



BIO CELLPHE

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**Carlo Morasso, Ph.D.
Istituti Clinici Scientifici Maugeri IRCCS**



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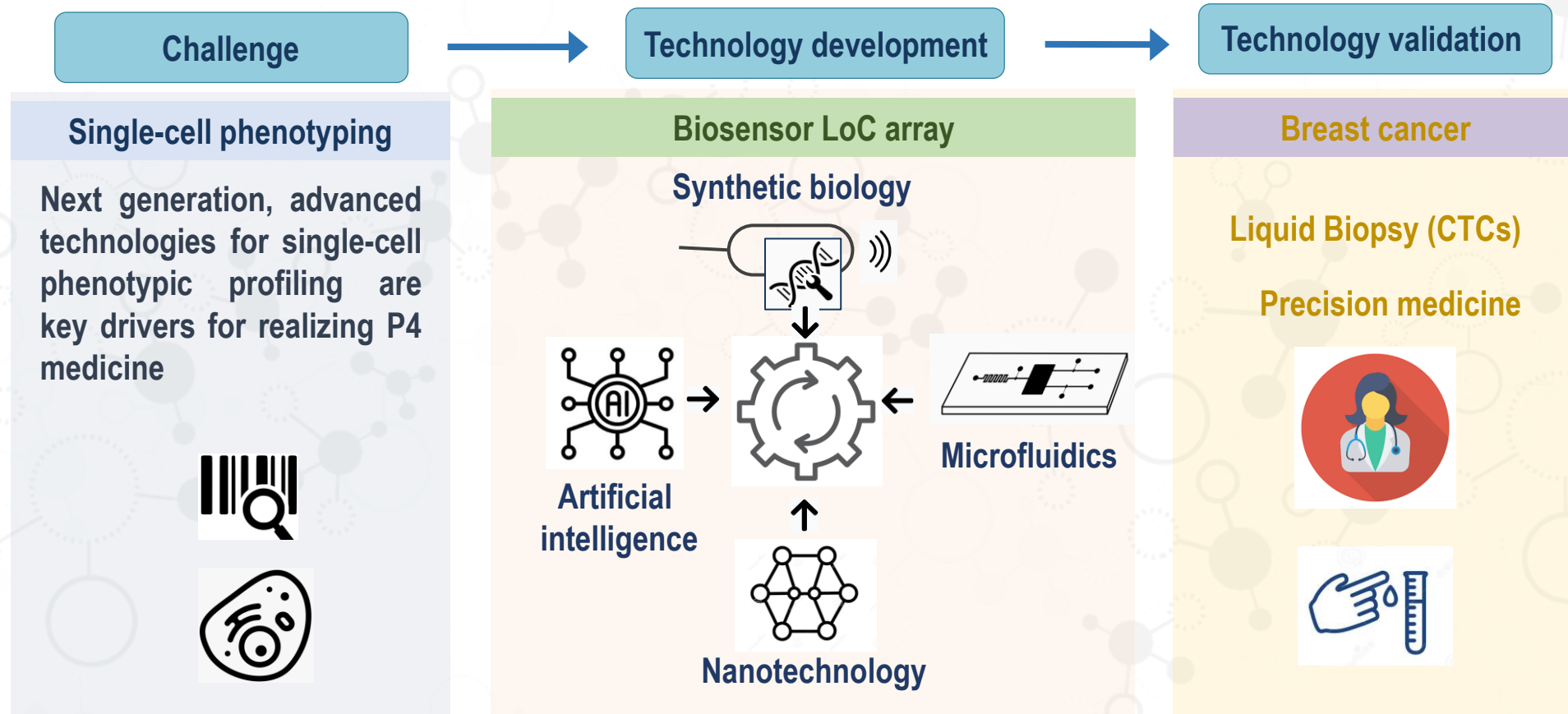


Aim of BIOCELLPHE

Development of a Lab-on-a-chip device for advanced diagnostics of CTCs in liquid biopsy of breast cancer



Aim of BIOCELLPHE



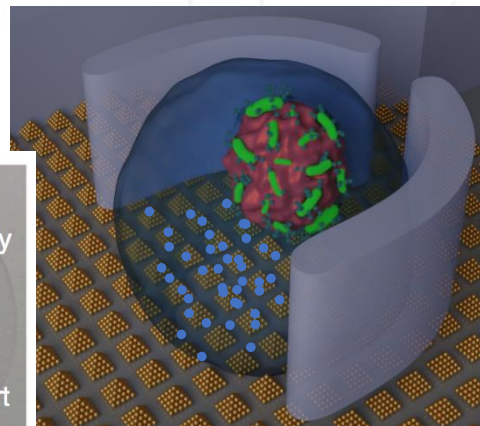
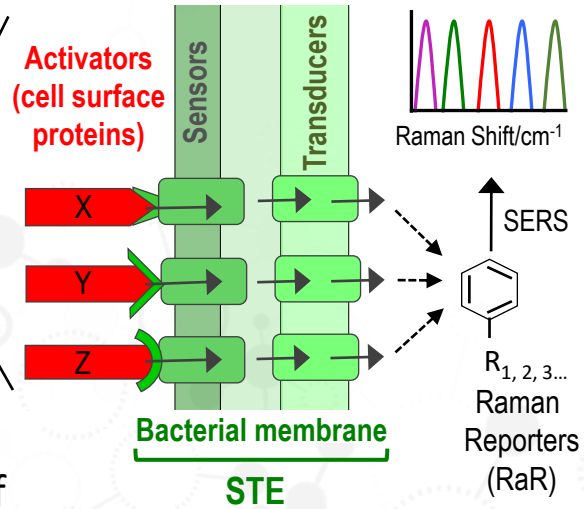
BIOCELLPHE CONCEPT



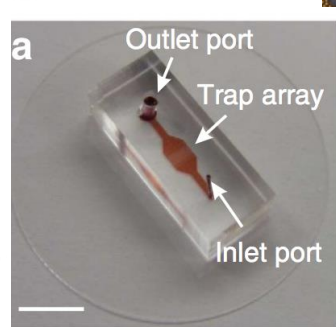
Engineering of *E. coli* (biosensor)



Specific binding of *E. coli* to a CTC and activation of RaR expression.



Single CTC encapsulation into small droplets and trapping on a plasmonic chip



The Consortium

RTOs and Universities

Universidade de Vigo

Dr. Isabel Pastoriza-Santos



Dr. Sara Abalde-Cela



Dr. Luis Angel Fernández
Dr. Luis Angel Fernández



Dr. Alfonso Rodríguez-Patón



Dr. Jean-Loup Faulon



La science pour la santé
From science to health

Dr. Jerome Bonnet

Research Hospital



Dr. Carlo Morasso

SMEs



Dr. Lorena Diéguez



Exploration of photonics markets

Dr. Benoît d'Humières

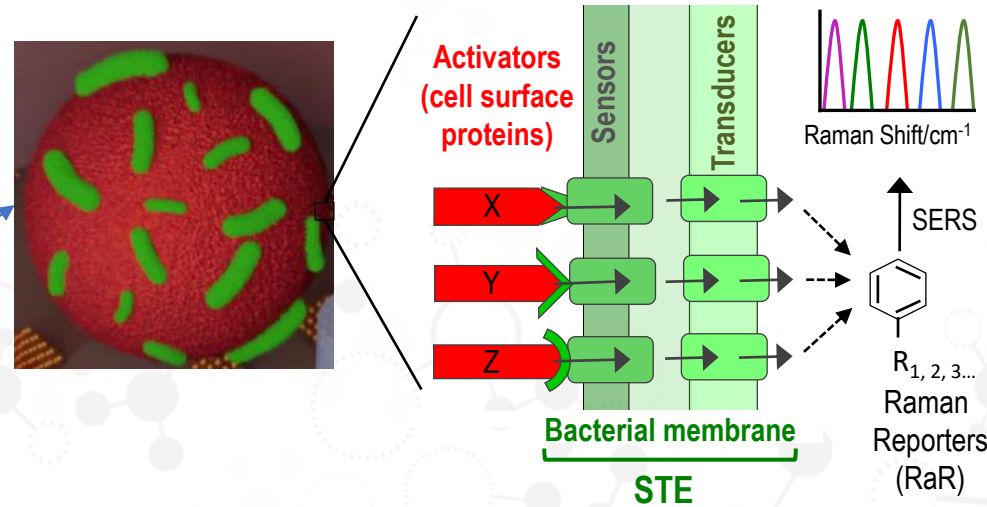


BIOCELLPHE: Living targeting agents

BIOSENSOR DEVELOPMENT



Engineering of *E. coli* (biosensor)



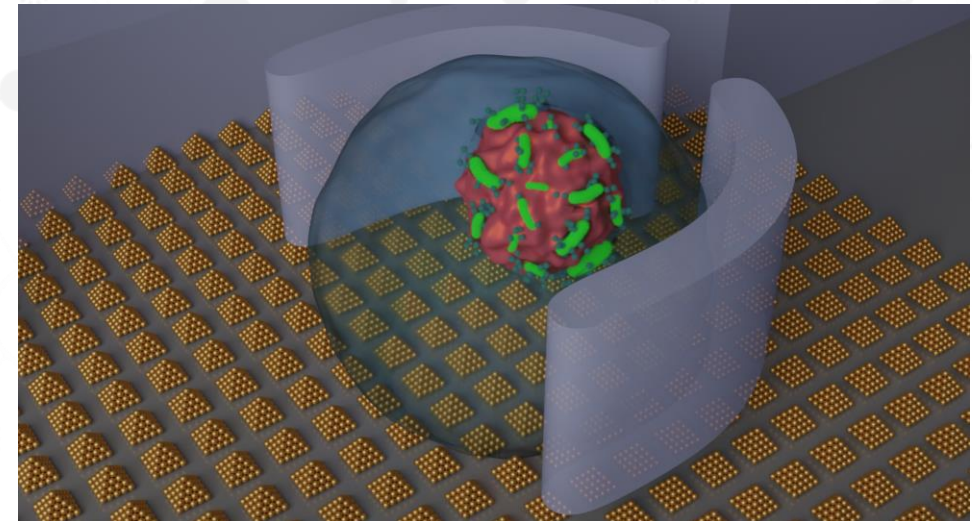
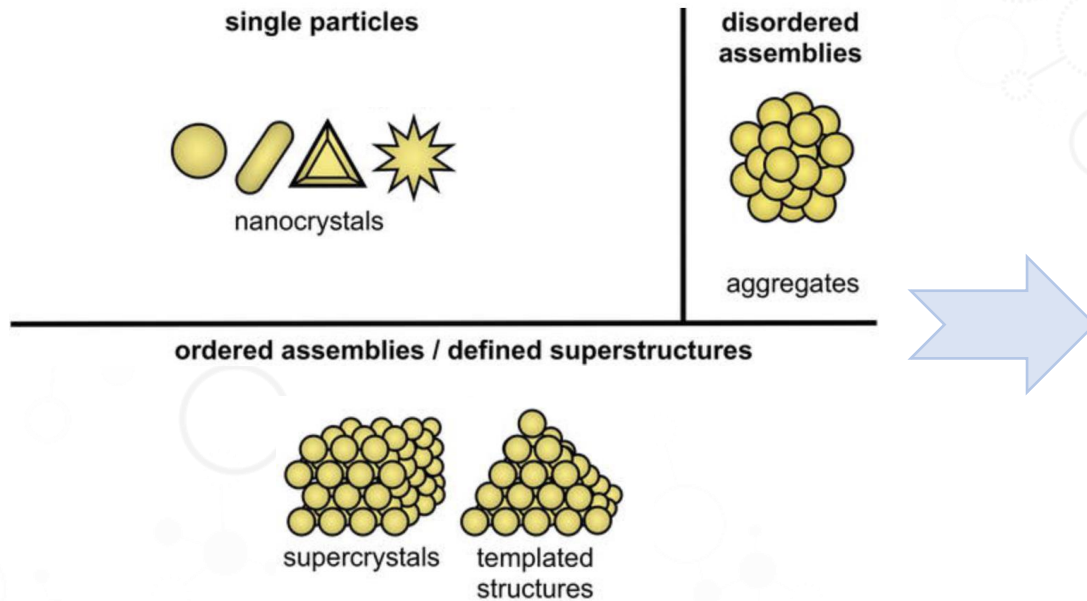
Specific binding of *E. coli* to a CTC and activation of RaR expression.

- *E. coli* strains expressing synthetic outer membrane sensor scaffolds from the chromosome-specific for EGFR, HER2, and PD-L1 cell surface biomarkers.
- Generation of *E. coli* pilot strains with chromosomal expression of both synthetic outer membrane sensor scaffolds and RaRs, which are detectable by SERS upon chemical induction.
- Upon binding with the target, *E. coli* are activated and start producing a Raman active molecule

BIOCELLPHE: Integrating plasmonics and microfluidics

LoC-SERS DEVICE FABRICATION

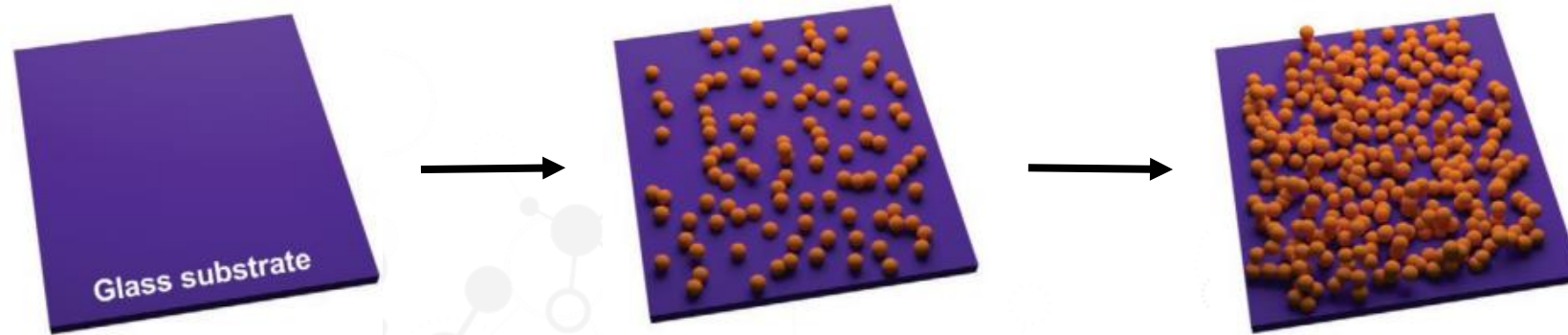
- Integration of plasmonic and fluidic modules, and detection of SERS molecules on chip.
- Data (RAR) we have developed and validated different artificial intelligence models.



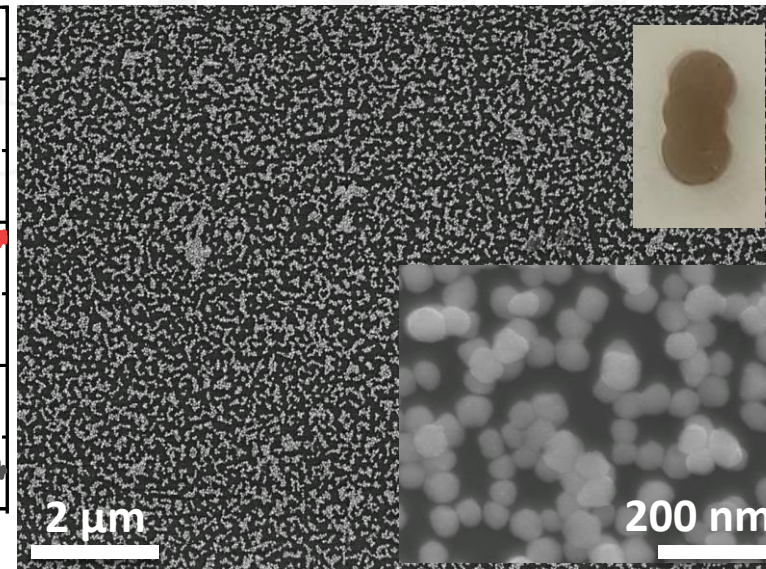
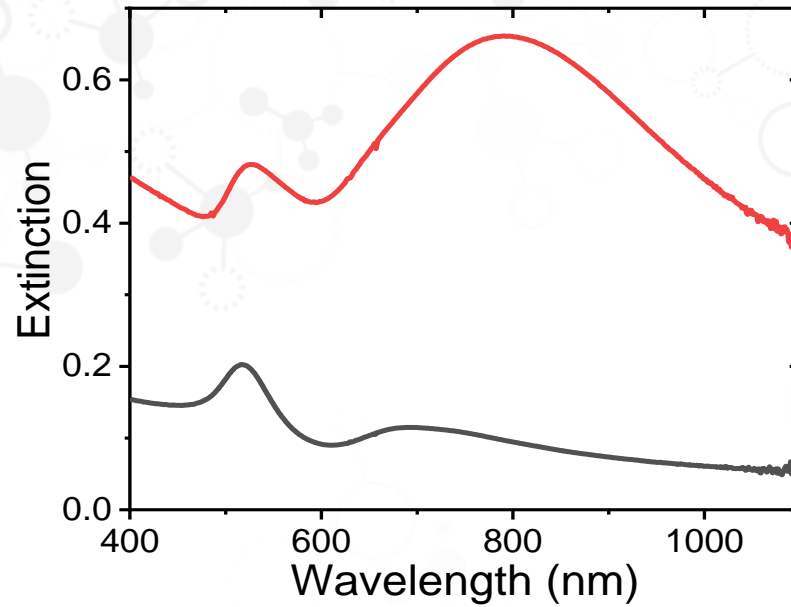
Implementation in LoC-SERS device

LBL SERS Substrate:

Optical and SEM characterization



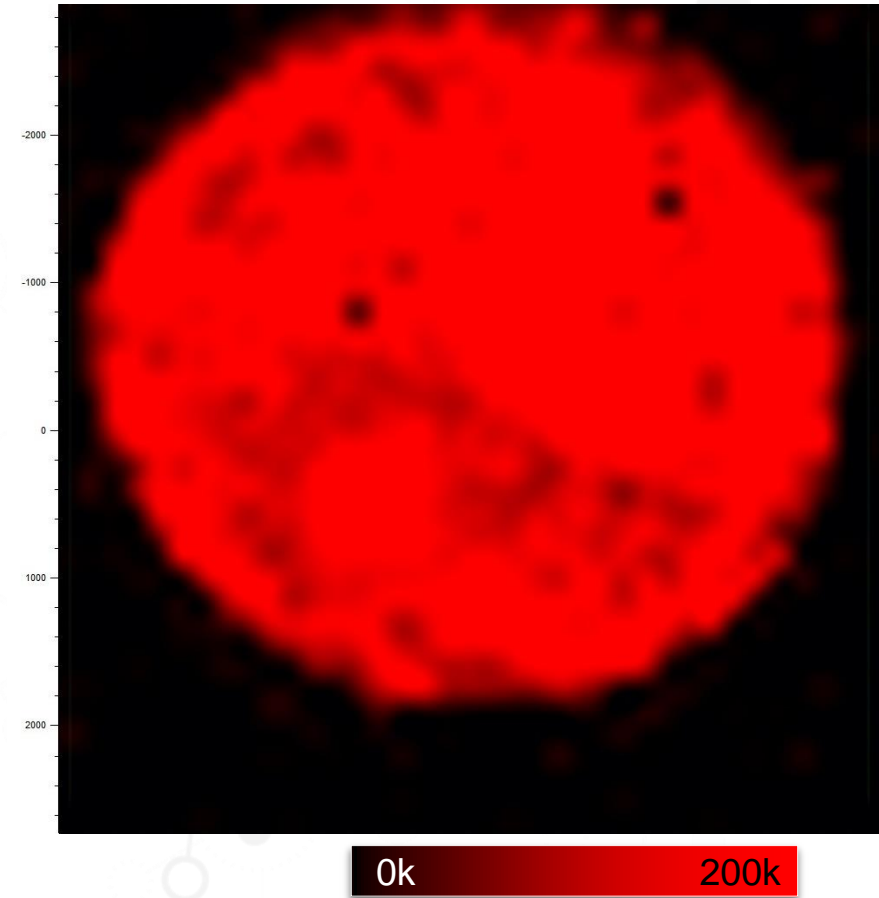
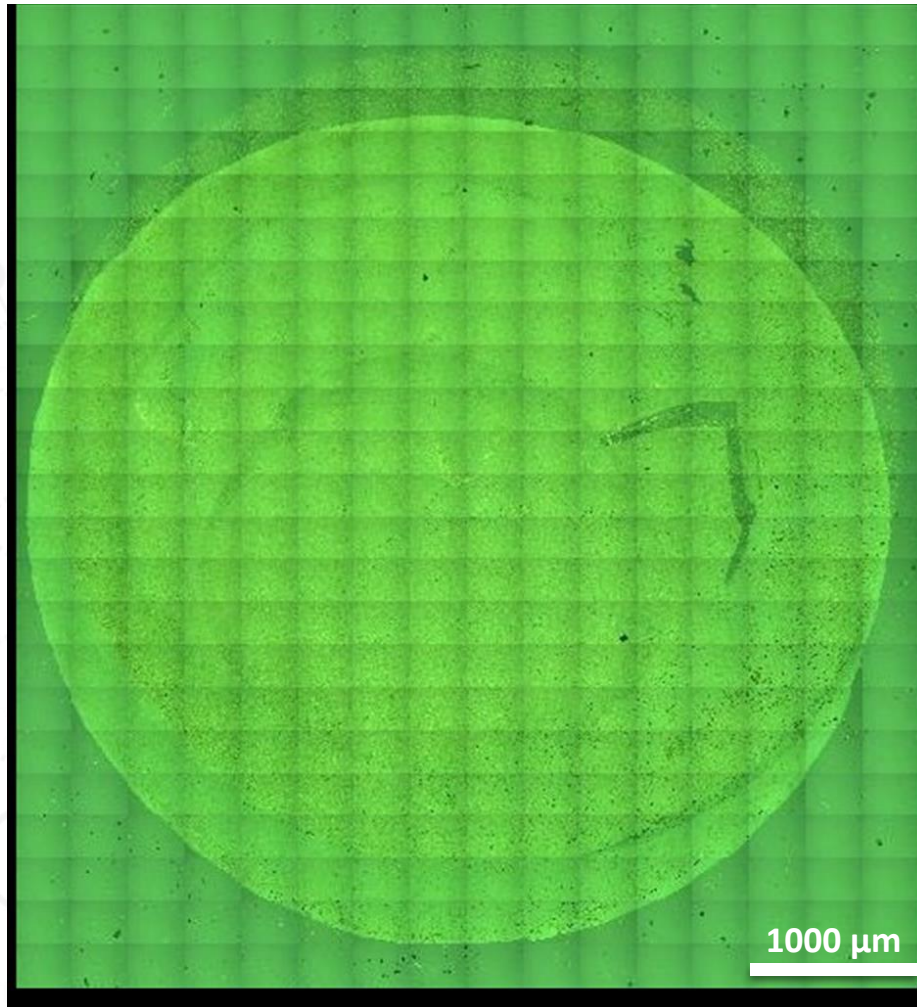
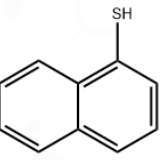
Small 2021, 17 (33), 1–11



LBL SERS Substrate:

Homogeneity

1-Napthalenethiol



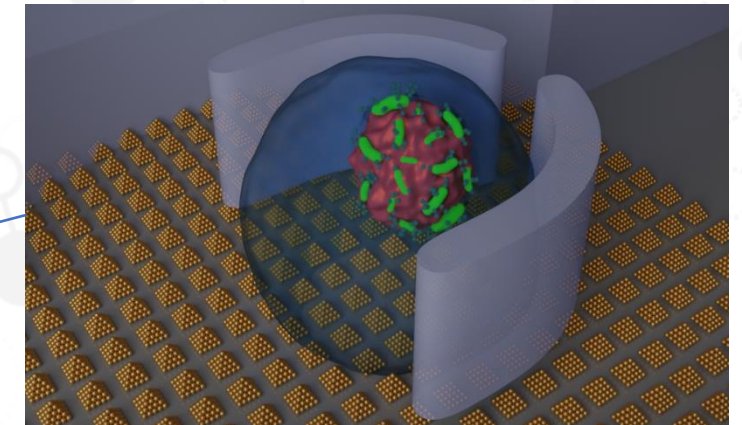
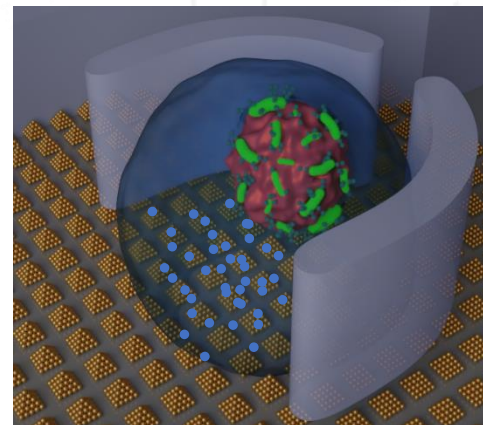
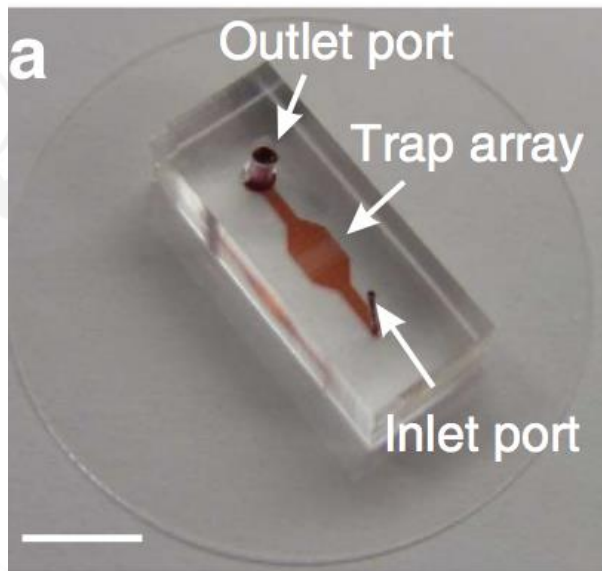
Mapping obtained by plotting the SERS signal to baseline of the characteristic band of the **1-NAT** at $1340-1390\text{ cm}^{-1}$



BIOCELLPHE Outcomes

- Simulation of microdroplet formation, sorting, incubation and cell isolation achieved
- Design of microdroplet encapsulation and incubation module with high incubation efficiency.
- Integration with the plasmonic sensing platforms (LBL and template-assisted) with good performance for the RaR detection.

LoC-SERS DEVICE FABRICATION



Single CTC encapsulation into microdroplets and trapping on a plasmonic chip



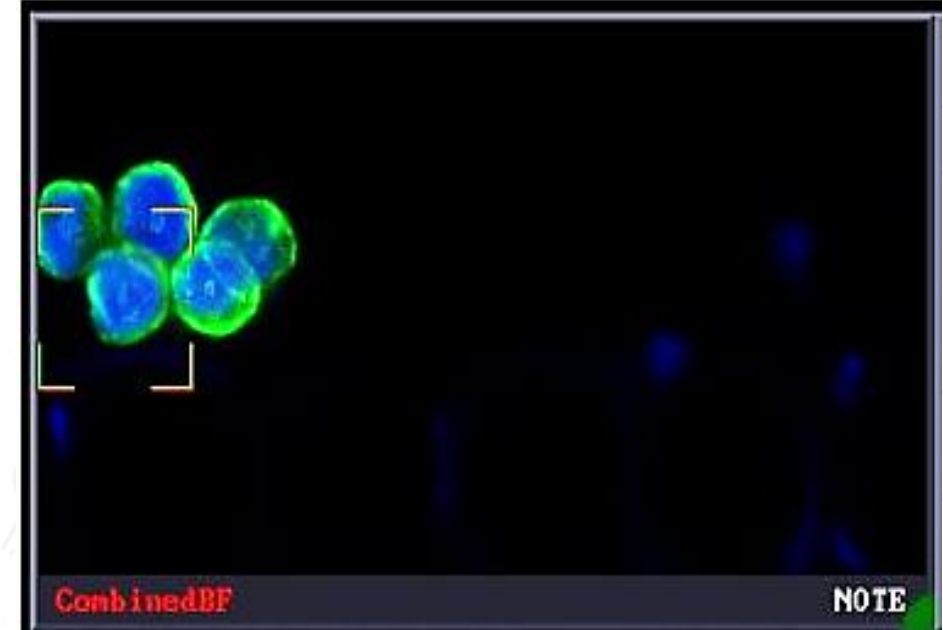
Validation of LoC-SERS device with clinical samples

➤ Initial tests

Device 1 – 7.5 mL –
standard ICC RUBY protocol

All devices analysed with
Ab cocktail:
DAPI, CD45, CK, HER2

Initial test show that the detection of CTC is, in principle, feasible in clinical samples (for now based on fluorescence). Integration with SERS is under progress.



CTCs (CK+) were
found in patient #8
(*eBC, Her2-
enriched*)





BIO
CELLPHE

Ultrasensitive **BIO**sensing platform for multiplex **CELL**ular protein **PHE**notyping at single-cell level



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