Micromotores Janus para aplicaciones de última generación en clínica y seguridad alimentaria

Beatriz Jurado Sánchez

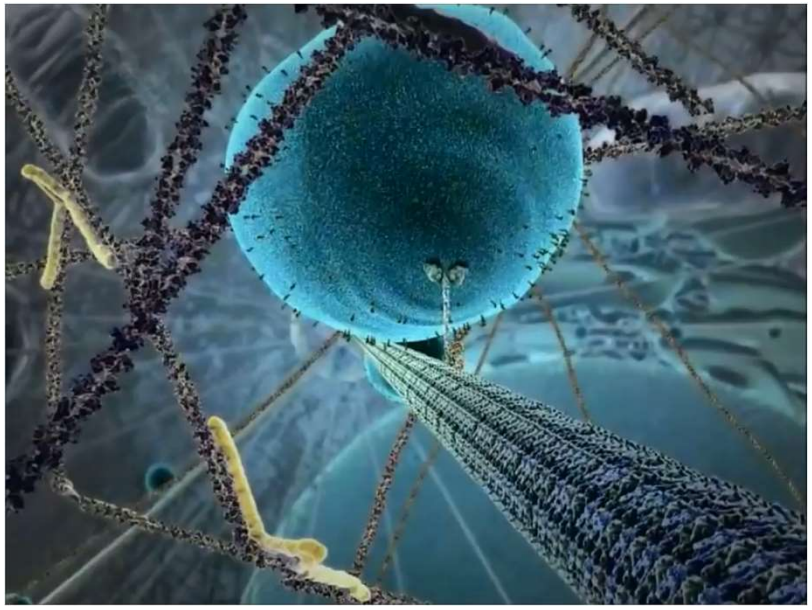
Universidad de Alcalá

Grupo de Investigación “Miniaturización y Nanotecnología Analíticas”

¿Qué es un micromotor?

Micro/nanodispositivos que pueden convertir energía en movimiento con el propósito de realizar varias tareas

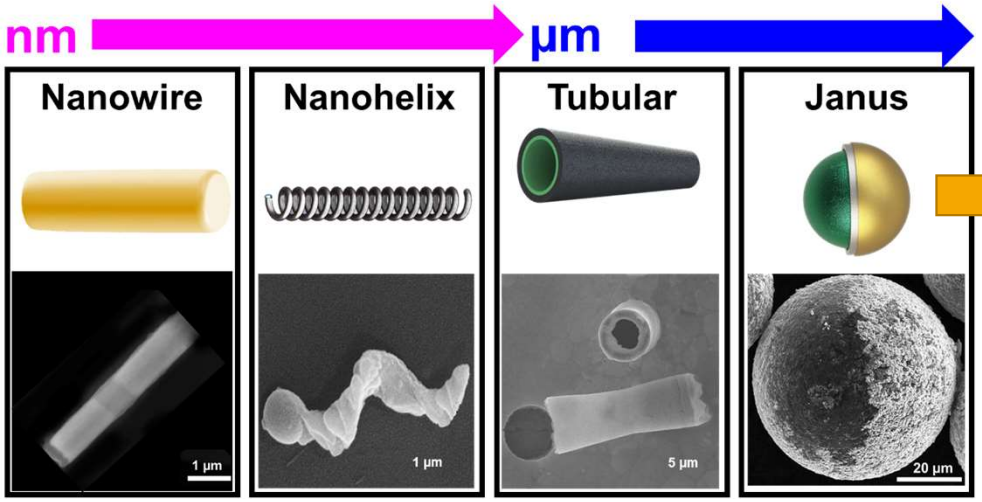
PROTEINAS NATURALES



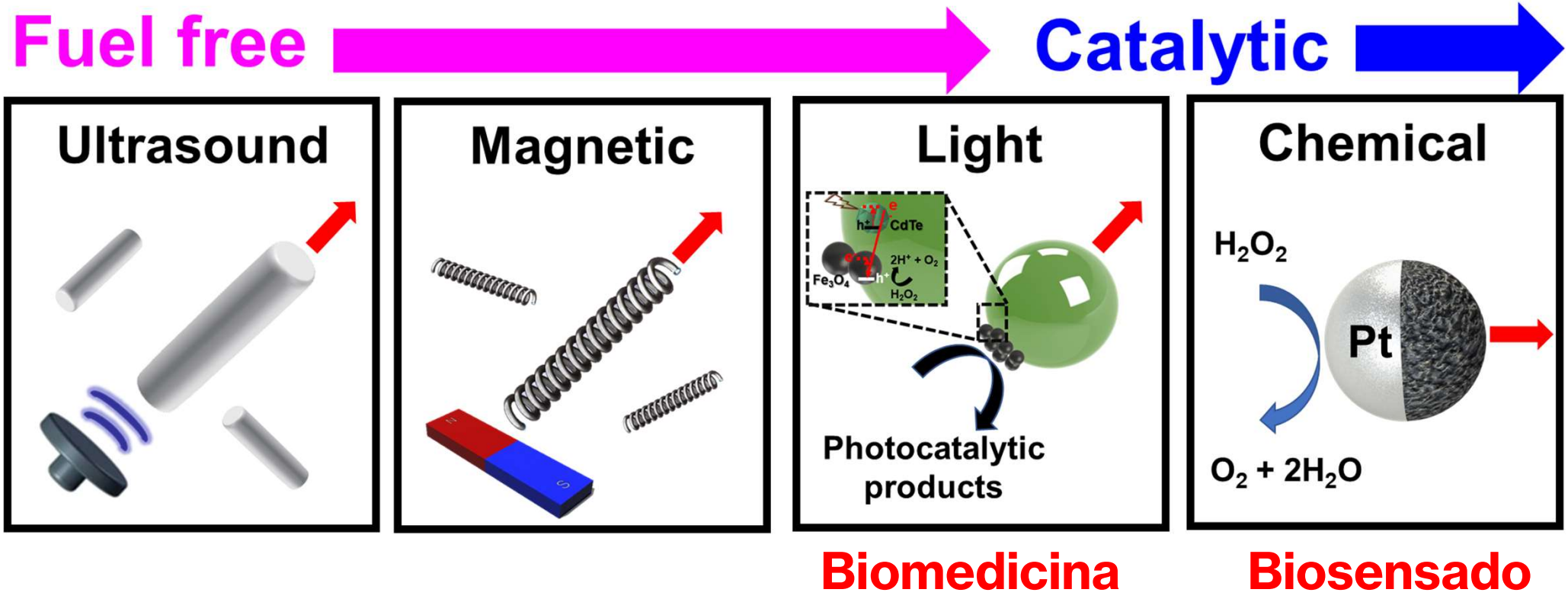
MICROMOTORES

Tipos de micromotores

Janus



Modos de propulsion



Detección de endotoxinas bacterianas: clínica y control alimentario

- **DETECCIÓN DE ENDOTOXINAS BACTERIANAS: TOXINA DE E. COLI , S. ENTERICA Y CÓLERA**

GDCh **Communications** Angewandte International Edition Chemie

Biosensors

International Edition: DOI: 10.1002/anie.201701396
German Edition: DOI: 10.1002/ange.201701396

Magnetocatalytic Graphene Quantum Dots Janus Micromotors for Bacterial Endotoxin Detection

Beatriz Jurado-Sánchez[+], Marta Pacheco[+], Jaime Rojo[+], and Alberto Escarpa**

analytical chemistry

Article

Cite This: *Anal. Chem.* 2018, 90, 2912−2917

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Sensitive Monitoring of Enterobacterial Contamination of Food Using Self-Propelled Janus Microsensors

M. Pacheco,[‡] B. Jurado-Sánchez,*[,‡,∥] and A. Escarpa*[,‡,∥]

Biosensors and Bioelectronics 165 (2020) 112286

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Biosensors and Bioelectronics

journal homepage: http://www.elsevier.com/locate/bios

ELSEVIER

Engineering Janus micromotors with WS_2 and affinity peptides for turn-on fluorescent sensing of bacterial lipopolysaccharides

Marta Pacheco[a], Víctor de la Asunción-Nadal[a], Beatriz Jurado-Sánchez[a,b,**], Alberto Escarpa[a,b,*]

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Research Article

Janus Micromotors Coated with 2D Nanomaterials as Dynamic Interfaces for (Bio)-Sensing

Kaisong Yuan, Miguel Ángel López, Beatriz Jurado-Sánchez,* and Alberto Escarpa*

Cite This: *ACS Appl. Mater. Interfaces* 2020, 12, 46588−46597

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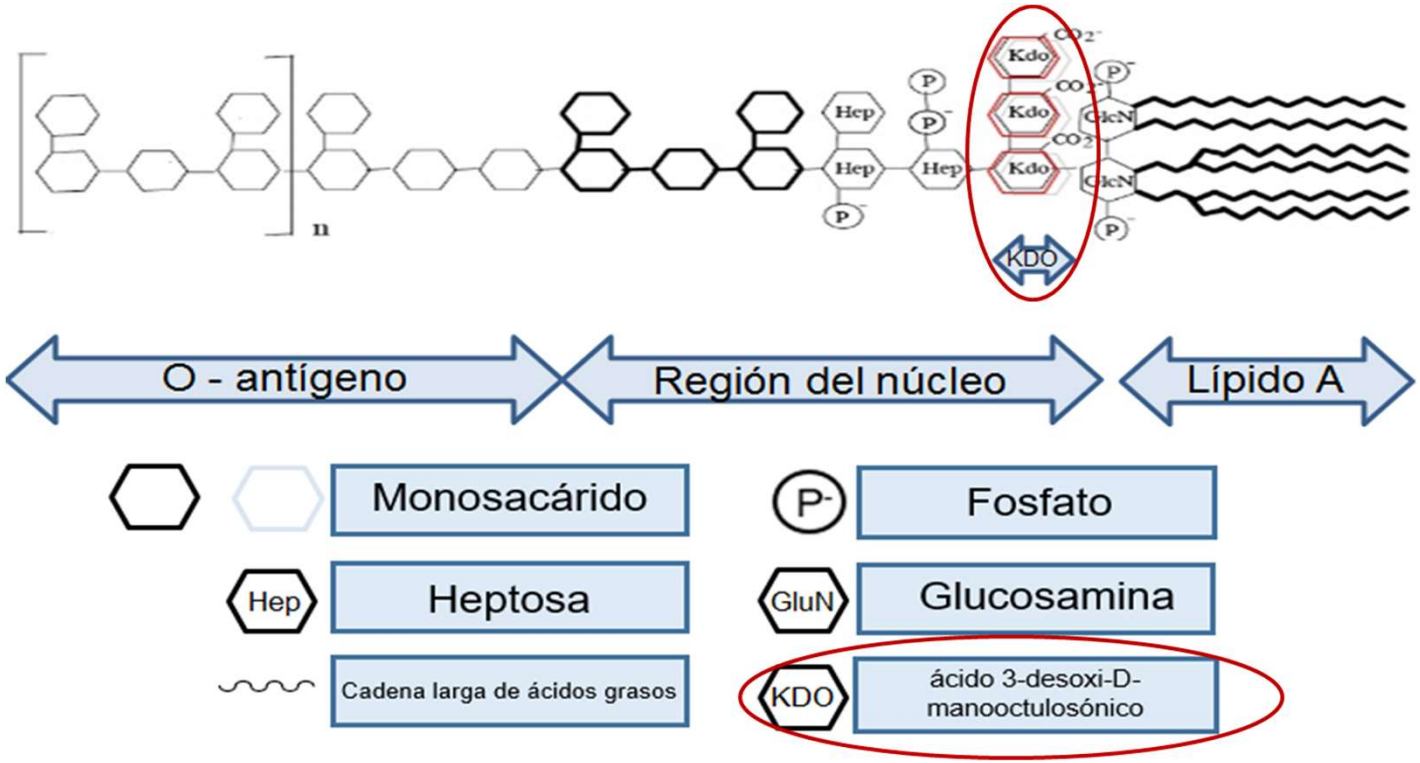
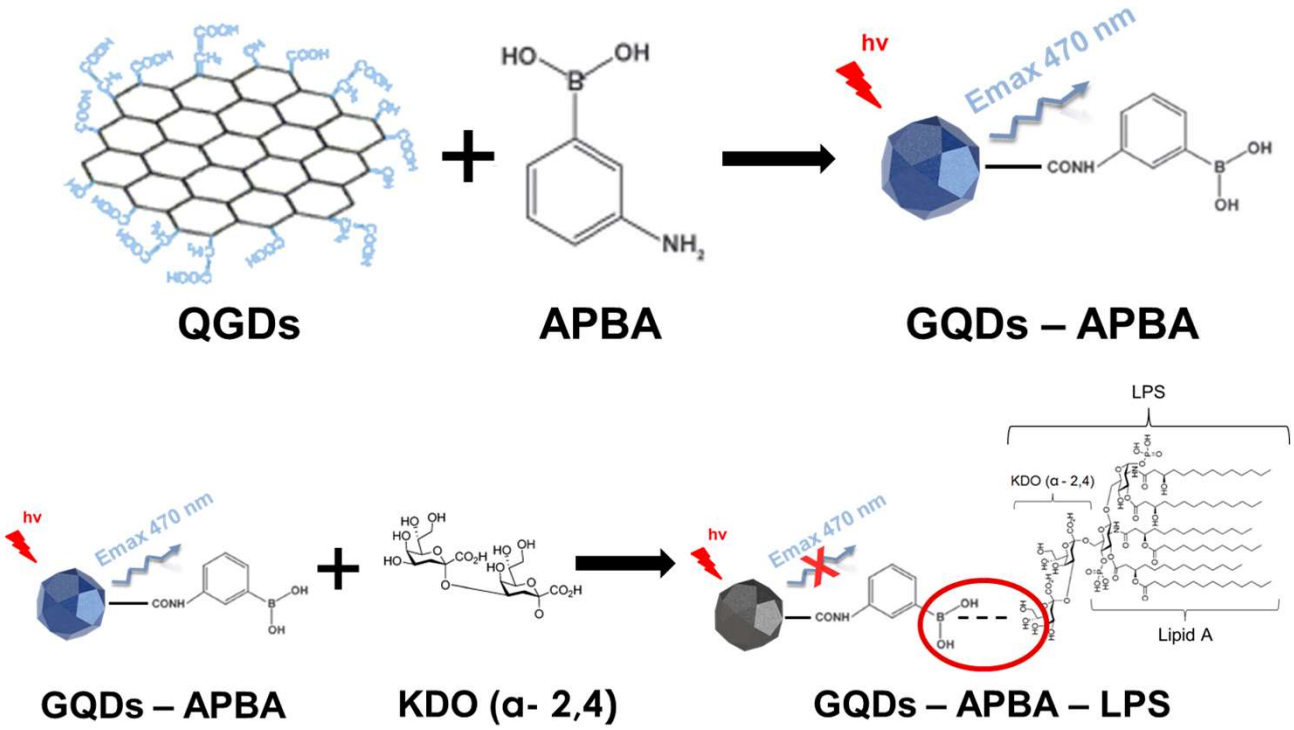
DETECCIÓN DE ENDOTOXINAS BACTERIANAS CON MICROMOTORES JANUS MODIFICADOS CON QDS

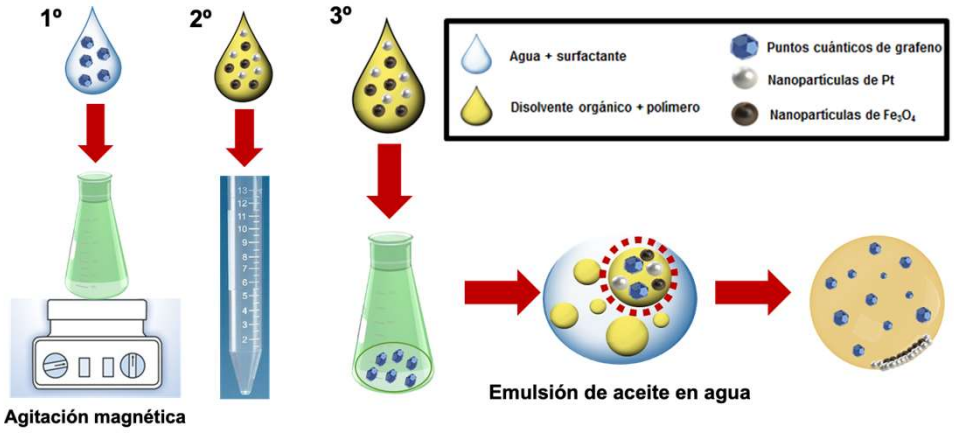
Estructura de las endotoxinas

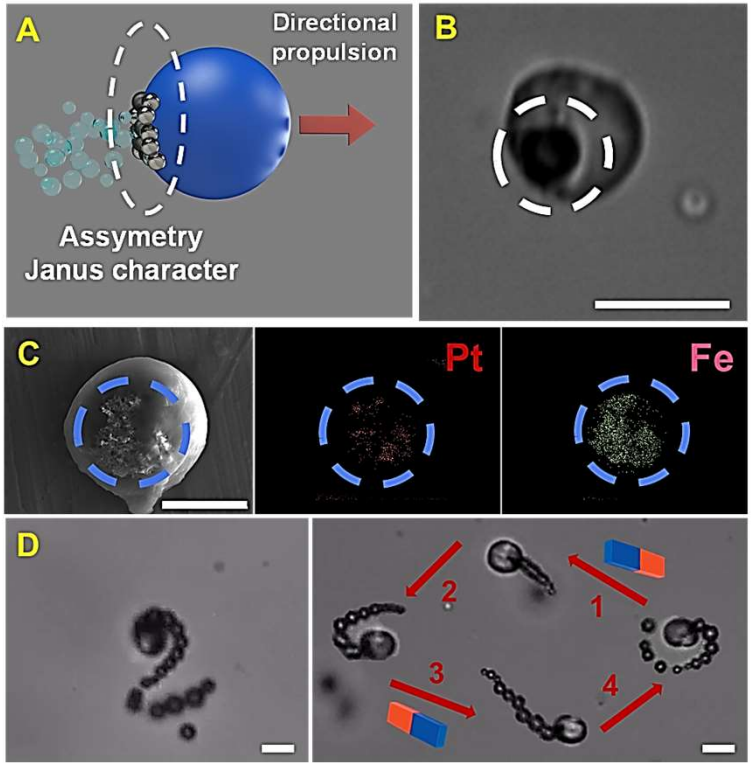


Estrategia 1: El principio

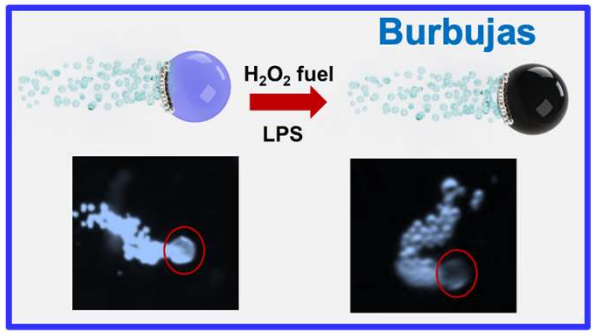


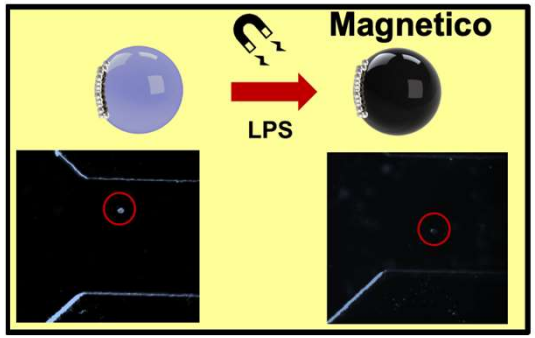
Síntesis de los micromotores

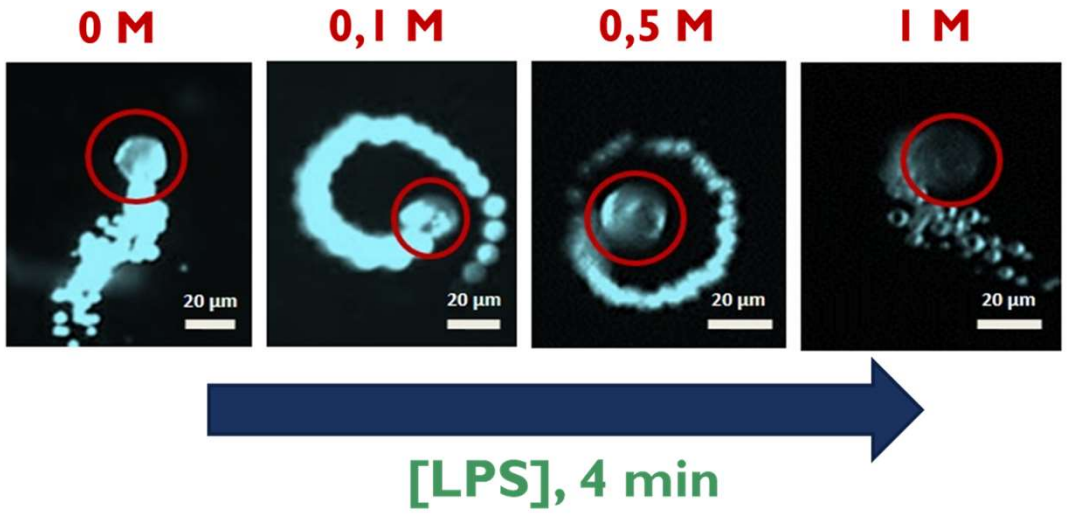




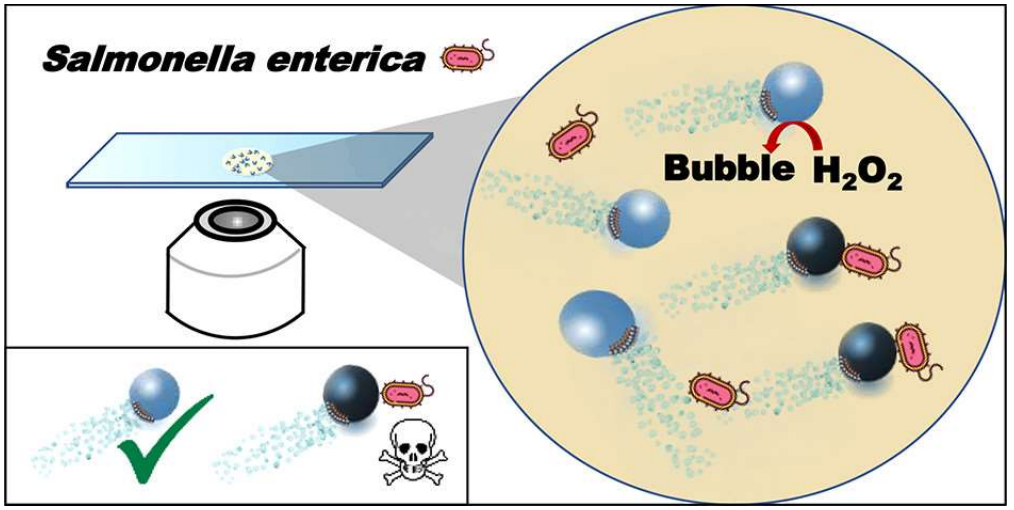
Detección ON-OFF endotoxina E. Coli

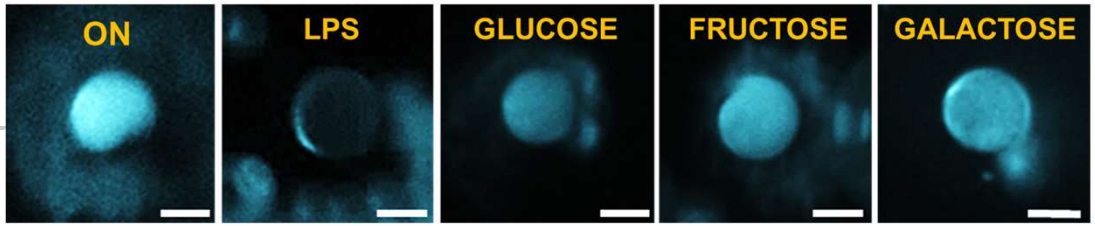


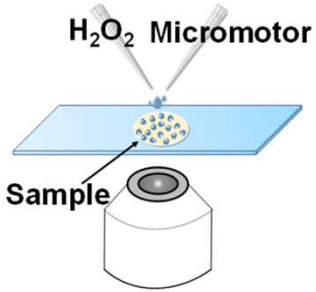


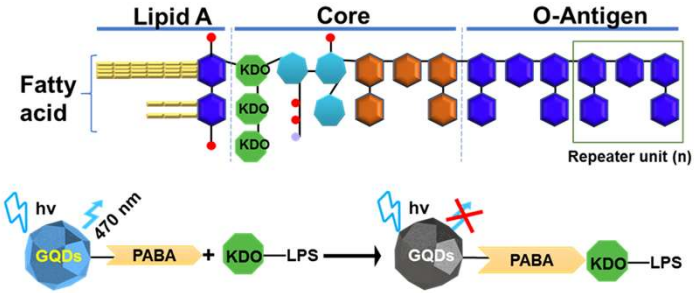


Detección ON-OFF endotoxina S. Enterica

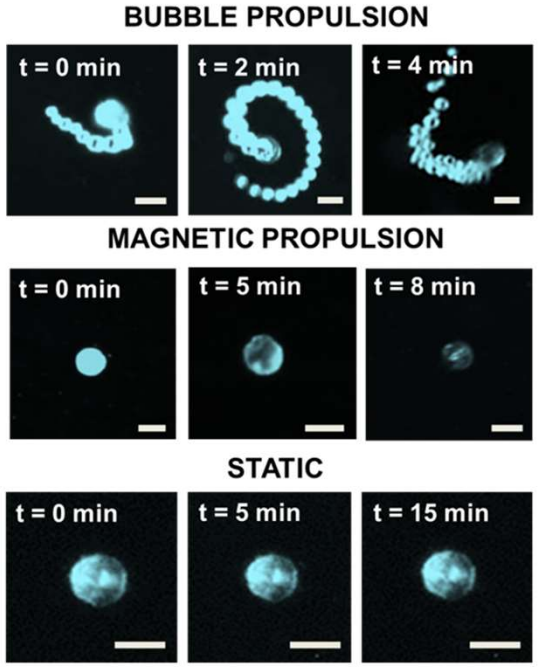


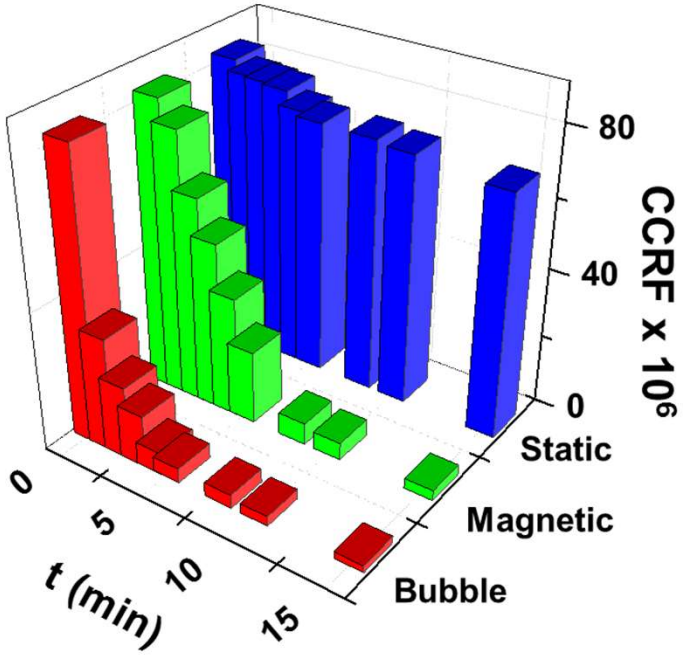


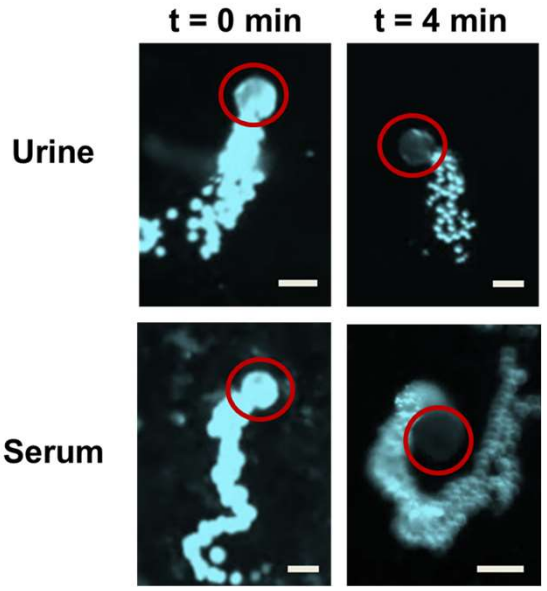





Bubble propulsion

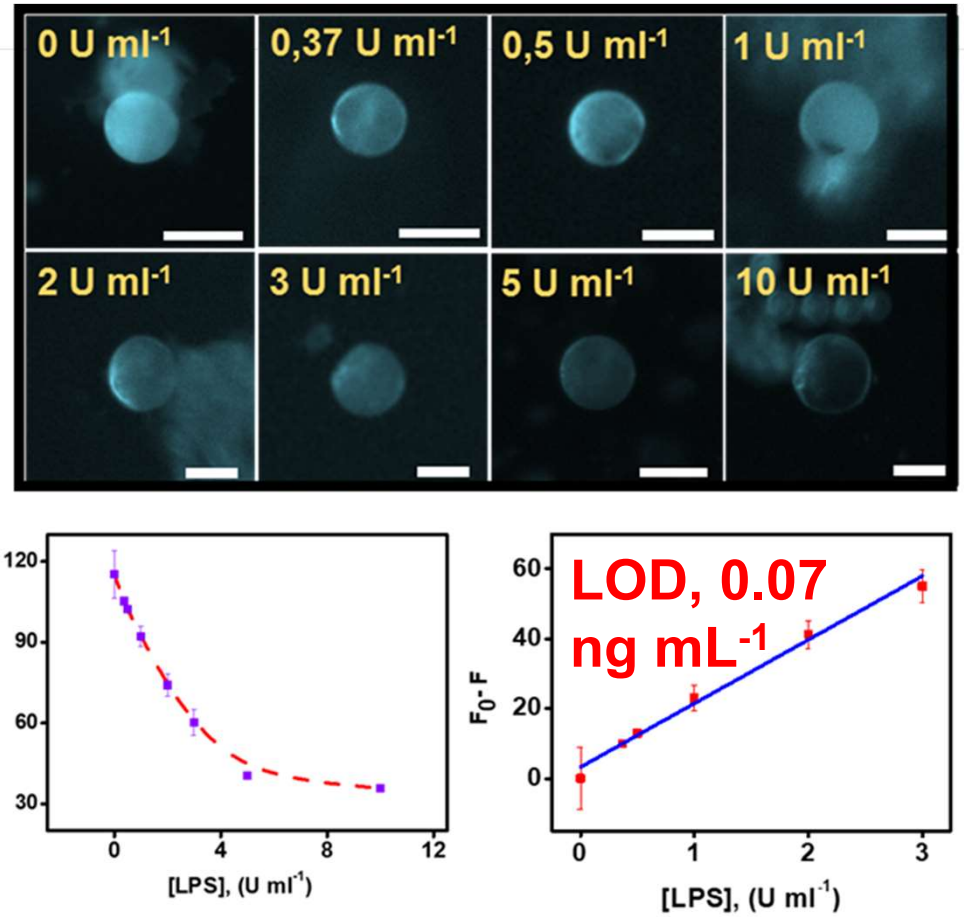


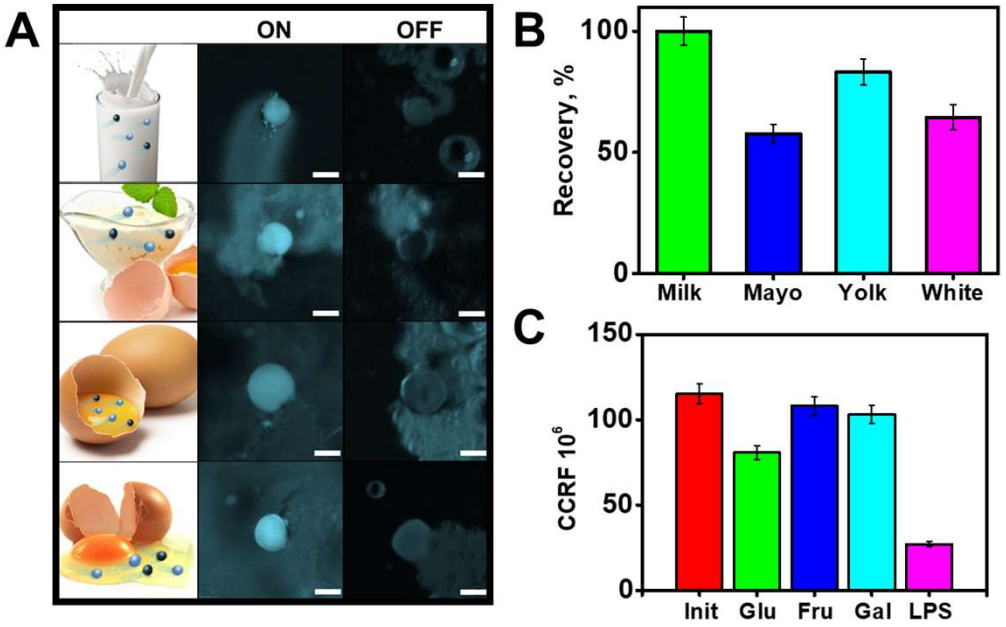


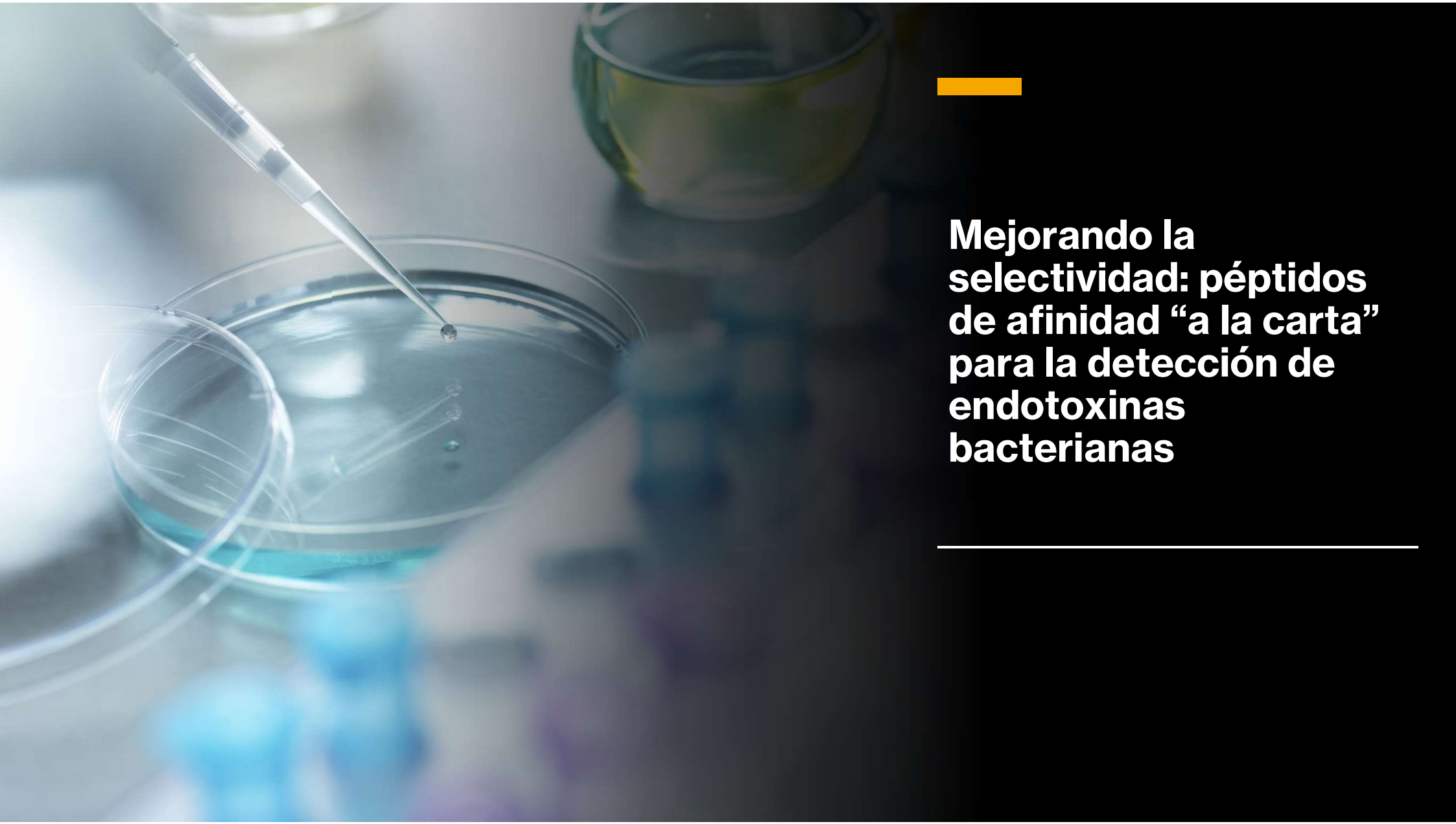


¿Porqué los Janus? Mezcla mejorada de fluidos, reducción tiempos de detección

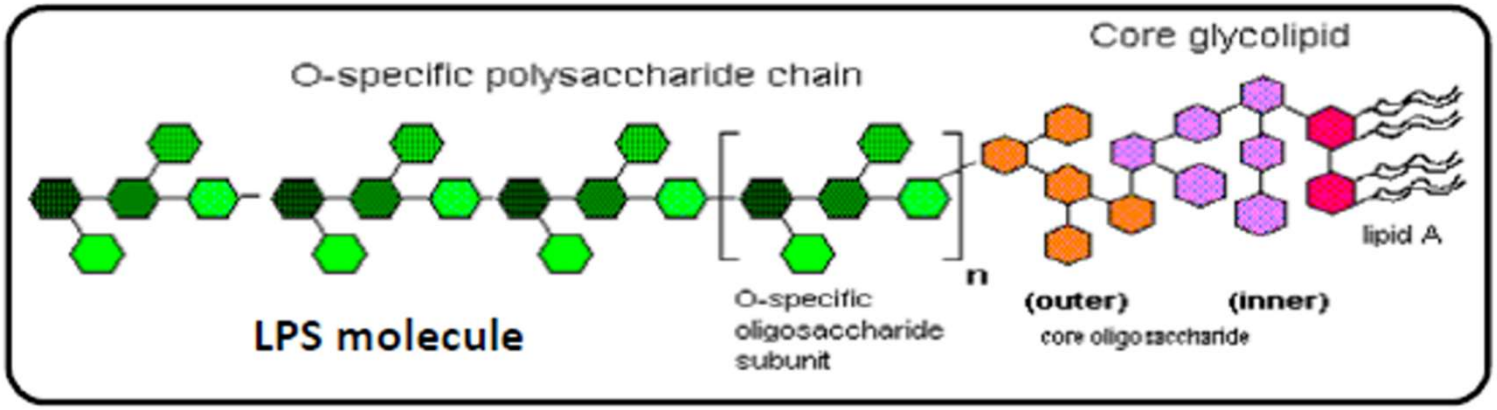
Aplicación en muestras reales



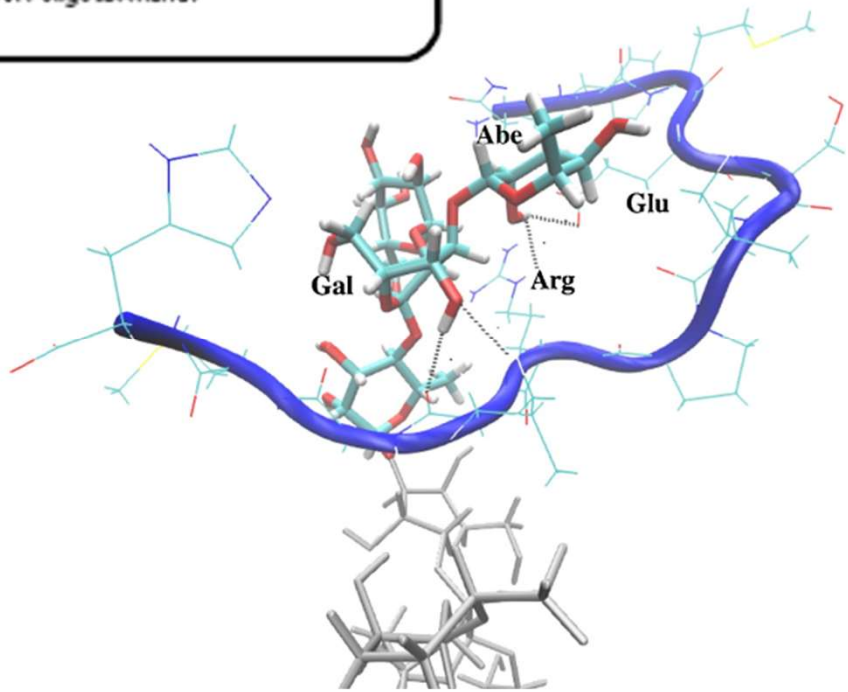




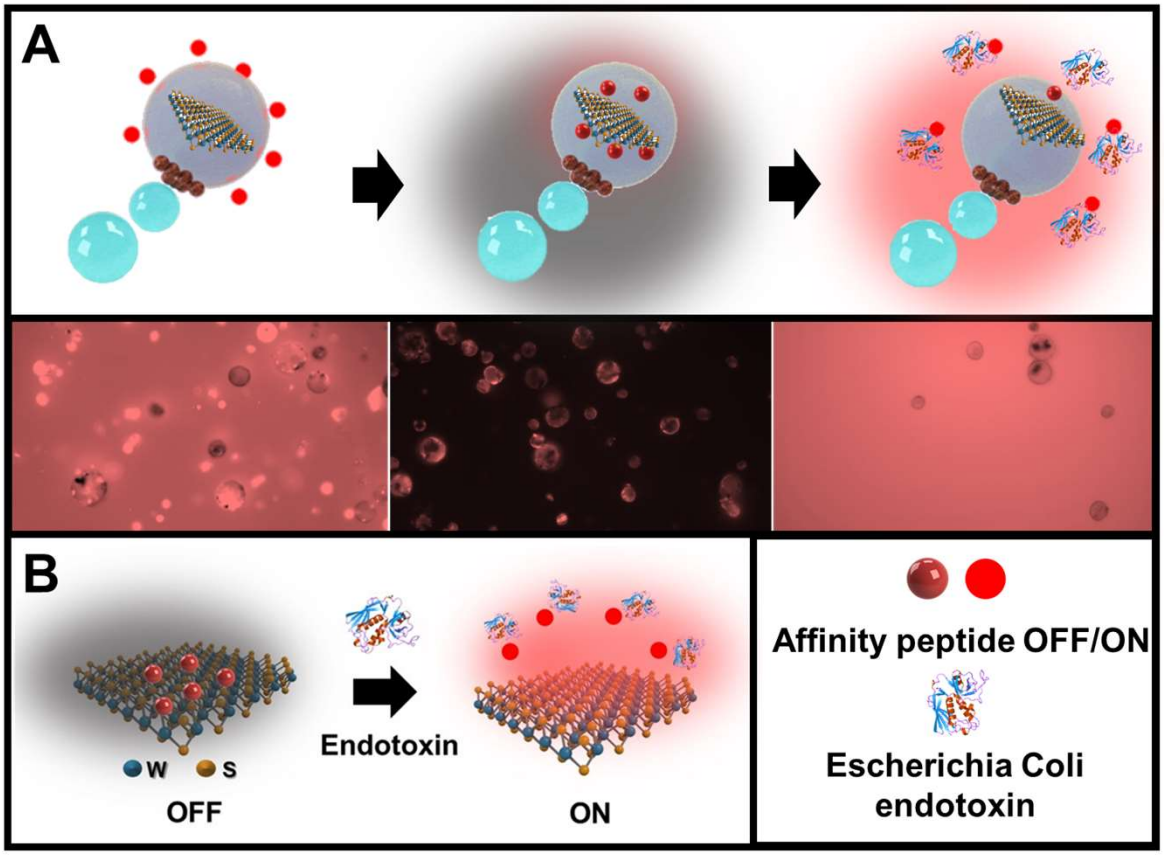
Mejorando la selectividad: péptidos de afinidad “a la carta” para la detección de endotoxinas bacterianas



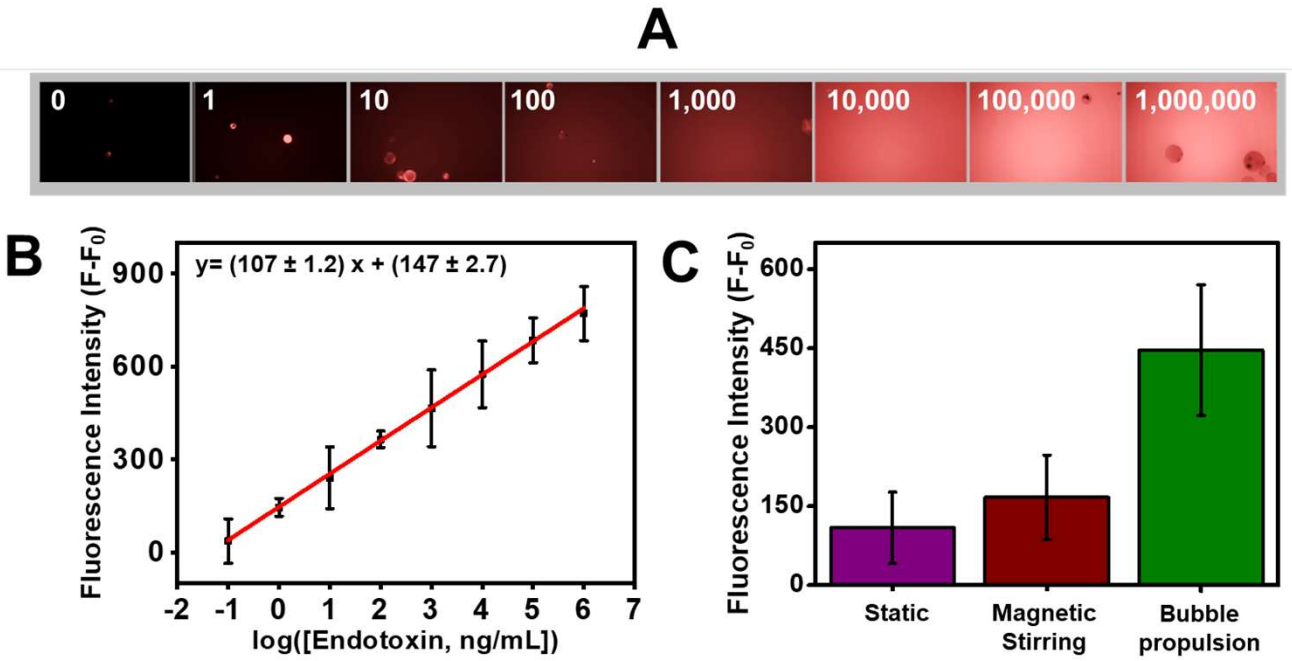
“Huella dactilar”
Diseño en laboratorio, región específica y diferencial de la



Detección OFF-ON endotoxina E. Coli

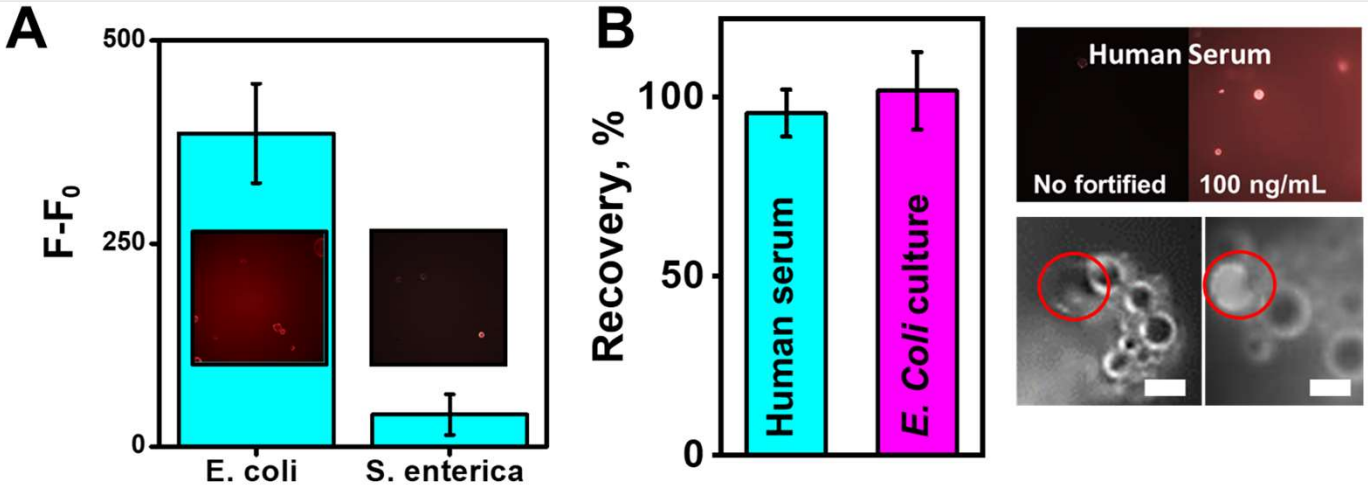


CALIBRADO Y SELECTIVIDAD



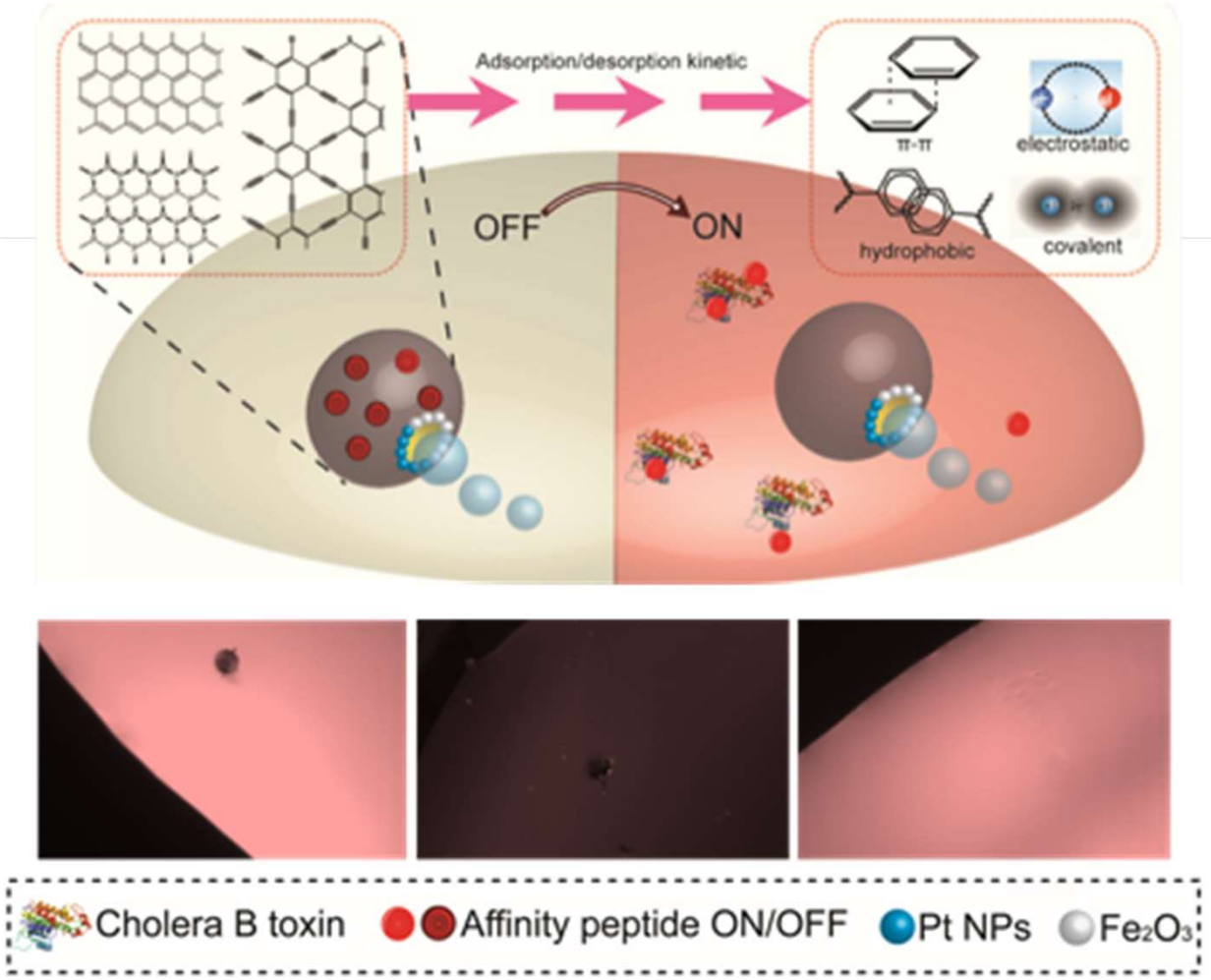
LOD, ng/mL	LOQ, ng/mL	Linear range, ng/mL	r
1.2	3.9	4.0-1,000,000	0.999

APLICACIÓN A MUESTRAS REALES
VALIDACIÓN VS GOLD STANDARD



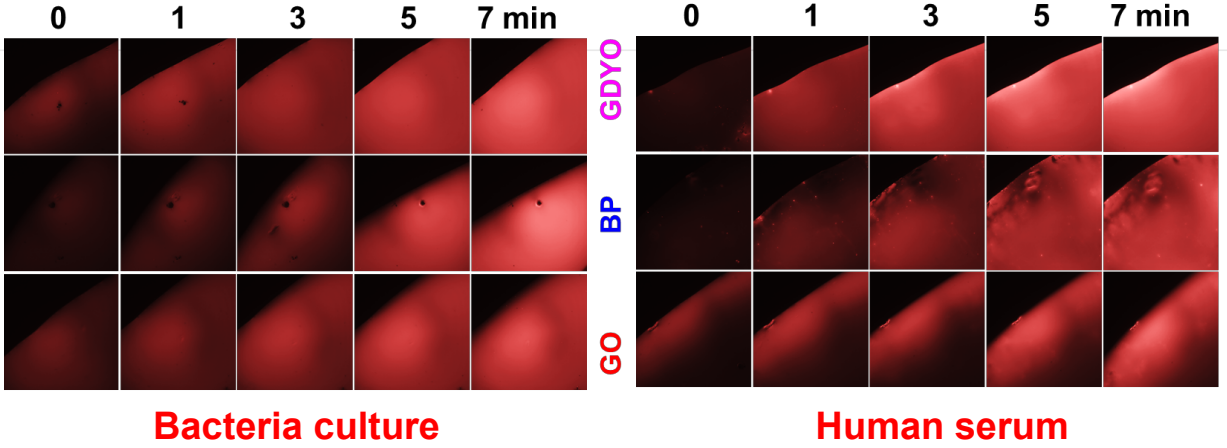
Escherichia Coli culture	[E.Coli endotoxin], ng/mL
WS_2 –peptide Janus microsensor	4.59 ± 0.80
Limulus amebocyte lysate test	4.50 ± 0.75

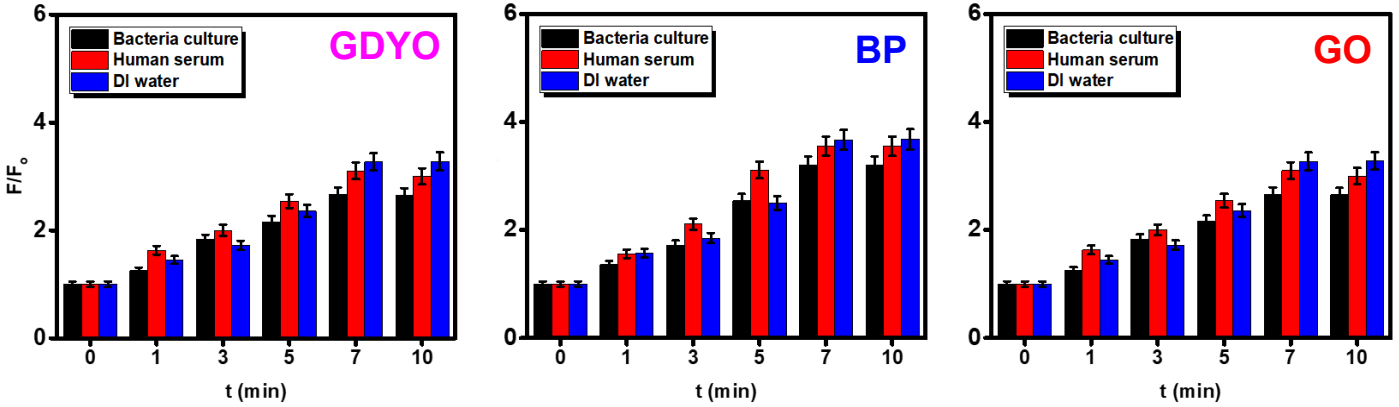
Detección OFF-ON toxina de cólera B



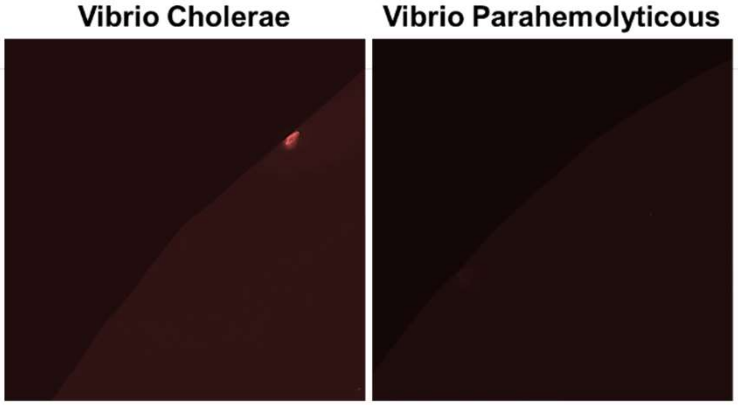

S4 Video
Multiple micromotor navigation

Detección en muestras biológicas

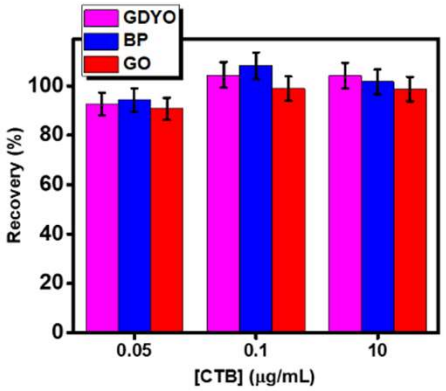


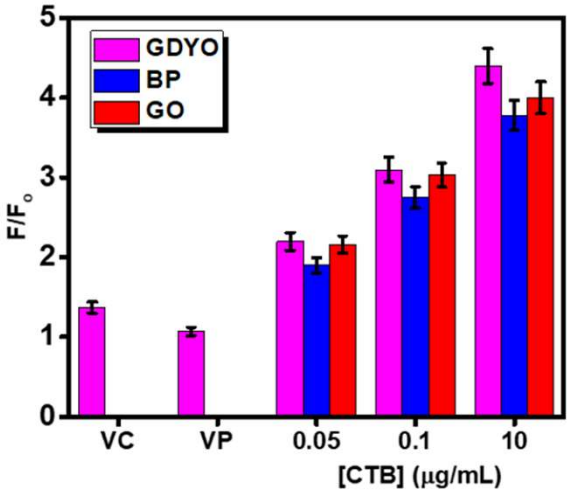


Detección en cultivos reales



High selectivity!!!!





Captura selectiva de bacterias y endotoxinas bacterianas

- **MICROMOTORES JANUS PROPULSADOS POR MECANISMOS BIOCOMPATIBLES**

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How to cite: *Angew. Chem. Int. Ed.* **2021**, *60*, 4915–4924
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German Edition: doi.org/10.1002/ange.202011617

Dual-Propelled Lanbiotic Based Janus Micromotors for Selective Inactivation of Bacterial Biofilms

Kaisong Yuan, Beatriz Jurado-Sánchez, and Alberto Escarpa**

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Micromotors

International Edition: DOI: 10.1002/anie.201910053
German Edition: DOI: 10.1002/ange.201910053

Visible-Light-Driven Janus Microvehicles in Biological Media

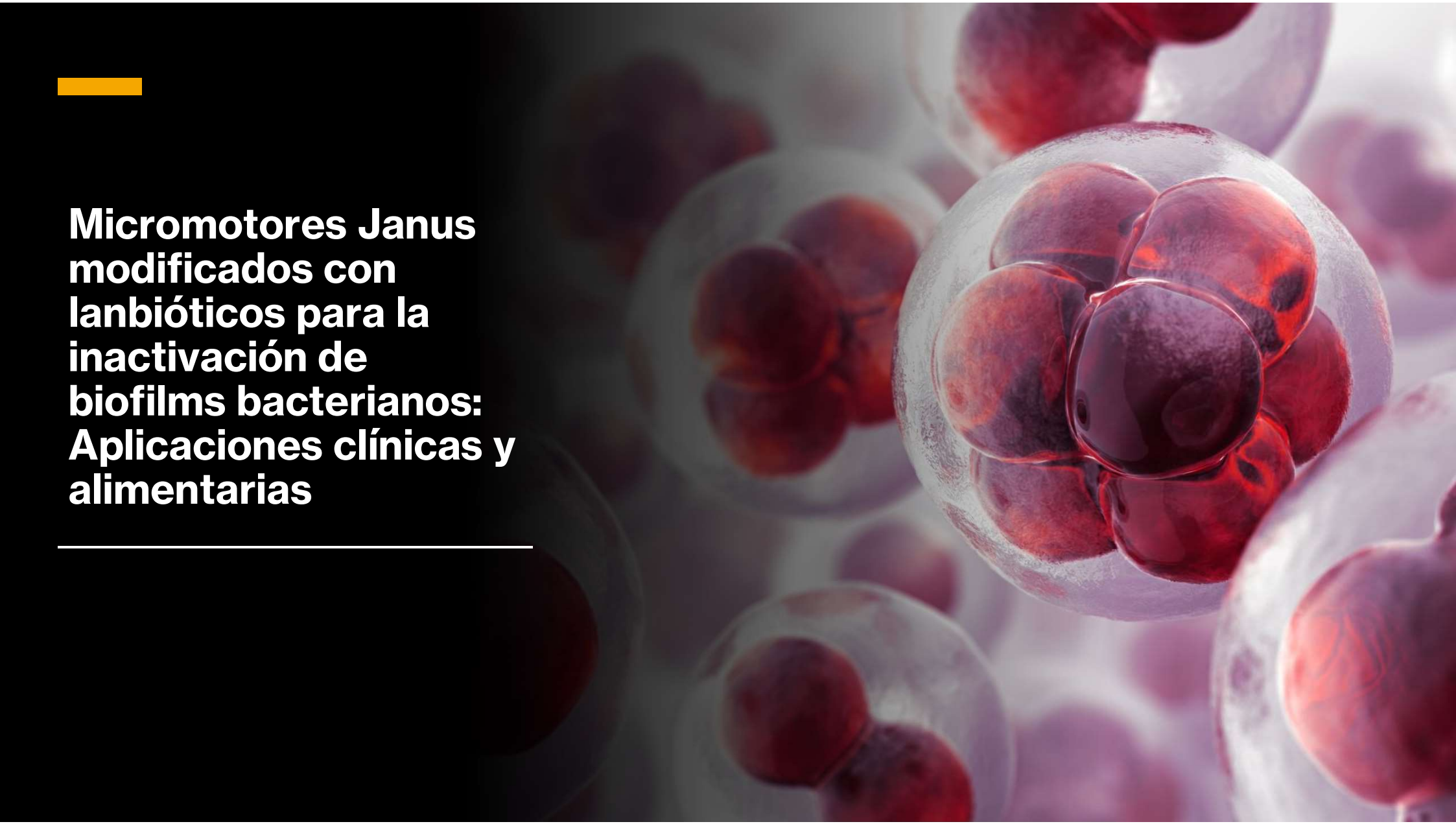
Marta Pacheco, Beatriz Jurado-Sánchez, and Alberto Escarpa**

WILEY-VCH

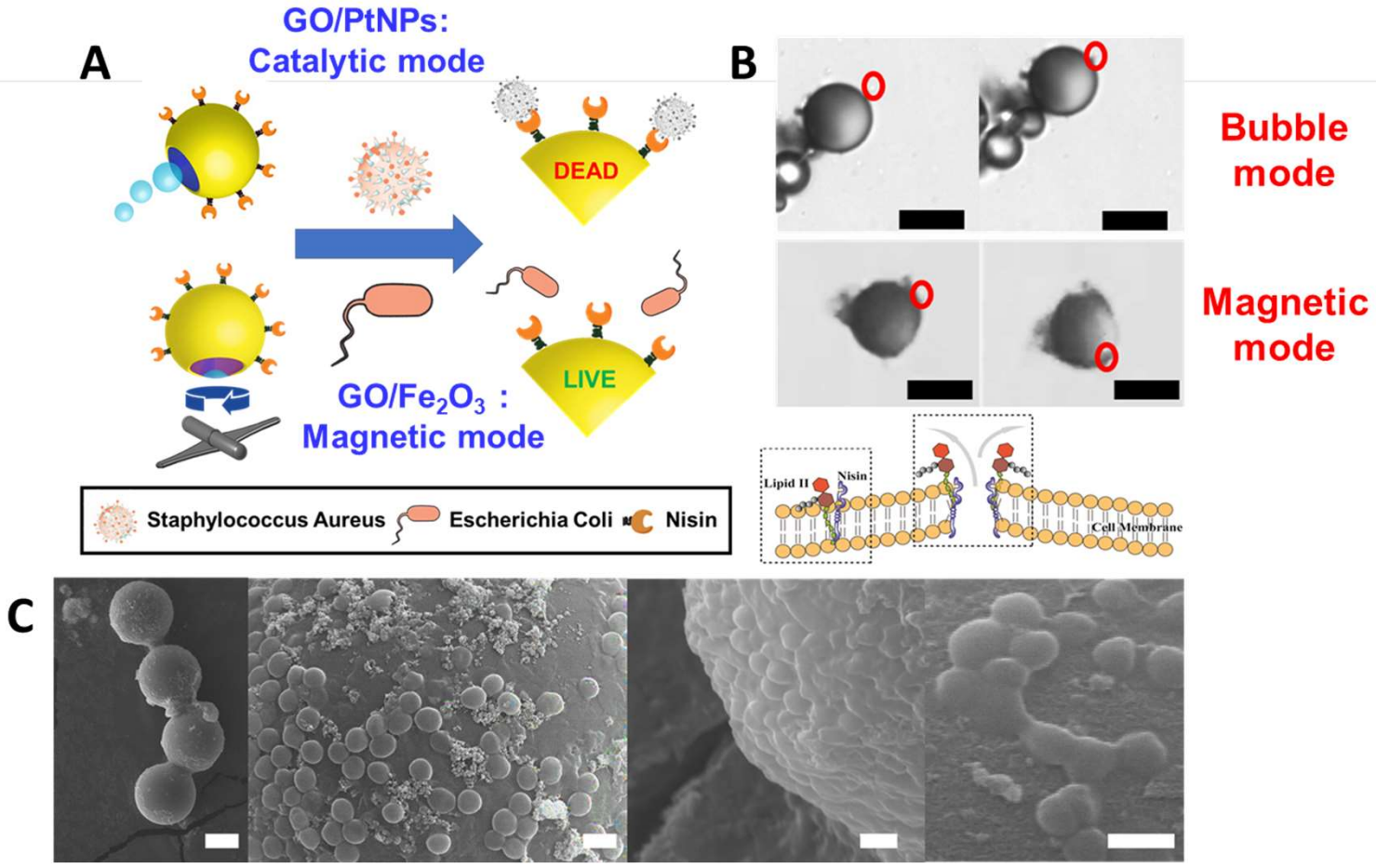
Functional coatings enable navigation of light-propelled micromotors in blood for effective biodetoxification

Marta Pacheco, Beatriz Jurado-Sánchez and Alberto Escarpa**

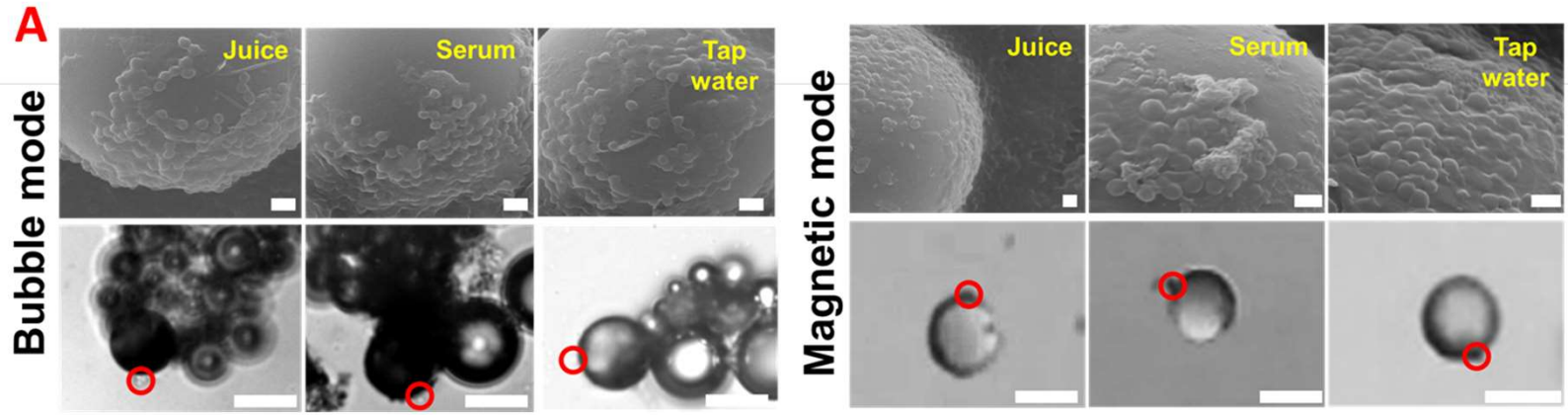
Micromotores Janus modificados con lanbióticos para la inactivación de biofilms bacterianos: Aplicaciones clínicas y alimentarias

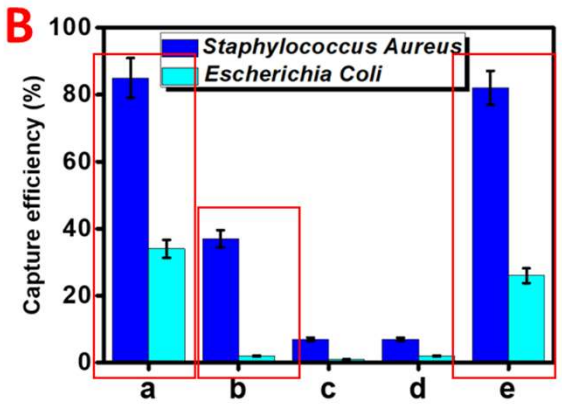


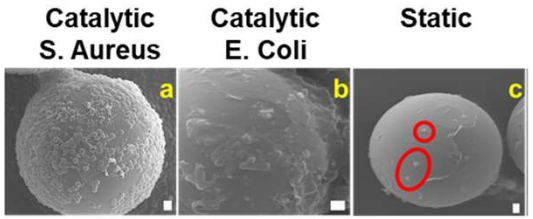
Estrategia


A
GO/PtNPs:
Catalytic mode
DEAD
LIVE
GO/Fe2O3 :
Magnetic mode
Staphylococcus Aureus
Escherichia Coli
Nisin
B
Bubble
mode
Magnetic
mode
Lipid II
Nisin
Cell Membrane
C

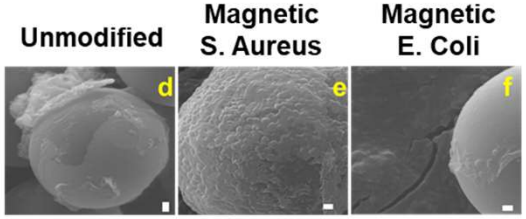
Captura selectiva de bacterias



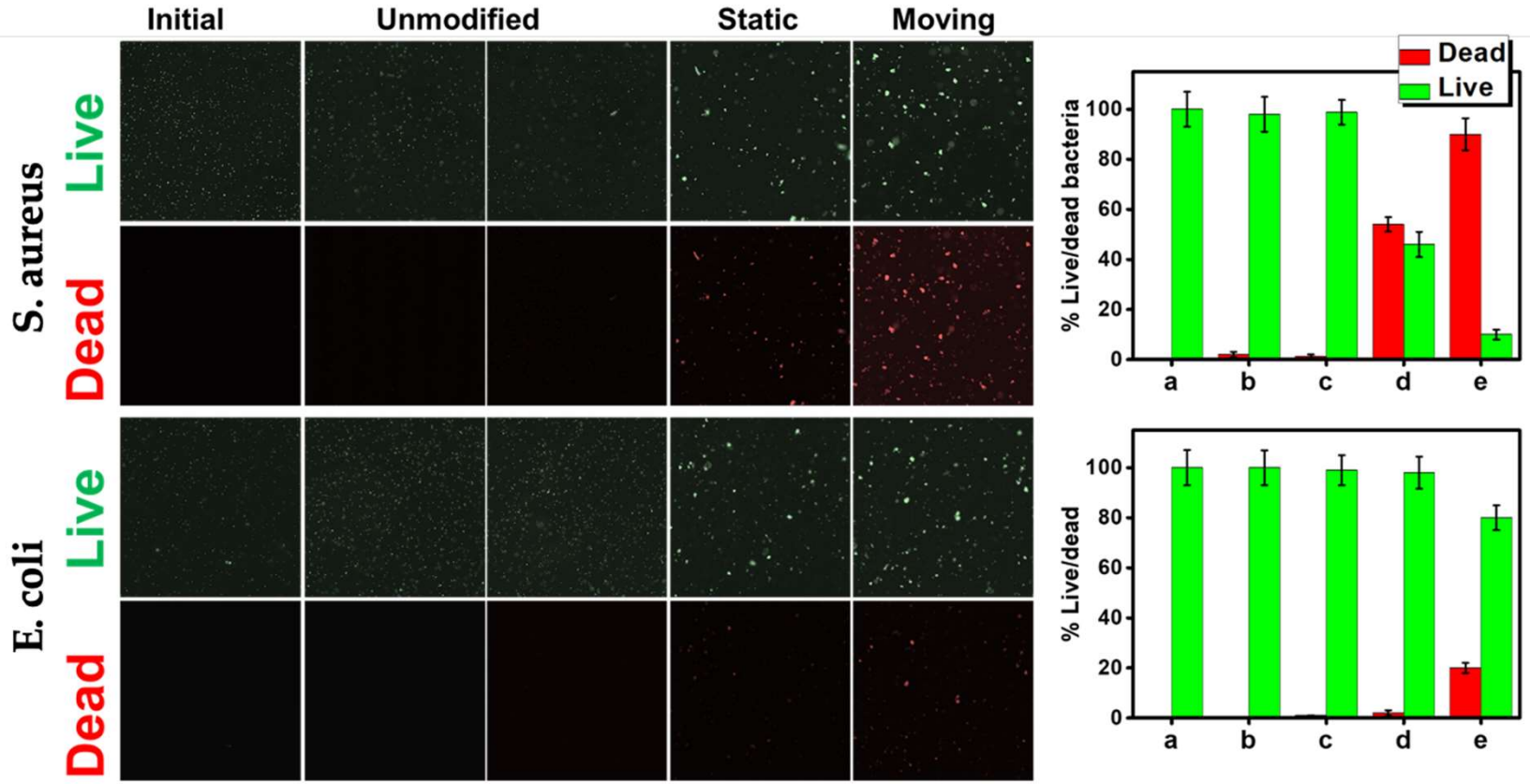




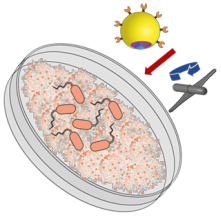
a) moving (catalytic mode);
b) static
c) Unmodified catalytic
d) unmodified magnetic
e) moving (magnetic mode).



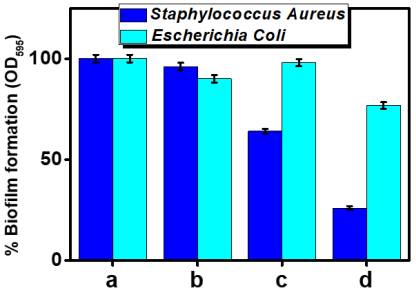
Inactivación selectiva de bacterias

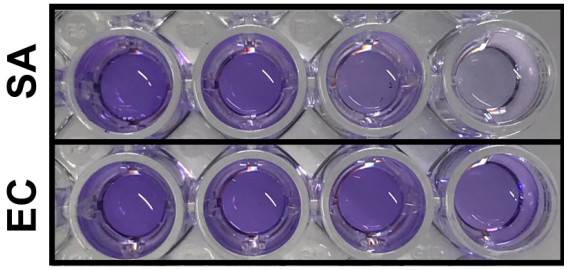


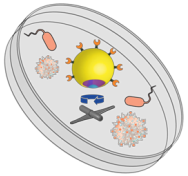
Inactivación selectiva de biofilms



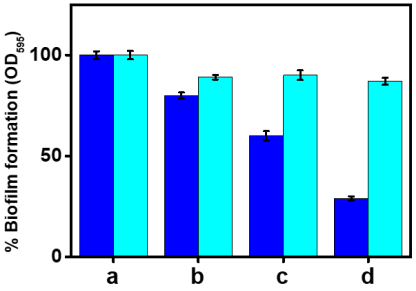
Fast killing

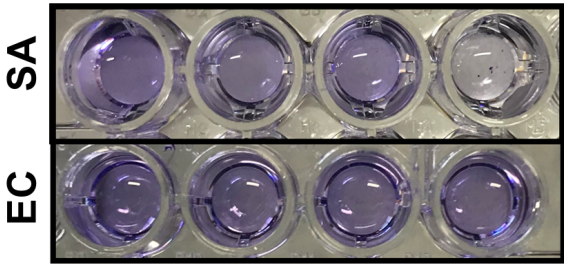


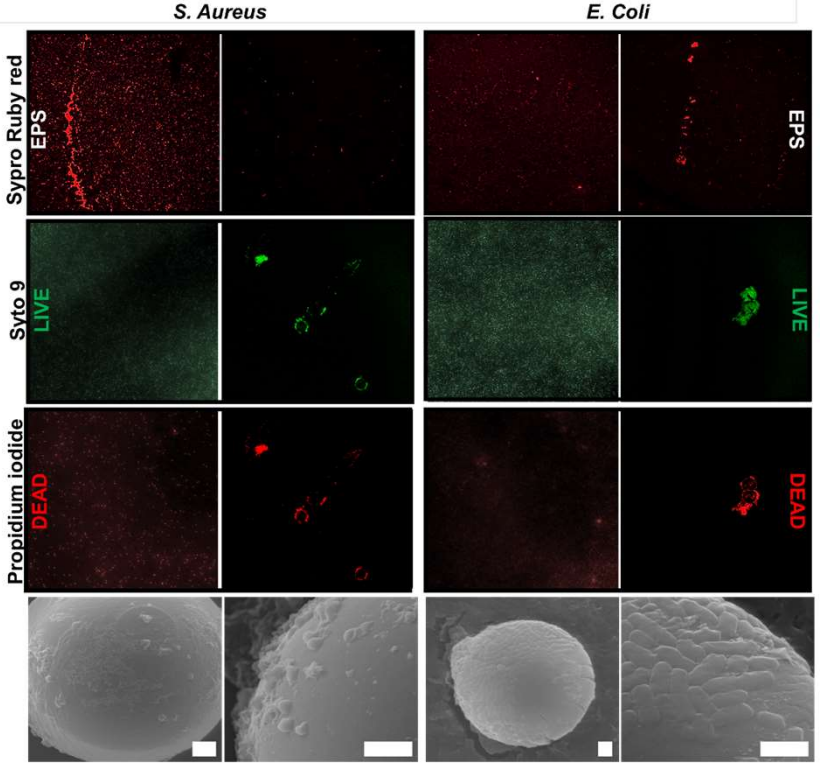




Long-term inactivation

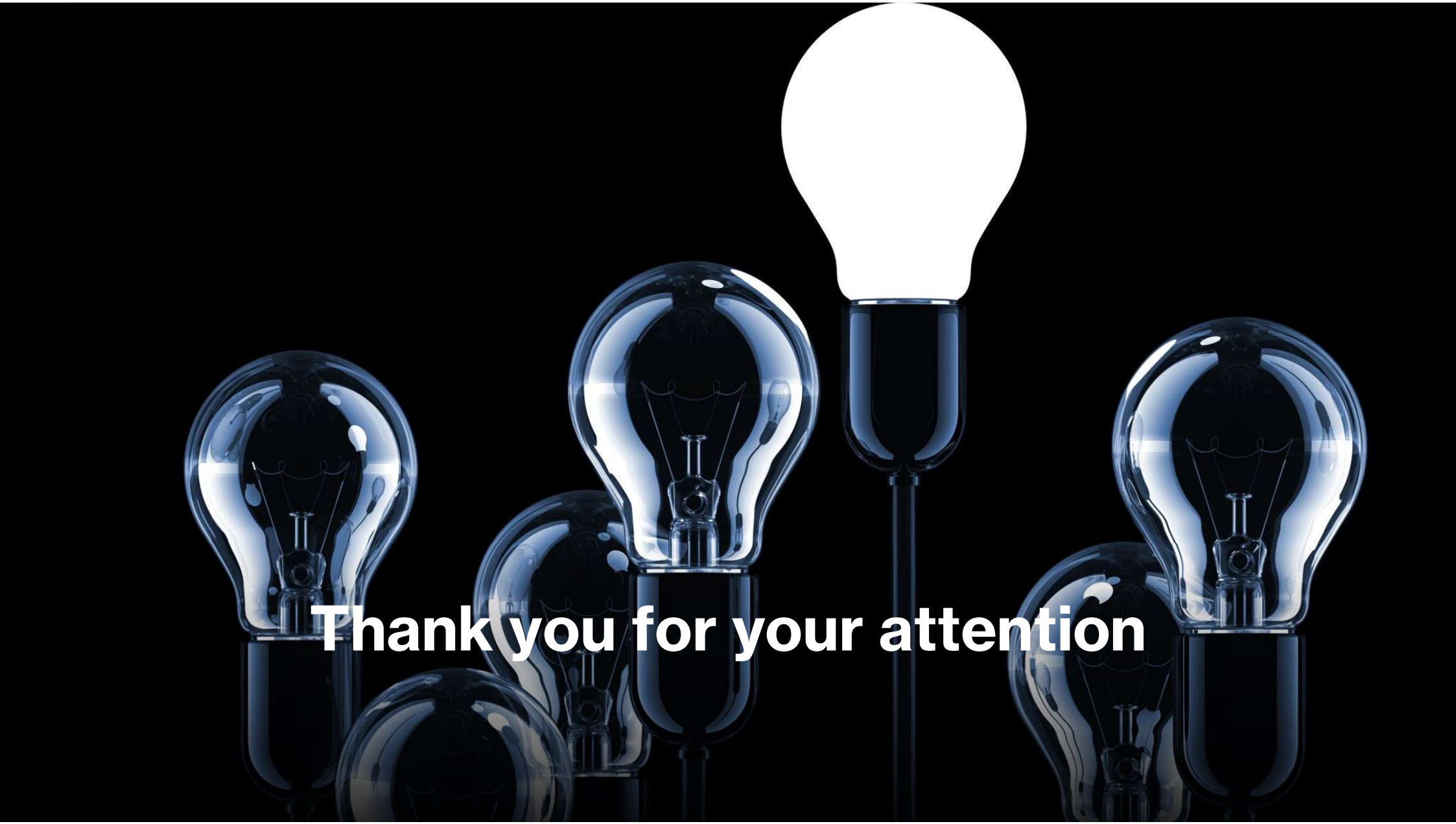






Propulsion en sangre

AGRADECIMIENTOS


Thank you for your attention