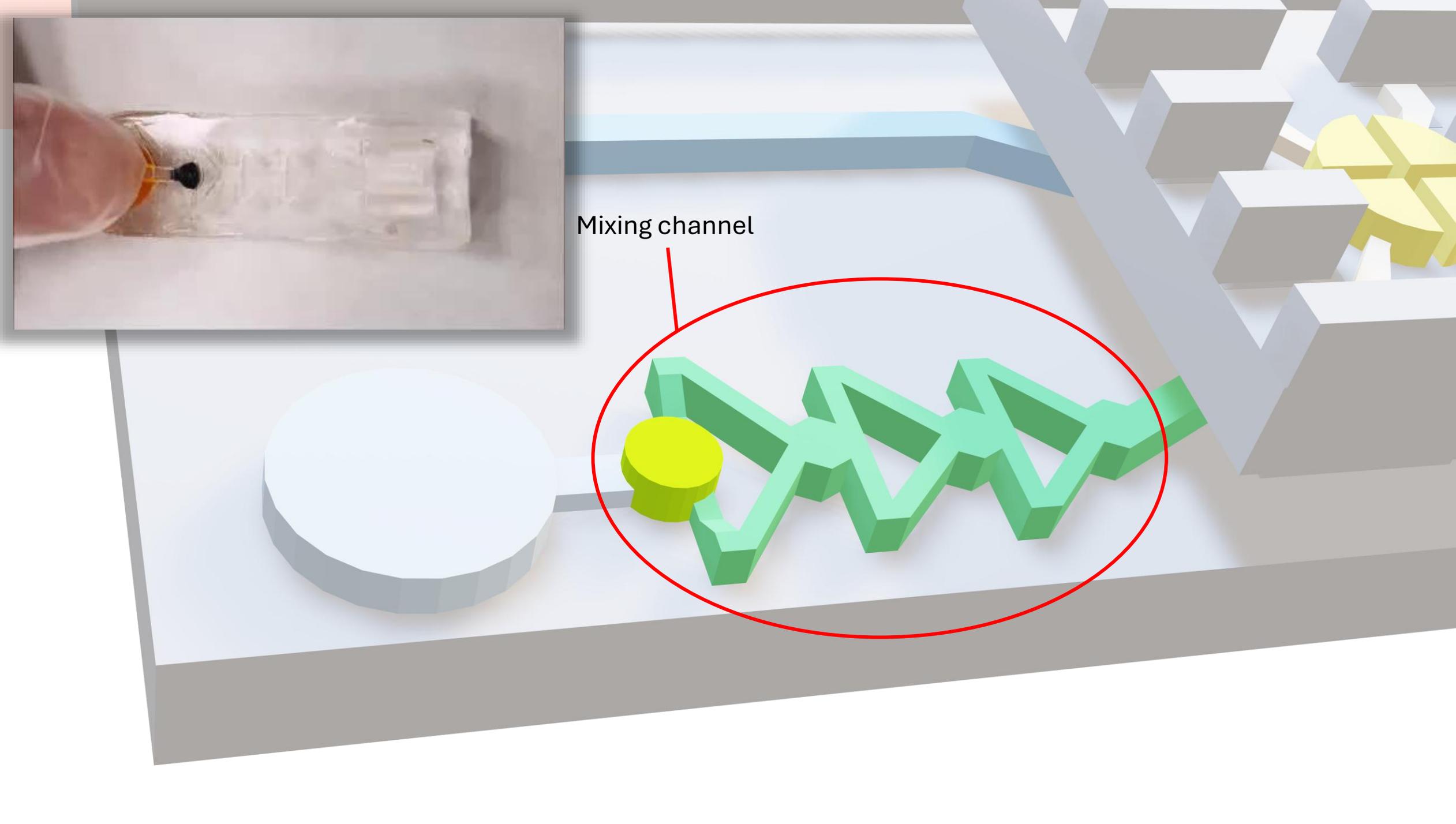


**Advantages of Chemiluminescence:**

- High sensitive detection (pM)
- High dynamic range
- Simple analytical procedures
- Low cost technique
- Simple and low-cost instrumentation (no need of a source of light)



Mixing channel



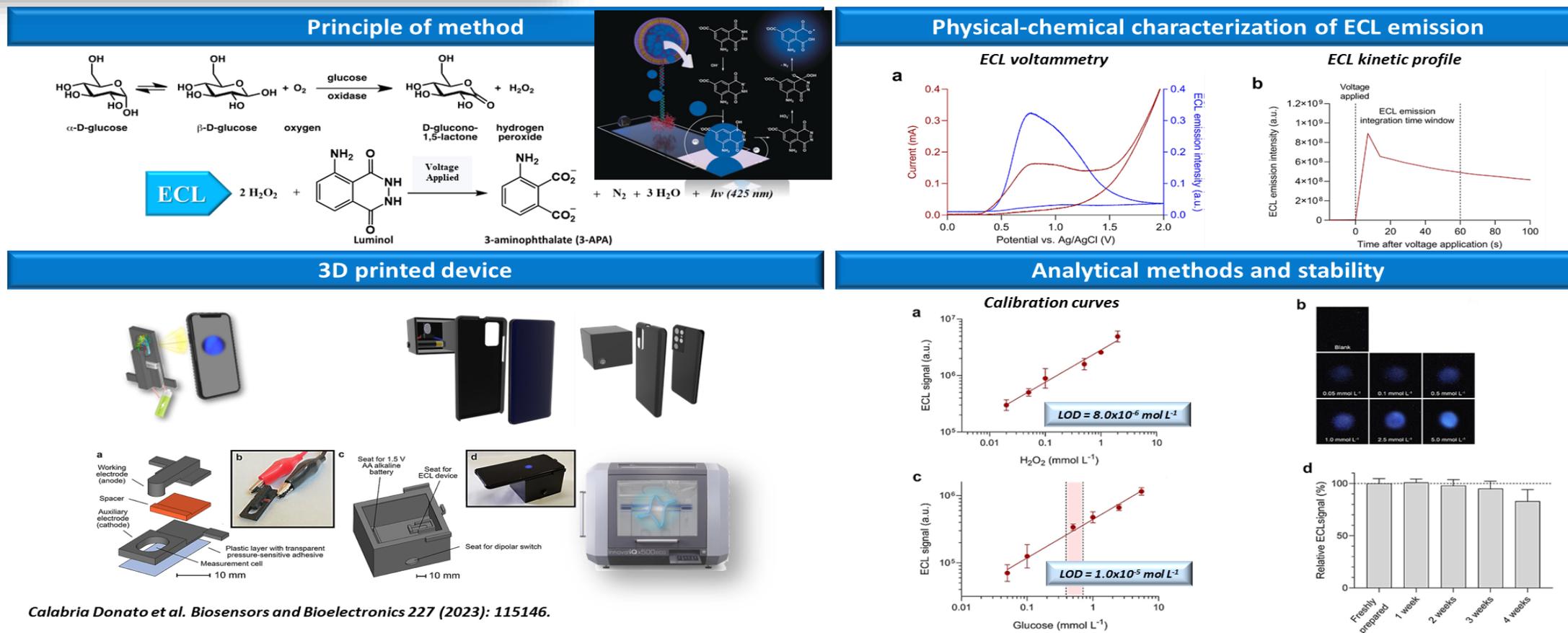
# SMARTPHONE-BASED 3D-PRINTED ELECTROCHEMILUMINESCENCE ENZYME BIOSENSOR FOR REAGENTLESS GLUCOSE QUANTIFICATION IN REAL MATRICES

Smartphone-based 3D-printed electrochemiluminescence enzyme biosensor for reagentless glucose quantification in real matrices

Donato Calabria<sup>a,b</sup>, Elisa Lazzarini<sup>a</sup>, Andrea Pace<sup>a</sup>, Ilaria Trozzi<sup>a</sup>, Martina Zangheri<sup>a,c,d</sup>, Stefano Cinti<sup>e,f</sup>, Marinella Difonzo<sup>a</sup>, Giovanni Valenti<sup>a</sup>, Massimo Guardigli<sup>a,b,g</sup>, Francesco Paolucci<sup>a,\*</sup>, Mara Mirasoli<sup>a,b,g,\*\*</sup>

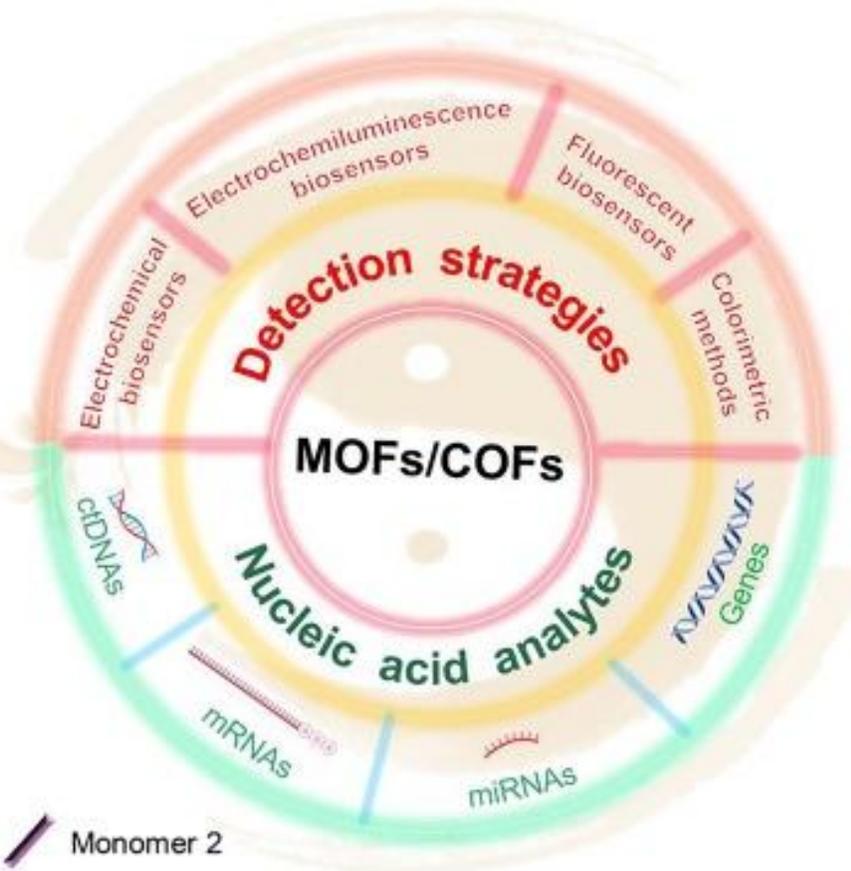
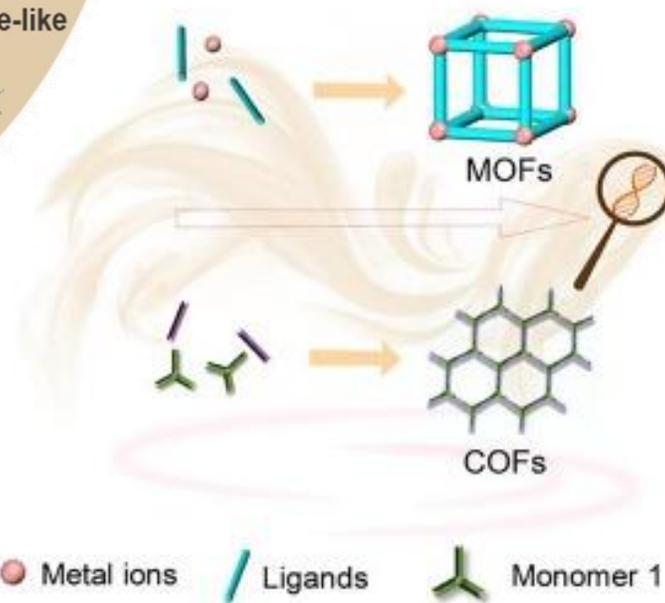
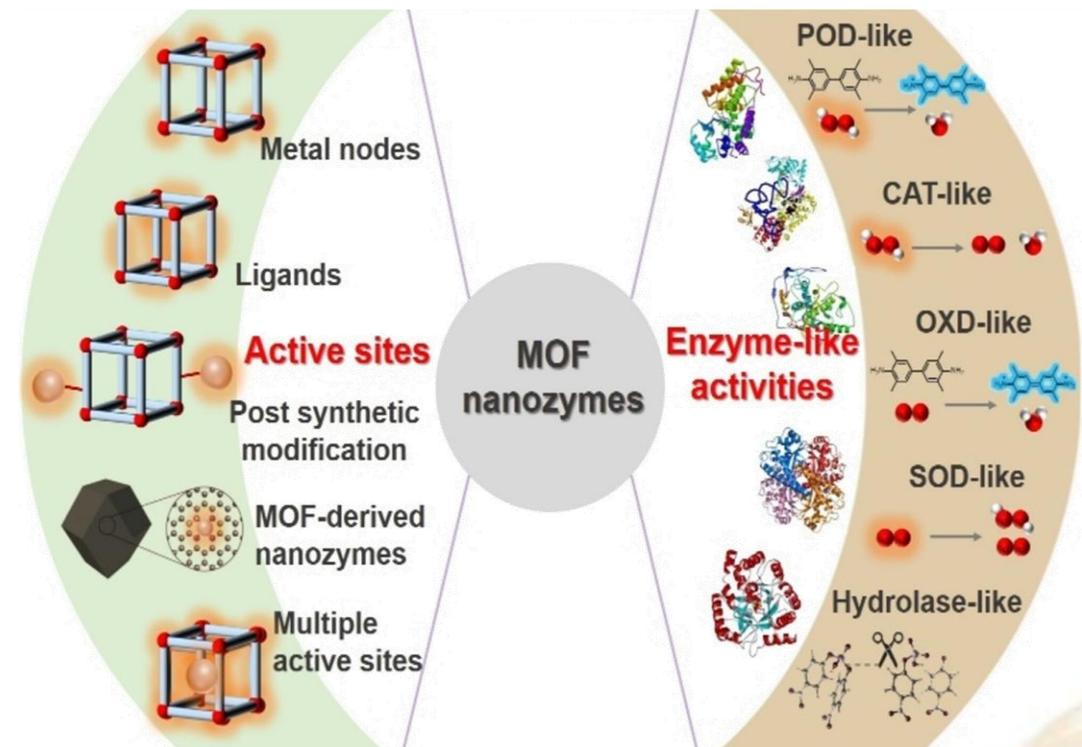
## Acknowledgements

This research was funded by the Italian Ministry of University and Research: PRIN2017 project "Cutting edge analytical chemistry methodologies and bio-tools to boost precision medicine in hormone-related diseases", Prot. 2017Y2PAB8; and PRIN2017 project "Functional 3D architectures for electrochemiluminescence applications", Prot. 2017FJCPEX.



# MOF = Metal Organic Frameworks

## COF = Covalent Organic Frameworks

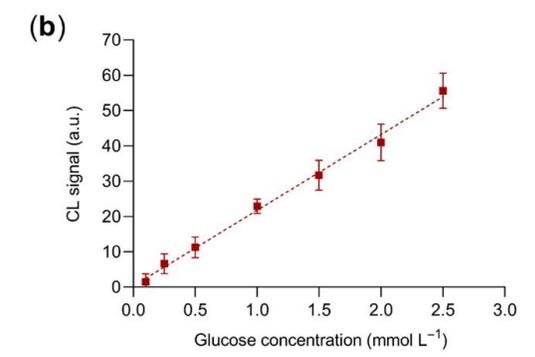
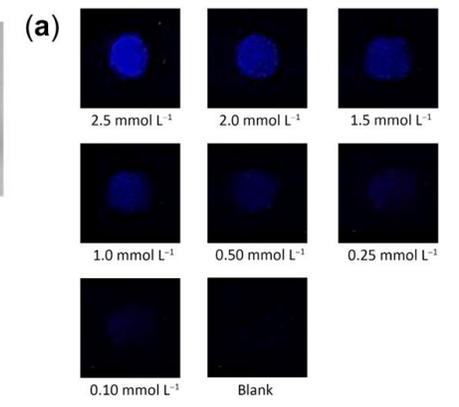
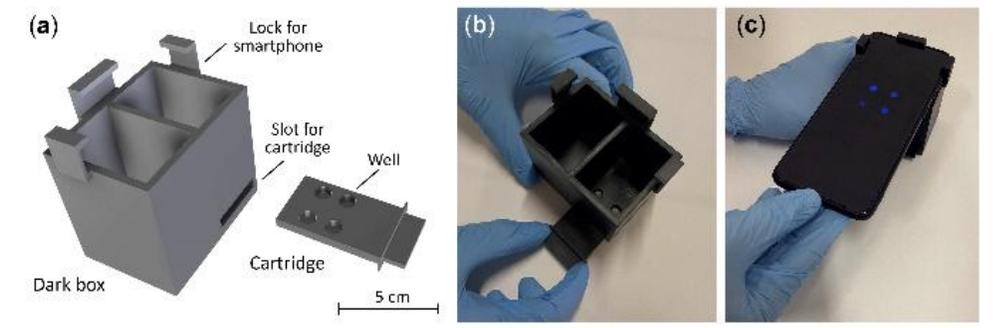
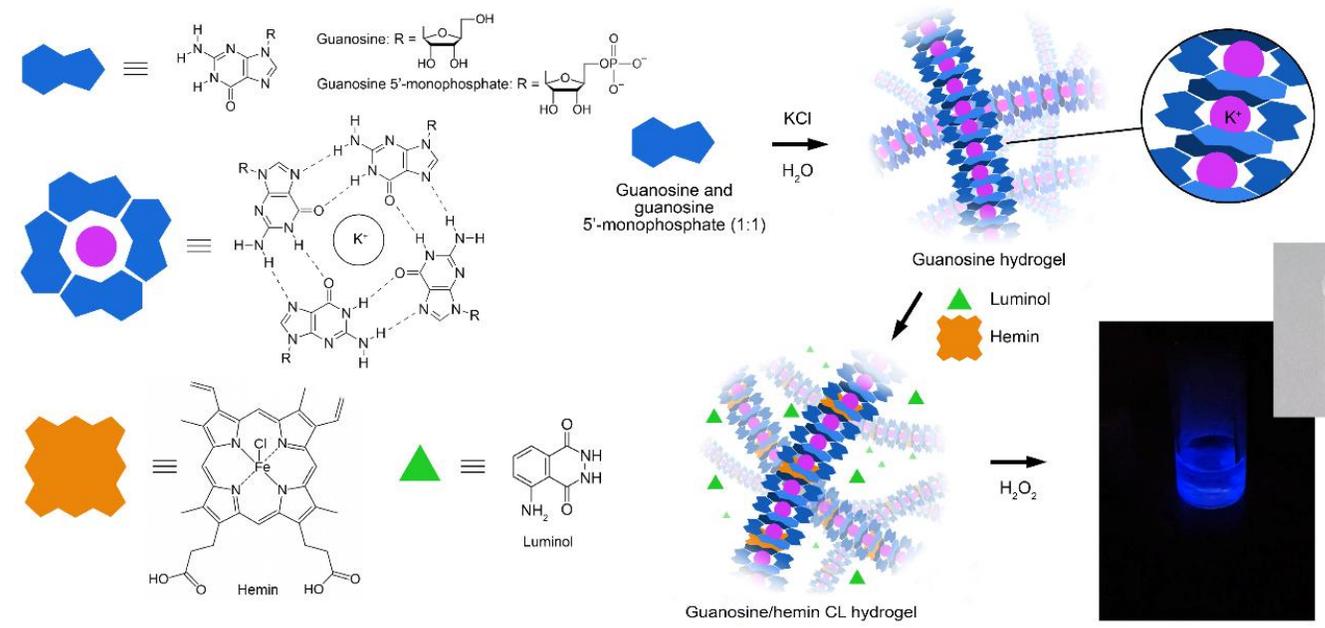
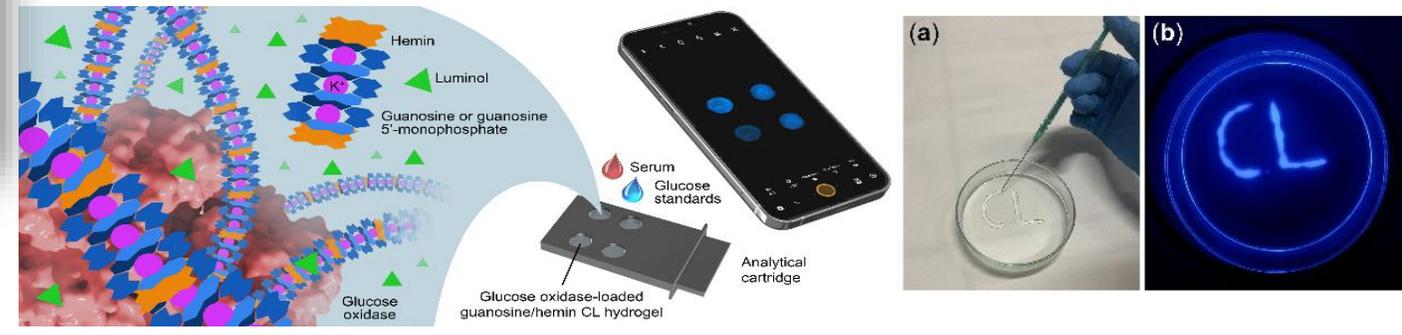


# SMARTPHONE-BASED CHEMILUMINESCENCE GLUCOSE BIOSENSOR EMPLOYING A PEROXIDASE-MIMIKING, GUANOSINE-BASED SELF-ASSEMBLED HYDROGEL

Article  
**Smartphone-Based Chemiluminescence Glucose Biosensor Employing a Peroxidase-Mimicking, Guanosine-Based Self-Assembled Hydrogel**

Donato Calabria <sup>1,2</sup>, Andrea Pace <sup>1</sup>, Elisa Lazzarini <sup>1</sup>, Ilaria Trozzi <sup>1</sup>, Martina Zangheri <sup>1,3,4</sup>, Massimo Guardigli <sup>1,2,5</sup>, Silvia Pieraccini <sup>1</sup>, Stefano Masiero <sup>1</sup> and Mara Mirasoli <sup>1,2,5,\*</sup>

**Funding**  
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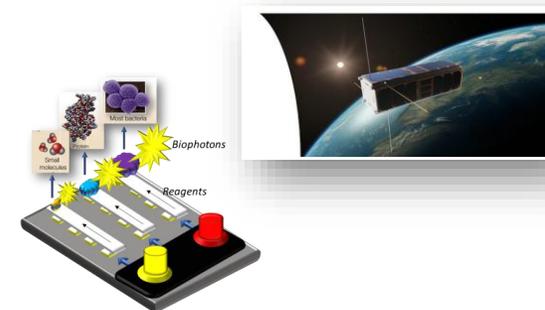
## AstroBio-CubeSat: A lab-in-space for chemiluminescence-based astrobiology experiments

Donato Calabria<sup>a, b, 1</sup>, Ilaria Trozzi<sup>a, 1</sup>, Elisa Lazzarini<sup>a</sup>, Andrea Pace<sup>a</sup>, Martina Zangheri<sup>a</sup>, Lorenzo Iannascoli<sup>c</sup>, Nithin Maipan Davis<sup>c</sup>, Sagar Sarvad Gosikere Matadha<sup>c</sup>, Thiago Baratto De Albuquerque<sup>c</sup>, Simone Pirrotta<sup>d</sup>, Marta Del Bianco<sup>d</sup>, Gabriele Impresario<sup>d</sup>, Liyana Popova<sup>e</sup>, Nicola Lovecchio<sup>f</sup>, Giampiero de Cesare<sup>f</sup>, Domenico Caputo<sup>f</sup>, John Brucato<sup>g</sup>, Augusto Nascetti<sup>c</sup>, Massimo Guardigli<sup>a, b</sup>, Mara Mirasoli<sup>a, b</sup>

# ASTROBIO-CUBESAT: A LAB-IN-SPACE FOR CHEMILUMINESCENCE-BASED ASTROBIOLOGY EXPERIMENTS

Searching for signs of past or present life is a high-priority task for the astrobiological exploration of our Solar System. Following a bioanalytical approach, a variety *in-situ* microfluidic analytical devices have been proposed for detecting target life biomarkers through an array of biospecific recognition reactions.

Extraterrestrial traces and origin of life researches by astrobiological biosensors

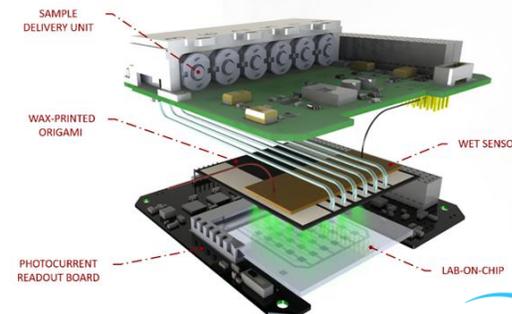


The ABCS project aims at the development of a CL-based fully autonomous analytical platform for the execution of multiple enzyme-based bioassays in a nanosatellite platform.

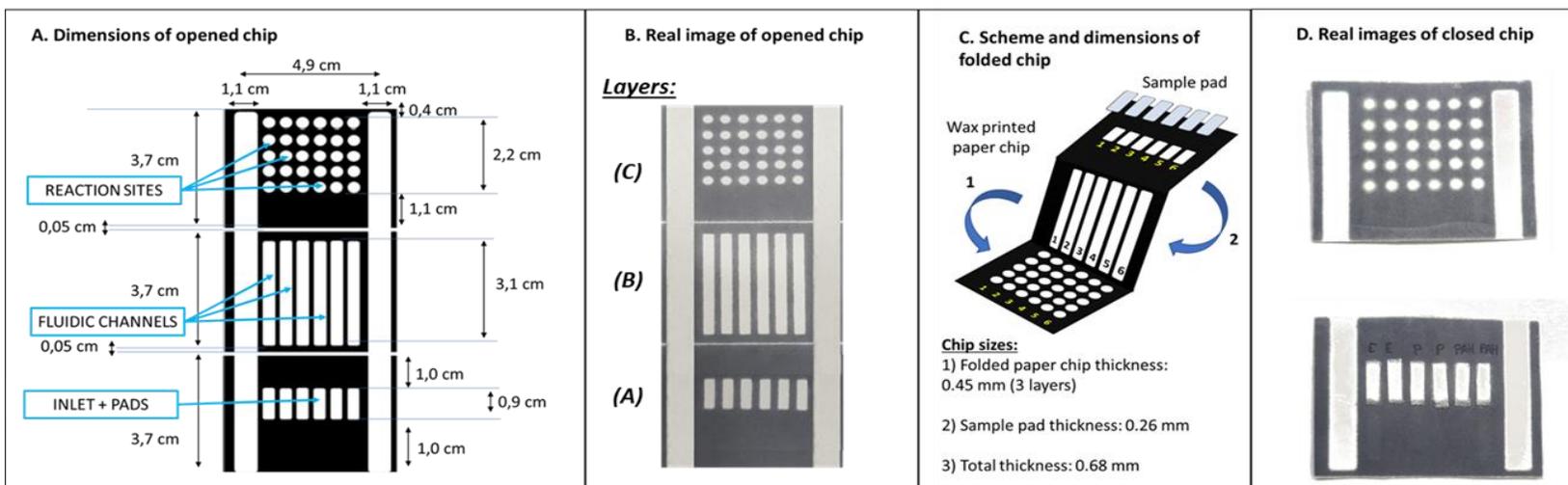
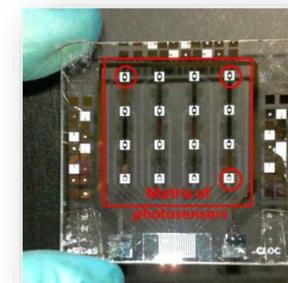
ABCS hosts a **micro laboratory based on Lab-on-Chip technology** able to provide a platform for an automatic bioanalytical experiments in space.

The **target applications** are:

- Search for signs of life in planetary exploration missions;
- Space biolabs without human support;
- Health monitoring in manned missions.



**Acknowledgments:** ABCS AstroBio-CubeSat is supported by ASI - Italian Space Agency ASI/INAF Agreement n. 2019-30-HH.0



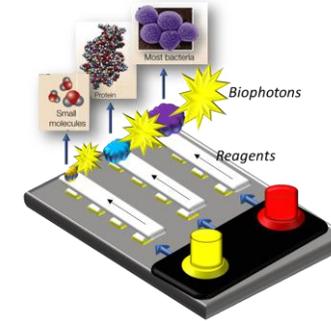
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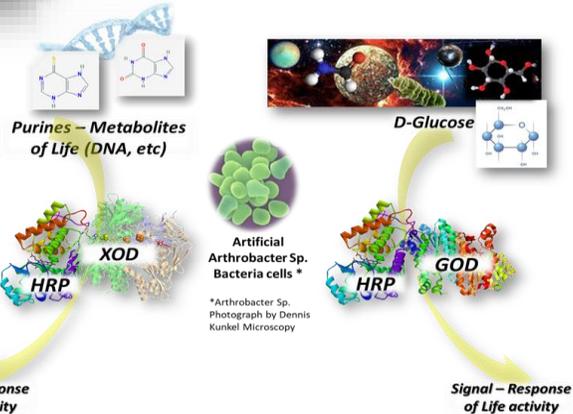
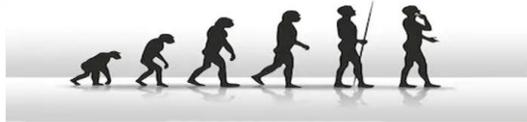
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Extraterrestrial traces and origin of life researches by astrobiological biosensors



### Evolution time line

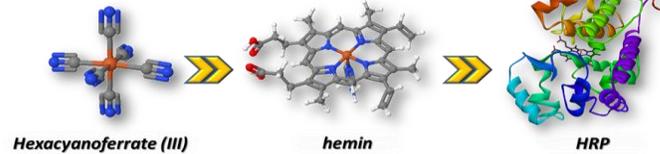


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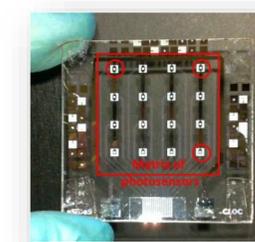
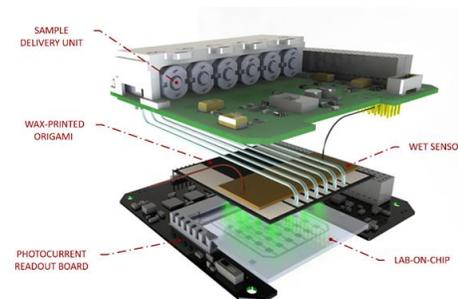
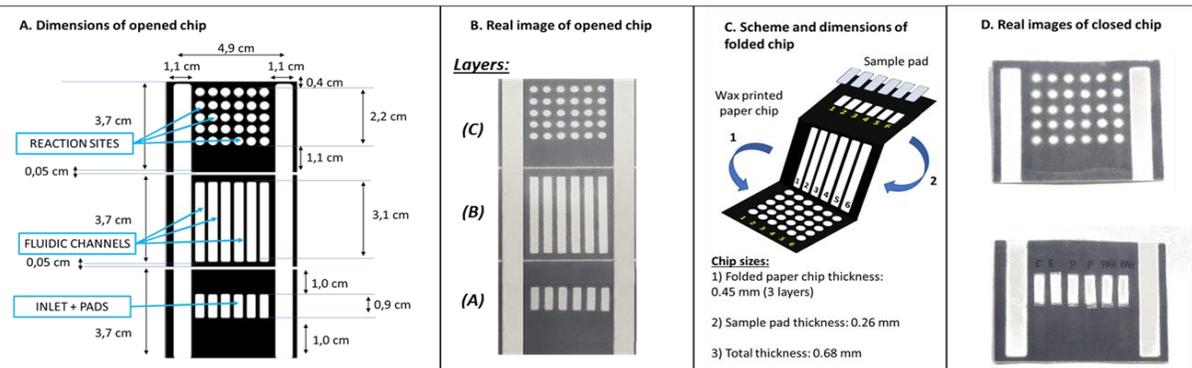
The **target applications** are:

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### Evolution of complexity of biorganic systems

The selected biomarkers of astrobiological interest are compounds at the basis of several fundamental biochemical reactions of life



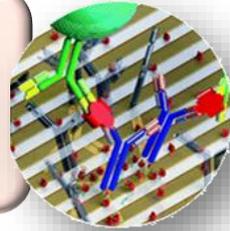
**Acknowledgments:** ABCS AstroBio-CubeSat is supported by ASI - Italian Space Agency ASI/INAF Agreement n. 2019-30-HH.0

# Biosensori per applicazioni nello Spazio

## MEDICINA NELLO SPAZIO

### APHRODITE

Autonomous PHotosensing Reusable  
Onboard Device for Immunological  
Tests Execution



### WEAR-ME!

sistema integrato miniaturizzato  
indossabile per il monitoraggio non  
invasivo del wound healing nell'astronauta

Beatrice Fraboni – Dipartimento di  
Fisica, Università di Bologna

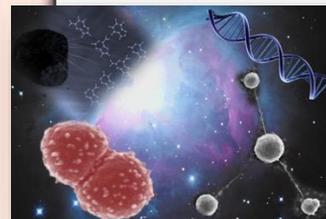


## ASTROBIOLOGIA

### BESIDES

BiomolEcular Signature DEtection System

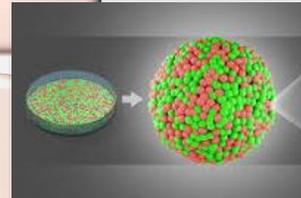
“Attività relative al supporto allo sviluppo di  
progetti/esperimenti scientifici nell'ambito  
dell'Astrobiologia”



## VALUTAZIONE EFFETTI RADIAZIONI SU SISTEMI BIOLOGICI

### ALCYONE

Autonomous Living Cell analYsis ON-chip for Evaluation  
of space Environment Effects:  
low-power integrated lab-on-chip for the assessment of  
radiation damage on living systems in nanosatellite missions  
nell'ambito del Programma Quadro HORIZON EUROPE



### BOREALIS

Biofilm Onboard Radiation Exposure Assessment  
Lab In Space

migliorare le tecniche di design degli schermi da radiazioni e  
le valutazioni dosimetriche in vari scenari di missione.