Finanziato dall'Unione europea NextGenerationEU
Ministero dell'Università e della Ricerca
Italiadomani PIANO NAZIONALE DI RIPRESA E RESILIENZA
agritech National Research Center for Technology in Agriculture

SMARTPHONE-BASED BIOSENSORS FOR BIOACTIVITY AND TOXICITY MONITORING TO VALORIZE AGRICULTURAL WASTE

Nazir F (University of Bologna), Gregucci D, Maiorano E, Calabretta MM, Michelini E

Department of Chemistry "Giacomo Ciamician", University of Bologna, Via Piero Gobetti 85, 40129, Bologna, Italy

ALMA MATER STUDIORUM UNIVERSITÀ DI BOLOGNA

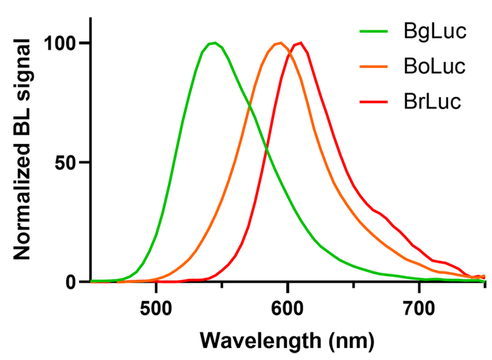
E-mail:
faisal.nazir@unibo.it elisa.michelini8@unibo.it

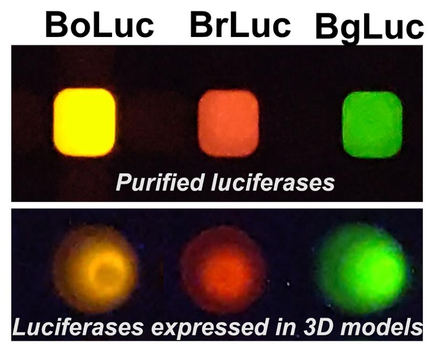
SPOKE, WP E TASK DI APPARTENENZA

SPOKE 8
WP 8.1 Producing new products to upgrade waste value
Task 8.1.1 Valorisation of the waste by green chemistry to obtain high value molecules or new products
Task 8.1.2 valorisation of the waste by biotechnology processes to obtain high value molecules or new products

NEW BIOLUMINESCENT TRACERS FOR BIOSENSORS

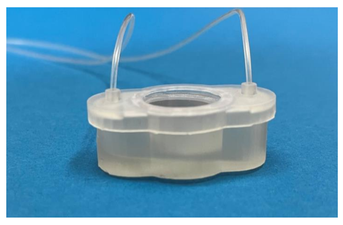
Bioluminescence (BL), i.e., the emission of light in living organisms, has become an indispensable tool for a plethora of applications including bioassays, biosensors, and in vivo imaging. Three synthetic luciferases, a green (BgLuc), an orange (BoLuc) and a red-emitting (BrLuc) luciferase, were designed and obtained to achieve high sensitivity and multiplexing capability for in vitro and in vivo biosensing.[1,2] All luciferases were characterized in terms of emission behaviour and thermal and pH stability showing promising features for biosensing

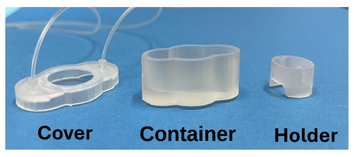


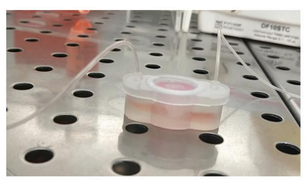


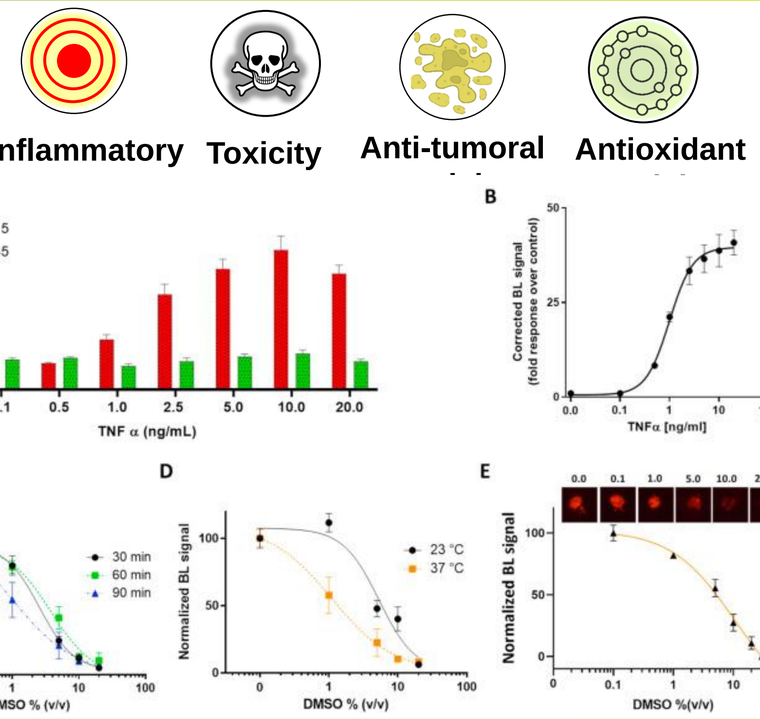
MICROFLUIDIC DEVICES FOR BIOACTIVITY TESTING OF AGRO-FOOD WASTE

Smartphone interfaced bioluminescence microfluidic tissue on-a-chip devices for multiplexed biosensing were developed for bioactivity evaluation of agro-food waste. The microfluidic chip can house co-cultures and microtissues and can be attached, via a 3D printed compact optical set-up to a portable microscope and the rear camera of a smartphone. 3D models can be obtained also at room temperature and non-controlled CO2 conditions.[3] The 3D microfluidic printed device is a cost-effective and sustainable tool for rapid analysis of 3D co-cultures and microtissues without the need of laboratory-grade microscopes, low-light detectors, or sophisticated optical set-ups, for rapid and cost-effective characterization of **bioactivity** and **cytotoxicity** of unknown samples from agricultural waste.



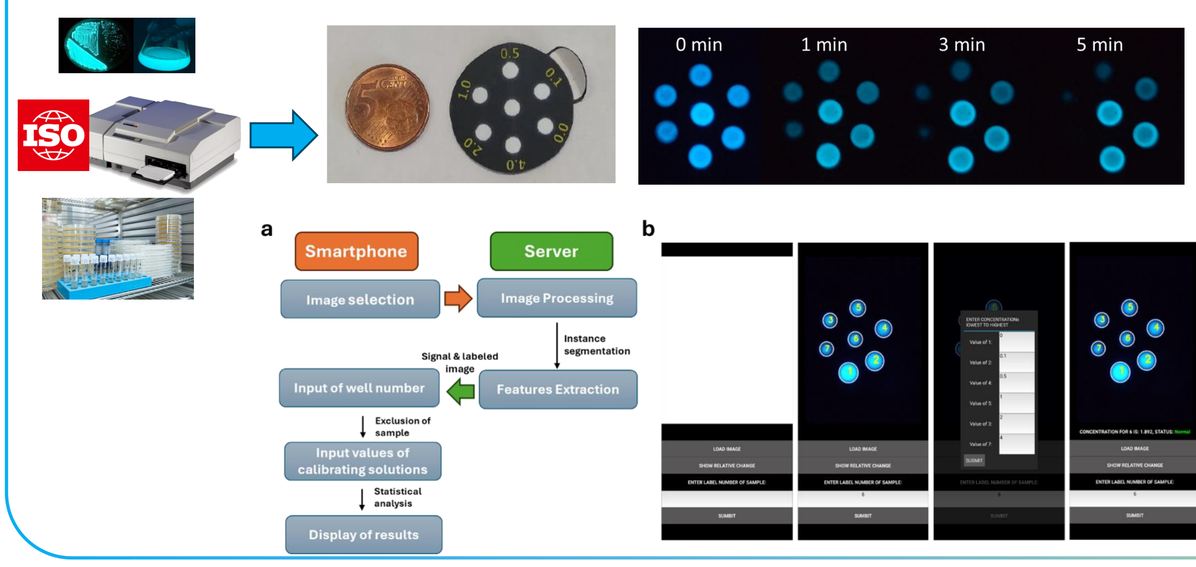




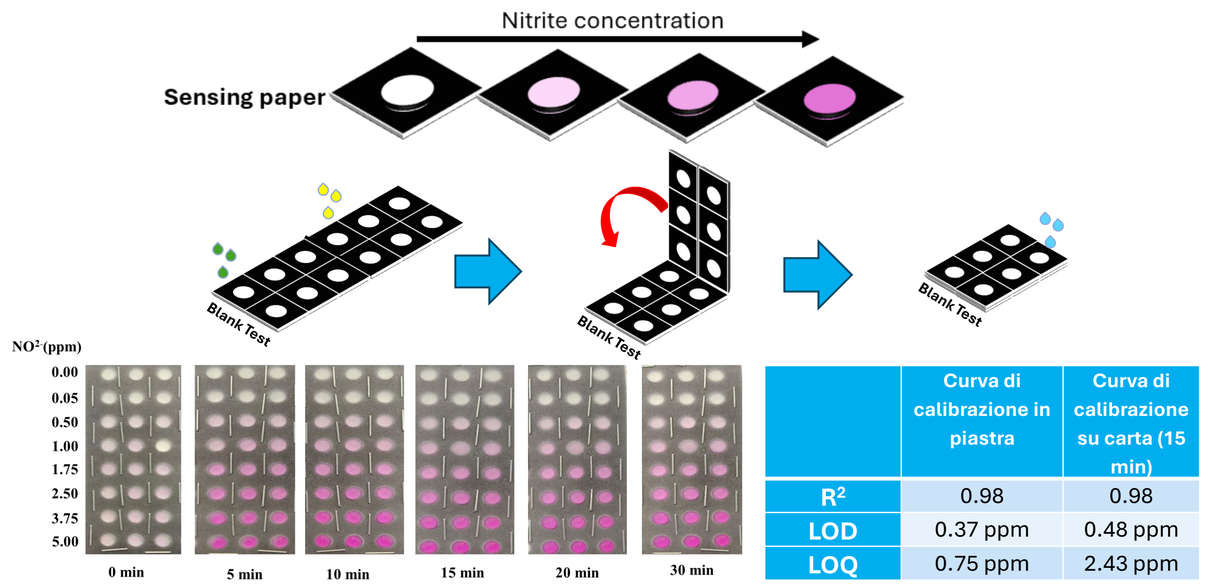


SMARTPHONE PAPER BIOSENSORS FOR TOXICITY ASSESSMENT AND NITRITE DETECTION

Bioluminescent Aliivibrio fischeri bacteria were immobilized onto a paper-based support to obtain a low-cost and user-friendly toxicity biosensor. A customized artificial intelligence-guided application was developed for rapid user-friendly analysis.



The Griess reaction was exploited for the development of a paper-based sensor based on a colorimetric detection for the monitoring of nitrite ions.



	Curva di calibrazione in piastra	Curva di calibrazione su carta (15 min)
R^2	0.98	0.98
LOD	0.37 ppm	0.48 ppm
LOQ	0.75 ppm	2.43 ppm

REFERENZE

1. Calabretta, M. M., Gregucci, D., Martínez-Pérez-Cejuela, H., & Michelini, E. (2022). A Luciferase Mutant with Improved Brightness and Stability for Whole-Cell Bioluminescent Biosensors and In Vitro Biosensing. Biosensors, 12(9), 742.
2. Calabretta, M. M., Gregucci, D., & Michelini, E. (2023). New synthetic red- and orange-emitting luciferases to upgrade in vitro and 3D cell biosensing. The Analyst, 148(22), 5642–5649.
3. Calabretta, M. M., Gregucci, D., Guardigli, M., & Michelini, E. (2024). Low-cost and sustainable smartphone-based tissue-on-chip device for bioluminescence biosensing. Biosensors & bioelectronics, 261, 116454.

This study was carried out within the Agritech National Research Center and received funding from the European Union Next-GenerationEU (PIANO NAZIONALE DI RIPRESA E RESILIENZA (PNRR) – MISSIONE 4 COMPONENTE 2, INVESTIMENTO 1.4 – D.D. 1032 17/06/2022, CN00000022). This manuscript reflects only the authors' views and opinions, neither the European Union nor the European Commission can be considered responsible for them.