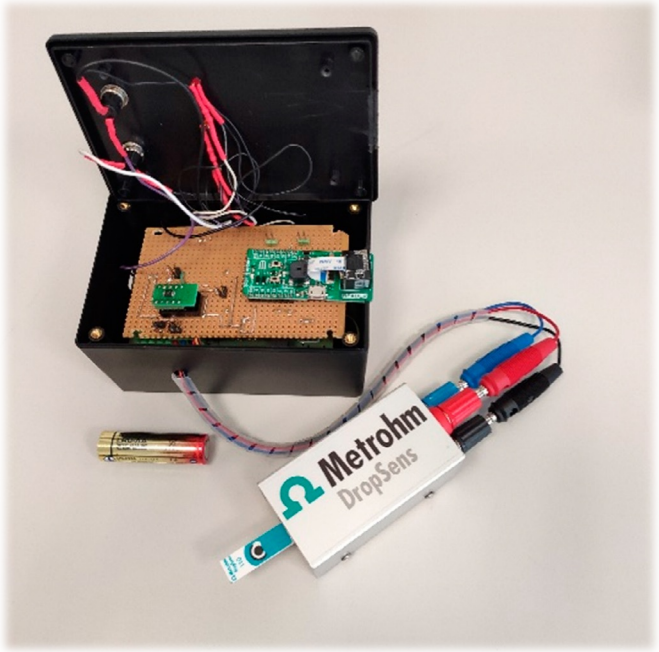
biosensors

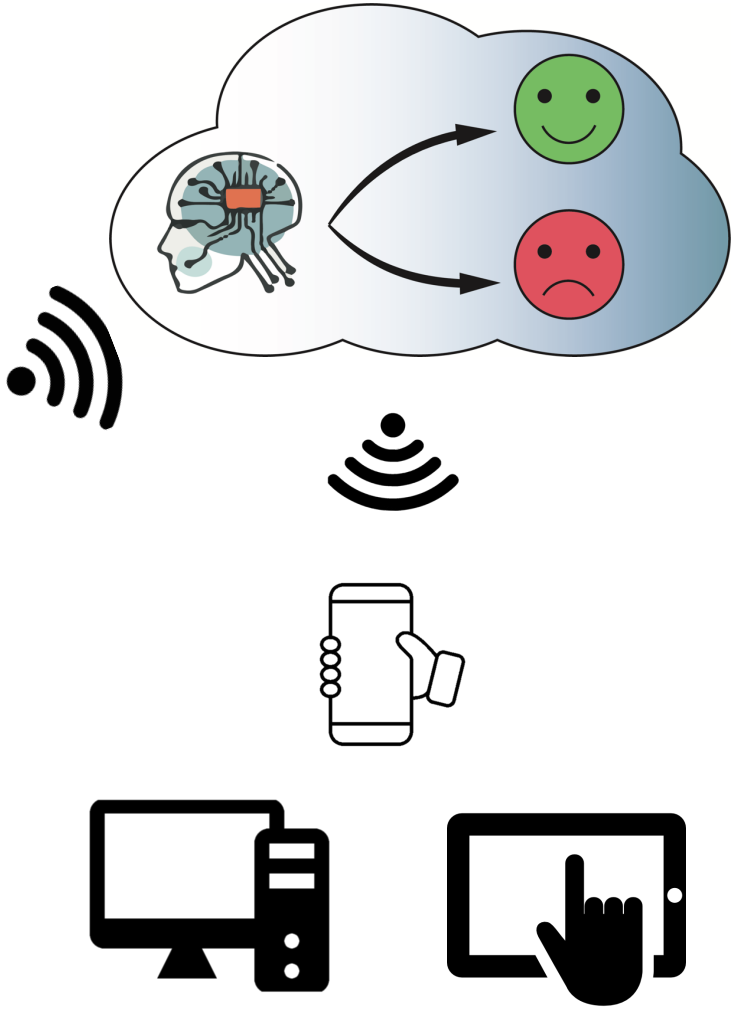
MDPI

Article

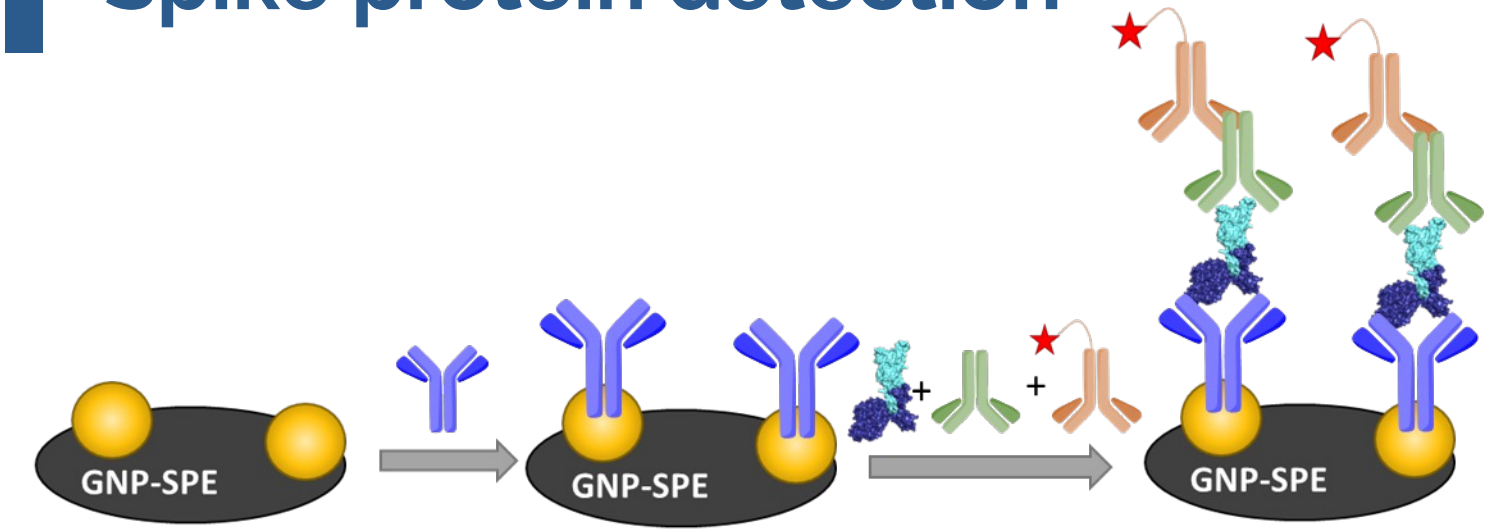
Rapid Quantification of SARS-Cov-2 Spike Protein Enhanced with a Machine Learning Technique Integrated in a Smart and Portable Immunosensor

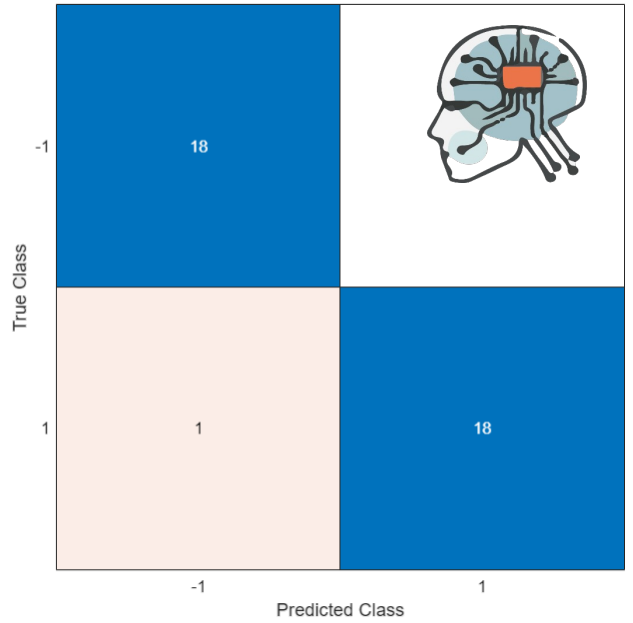
Simone Fortunati [1], Chiara Giliberti [1], Marco Giannetto [1,*], Angelo Bolchi [1], Davide Ferrari [1], Gaetano Donofrio [2], Valentina Bianchi [3], Andrea Boni [3], Ilaria De Munari [3] and Maria Careri [1,*]

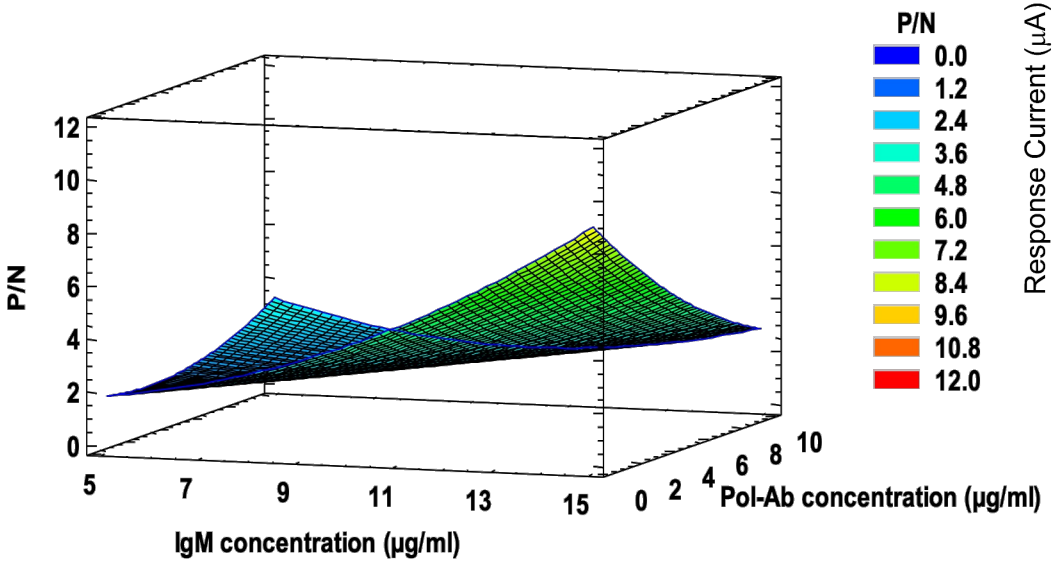


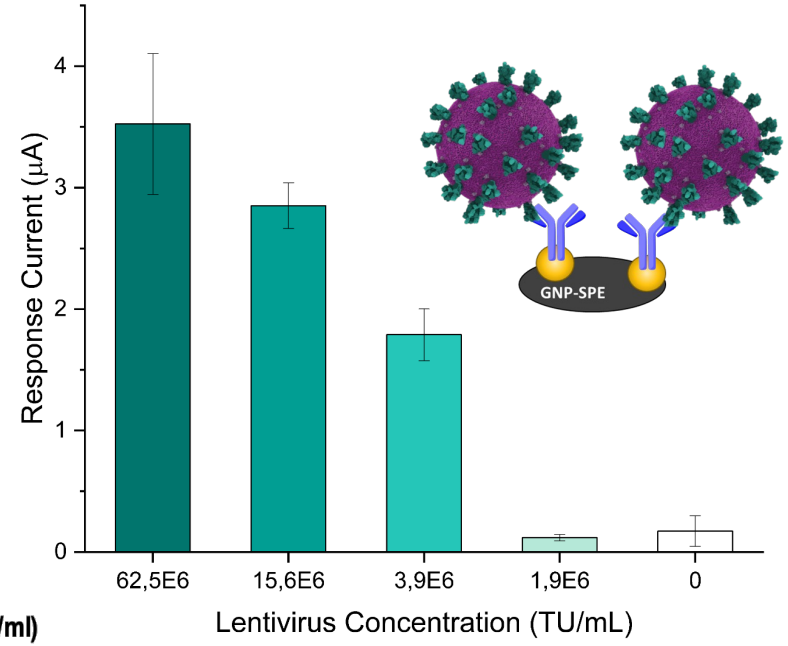


Spike protein detection









In collaboration with the group of Prof. G. Donofrio (University of Parma)

Learning model	Accuracy (%)
Linear	98.9
Quadratic	98.9
Cubic	97.7
Gaussian	92.8
Without ML	83

Outline

- Introduction

- Immunosensors

- Genosensors

- Conclusions

Biosensors and Bioelectronics: X 15 (2023) 100404

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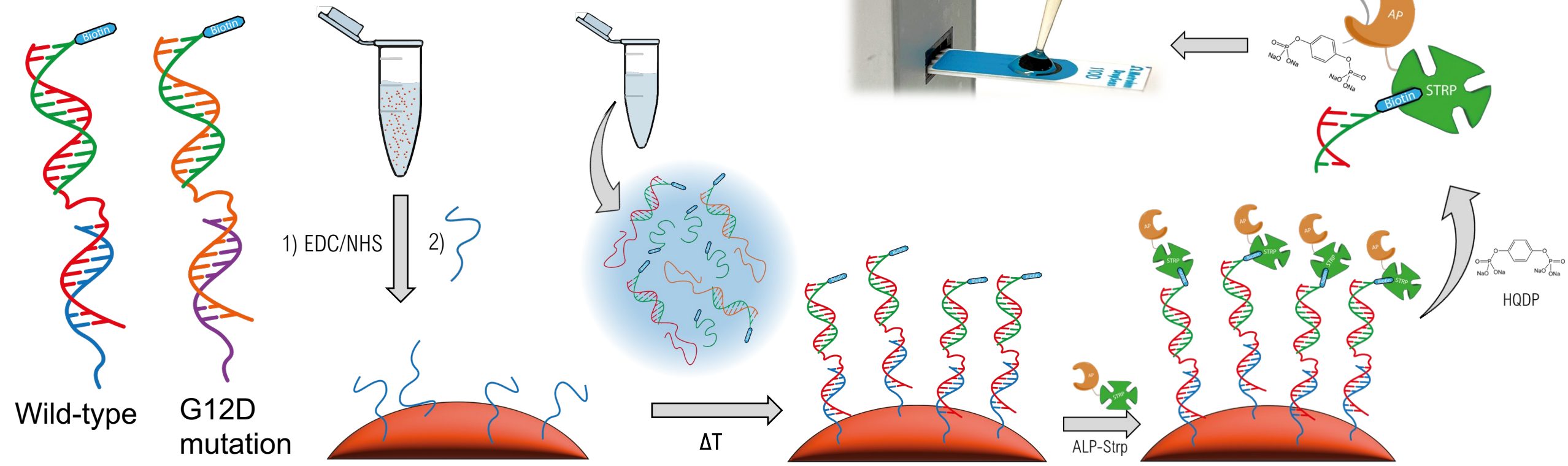
Biosensors and Bioelectronics: X

journal homepage: www.journals.elsevier.com/biosensors-and-bioelectronics-x

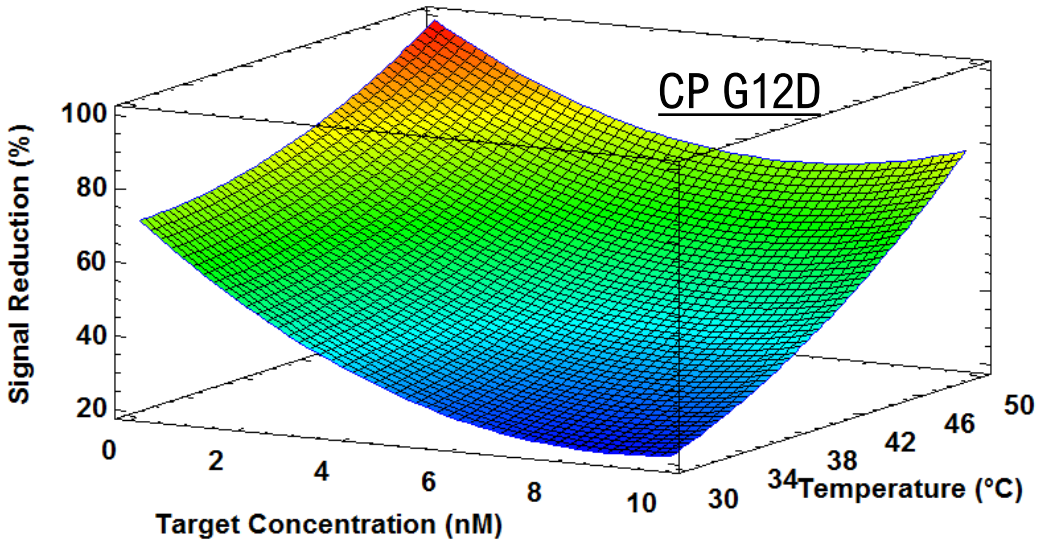
In collaboration with Dr. Patrizio Giacomini from Istituto Nazionale Tumori «Regina Elena», Rome

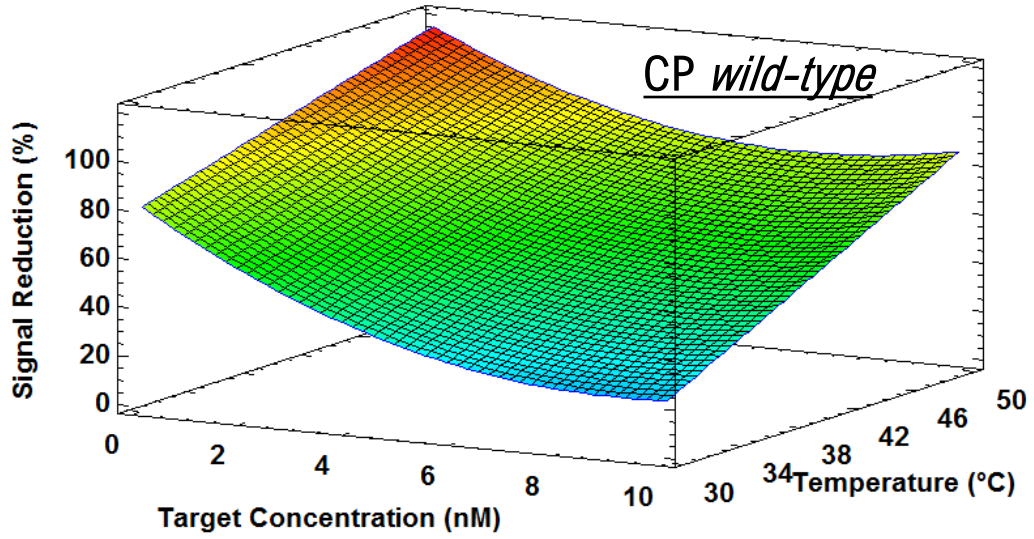
A highly sensitive electrochemical magneto-genosensing assay for the specific detection of a single nucleotide variation in the KRAS oncogene in human plasma

Simone Fortunati [a,1], Chiara Giliberti [a,1], Marco Giannetto [a,*], Alessandro Bertucci [a], Sabrina Capodaglio [a], Elena Ricciardi [b], Patrizio Giacomini [c], Valentina Bianchi [d], Andrea Boni [d], Ilaria De Munari [d], Roberto Corradini [a], Maria Careri [a]



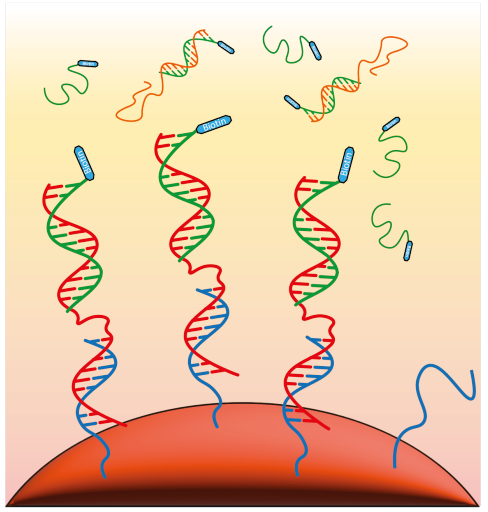
ctDNA detection

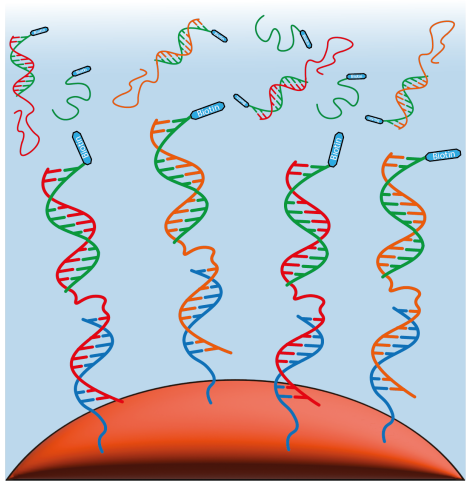


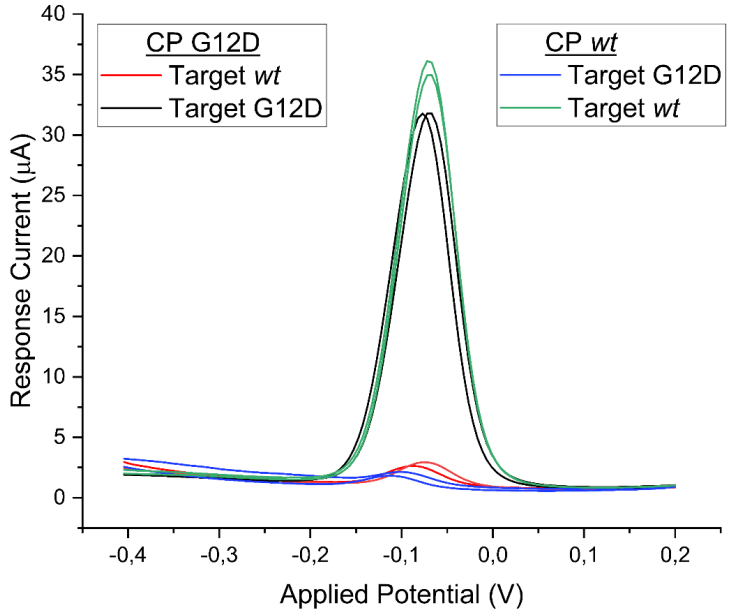


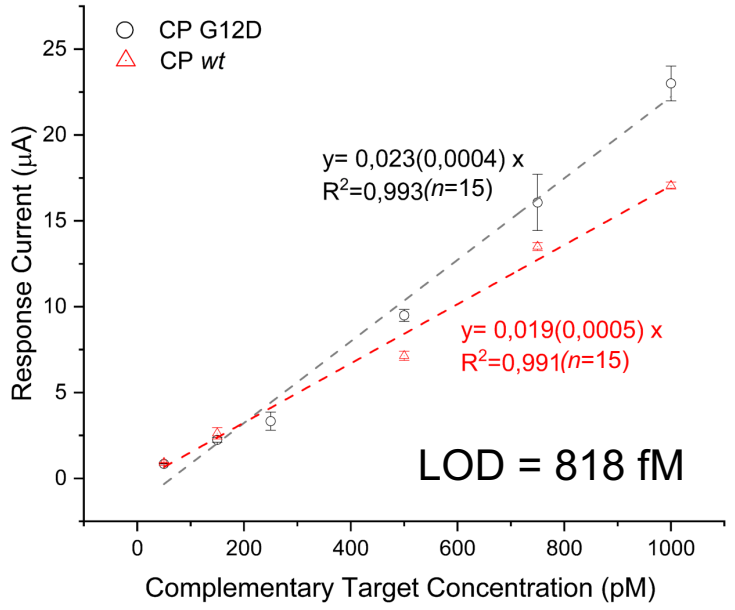
50°C

25°C

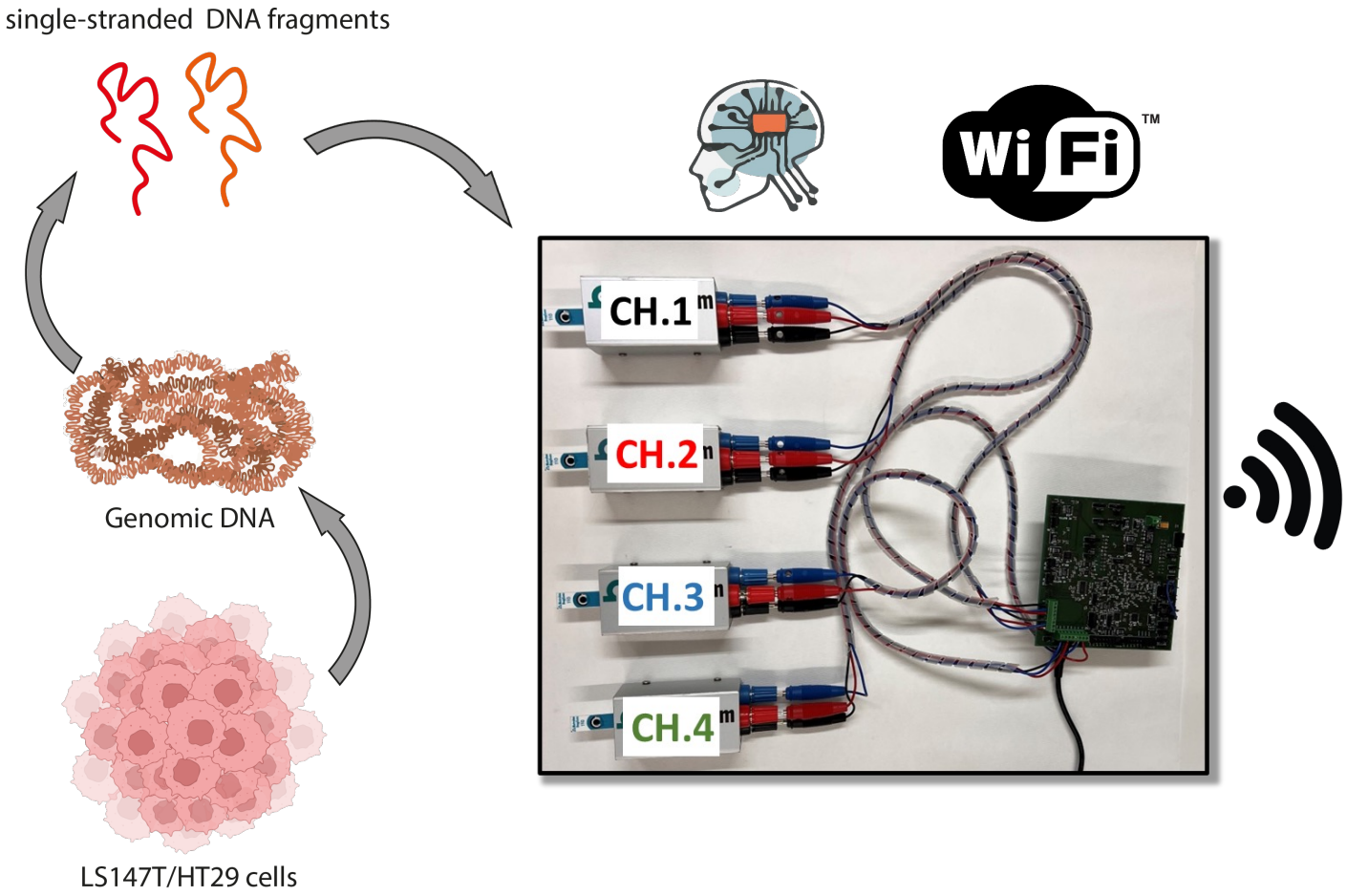


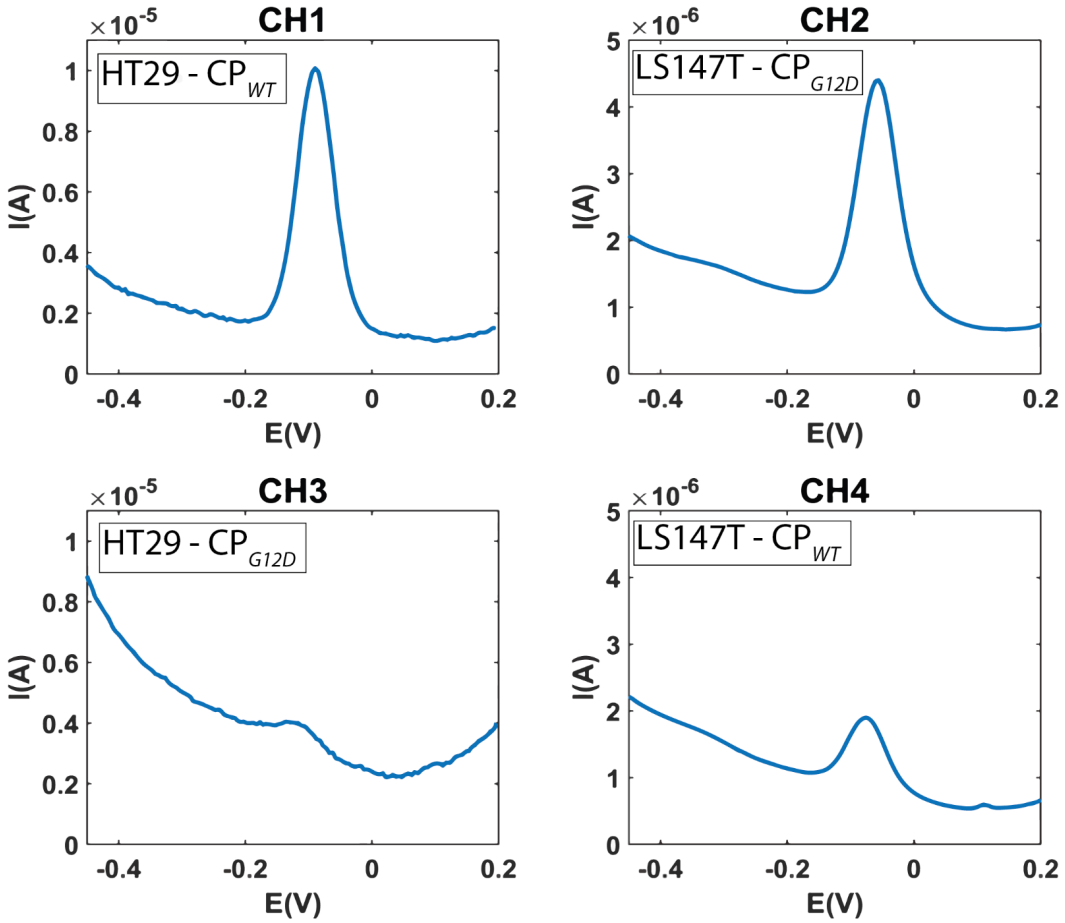






ctDNA detection

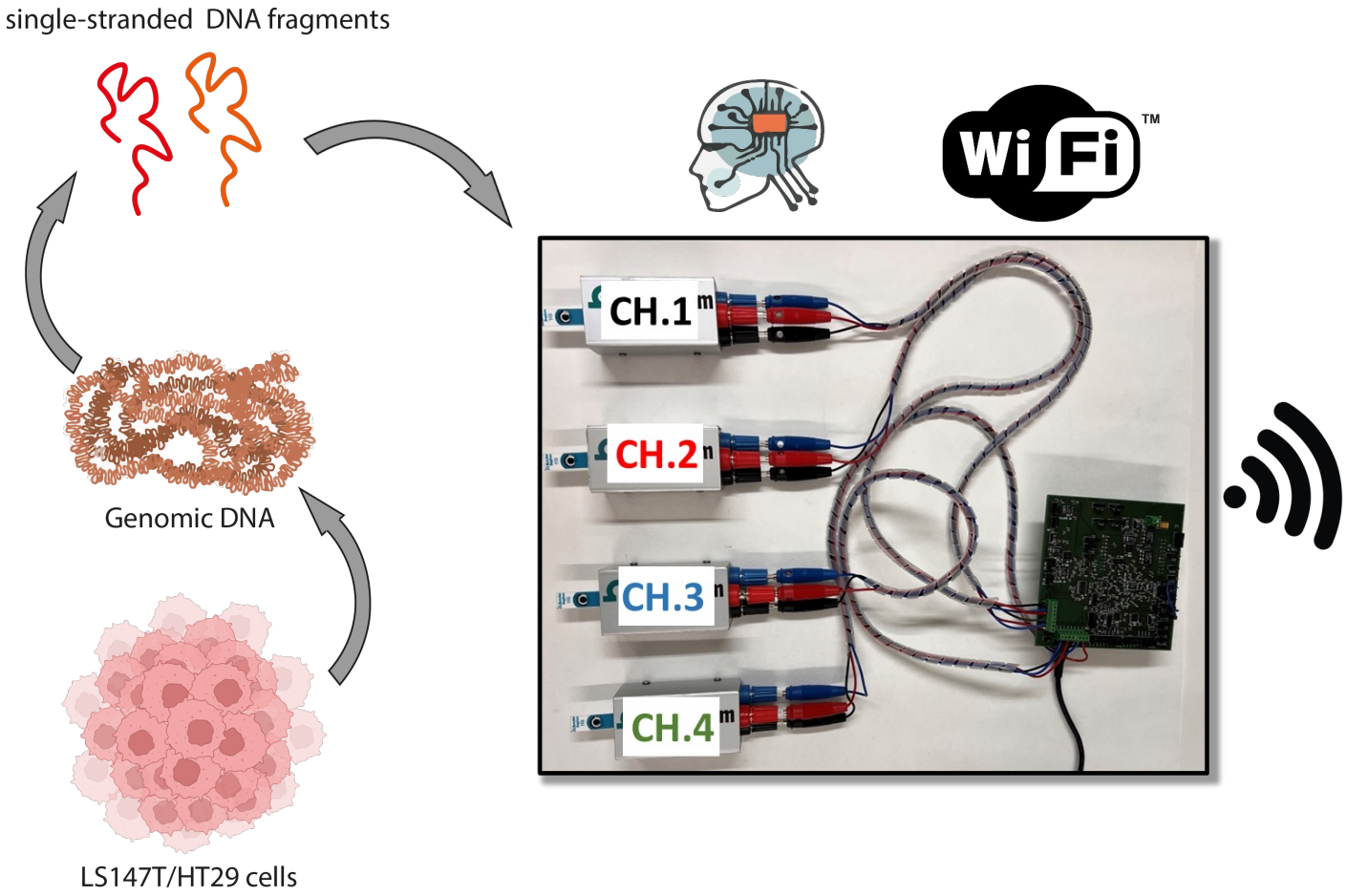


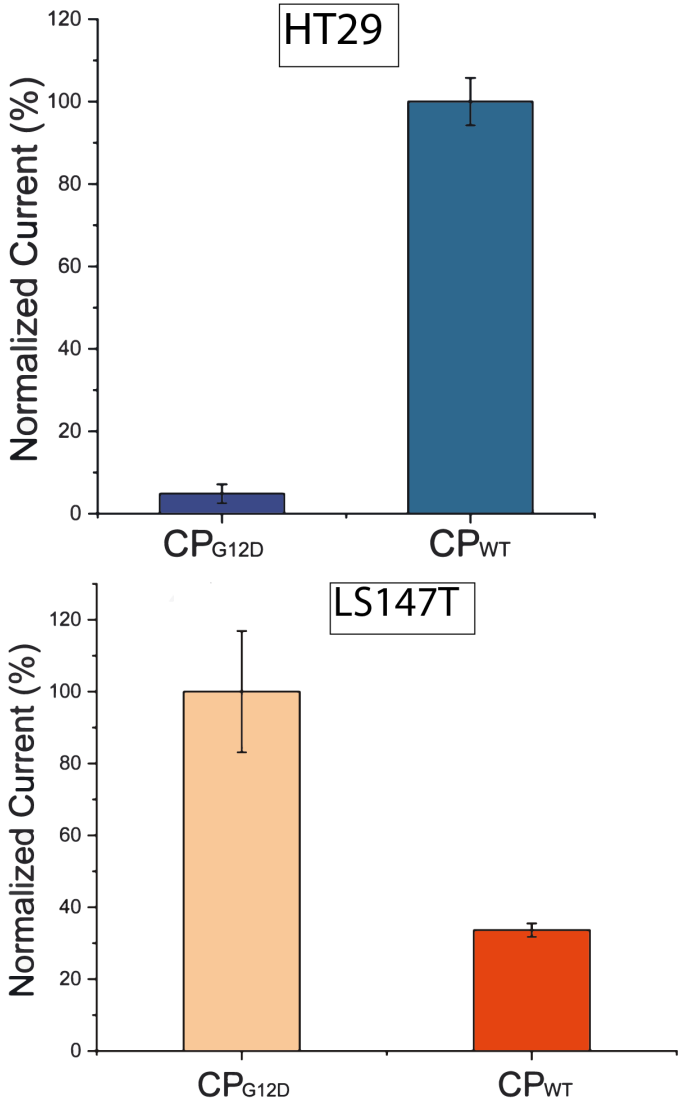


LS147T: wild-type and G12D

HT29: wild-type

ctDNA detection





LS147T: wild-type and G12D

HT29: wild-type

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ISTITUTO NAZIONALE TUMORI
REGINA ELENA

Outline

- Introduction

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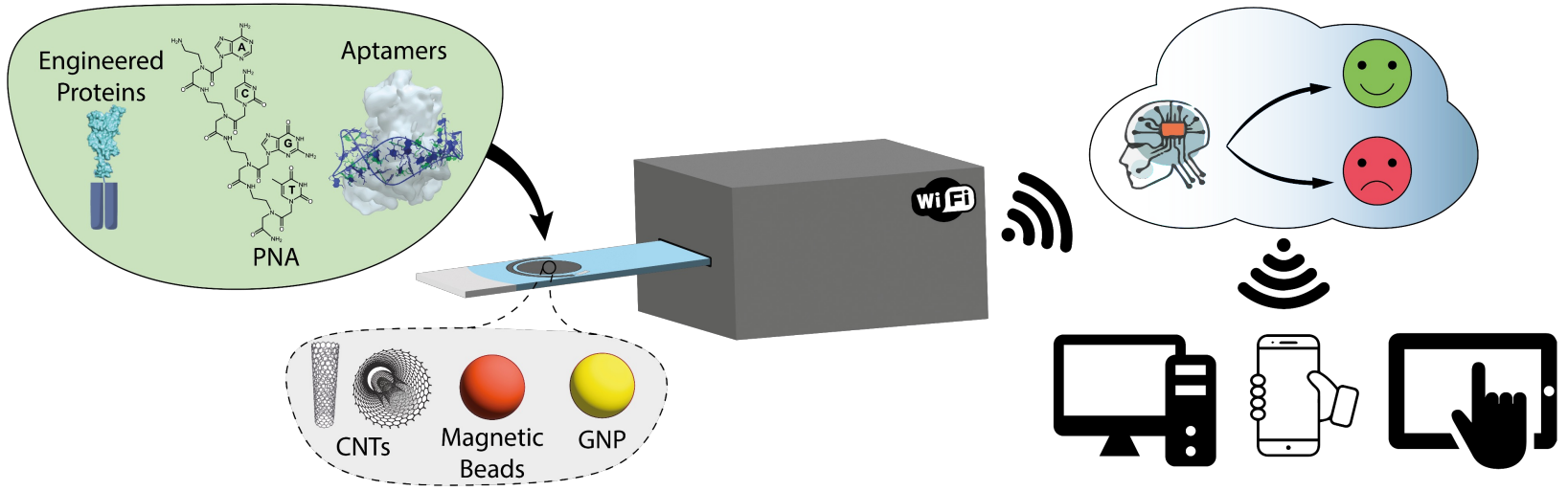
- Conclusions

Conclusions

- Wide choice of receptor immobilization strategies
- Cheap commercially available materials (SPE, MB)
- Seamless integration with smart acquisition device
- Accuracy improved by ML implementation



Acknowledgements

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Prof. Ilaria De Munari

Prof. Valentina Bianchi

Prof. Andrea Boni

Dr. Massimo Locatelli

Dr. Patrizio Giacomini

Dr. Elena Ricciardi

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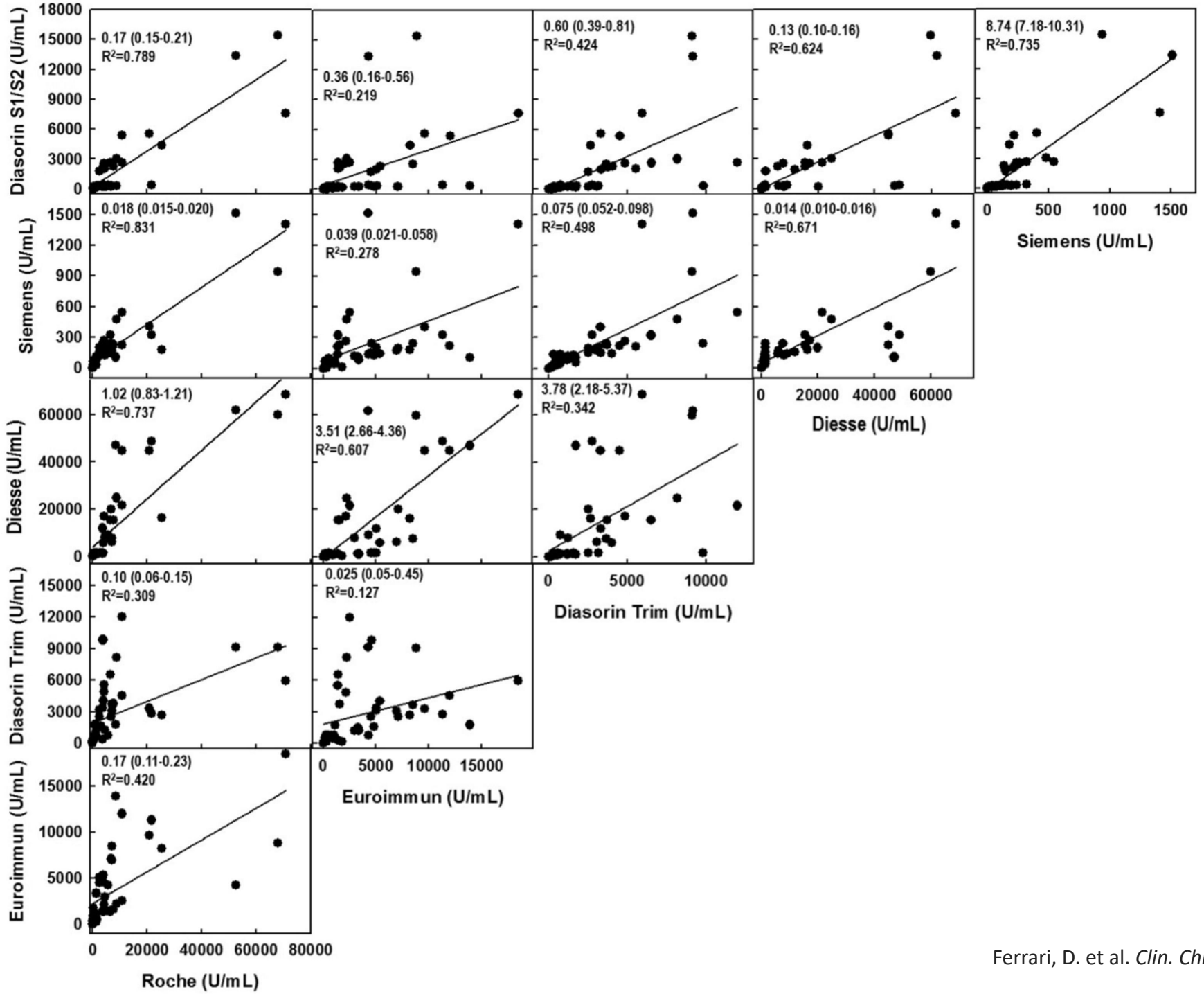
- "Smart magnetic genosensors for liquid biopsy aimed at personalized cancer therapy" — Bando di Ateneo per la Ricerca 2022 - Azione B, University of Parma (P.I. Simone Fortunati)
- "Biosensori innovativi per il "Point of Care Testing" (PoCT) integrati con dispositivi smart basati su tecnologie "Internet of Things" (IoT)" - Programma Operativo PON "Ricerca e Innovazione" 2014-2020 su tematiche dell'innovazione



Ferrari, D. et al. *Clin. Chim. Acta* **522**, 144–151 (2021).

Challenges

Single-use reagents

- High cost
- Waste

Shipping/storage

- Biocompounds stability

Medical staff preparation

- Quality errors (0,52-0%)
  - Preanalytical: 32%
  - Analytical: 65,3%

O'Kane, M. J. et al. *Clin. Chem.* **57**, 1267–1271 (2011).

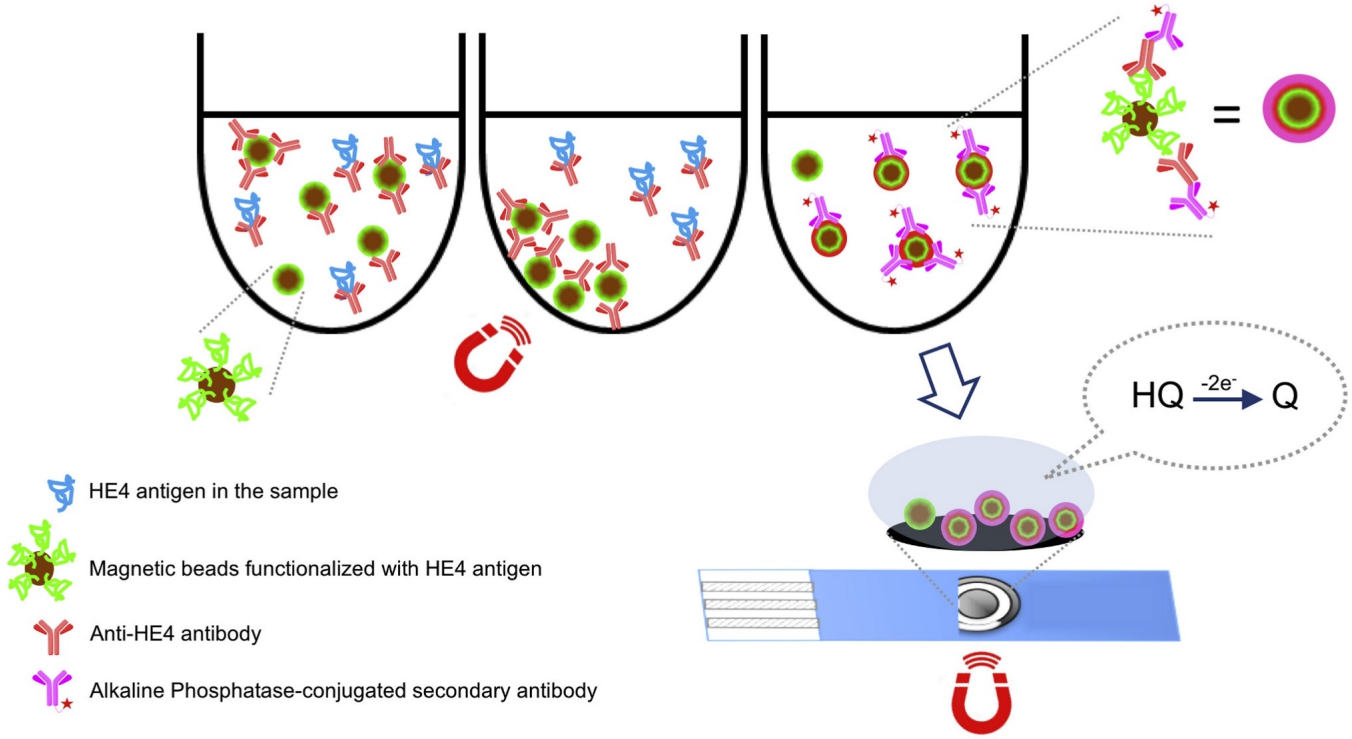
sensors

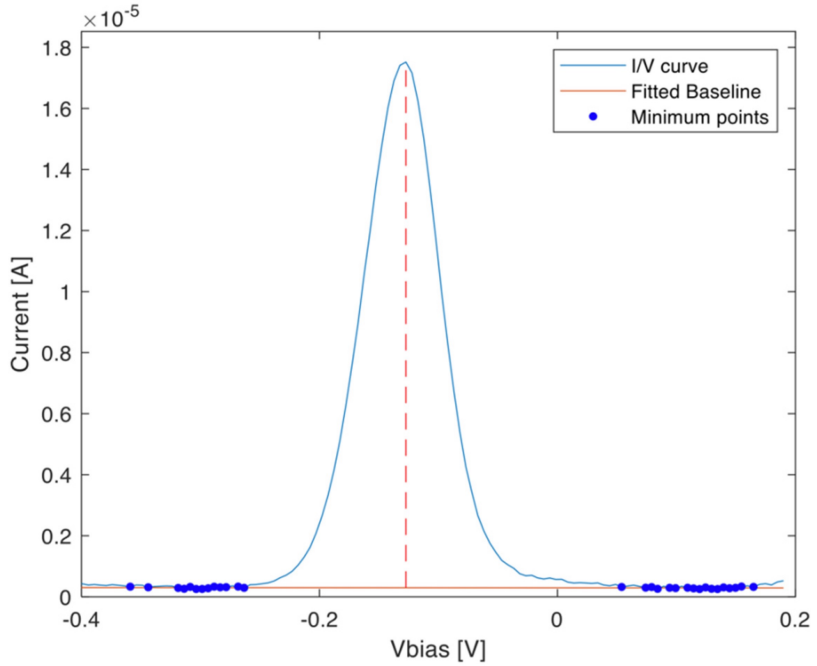
MDPI

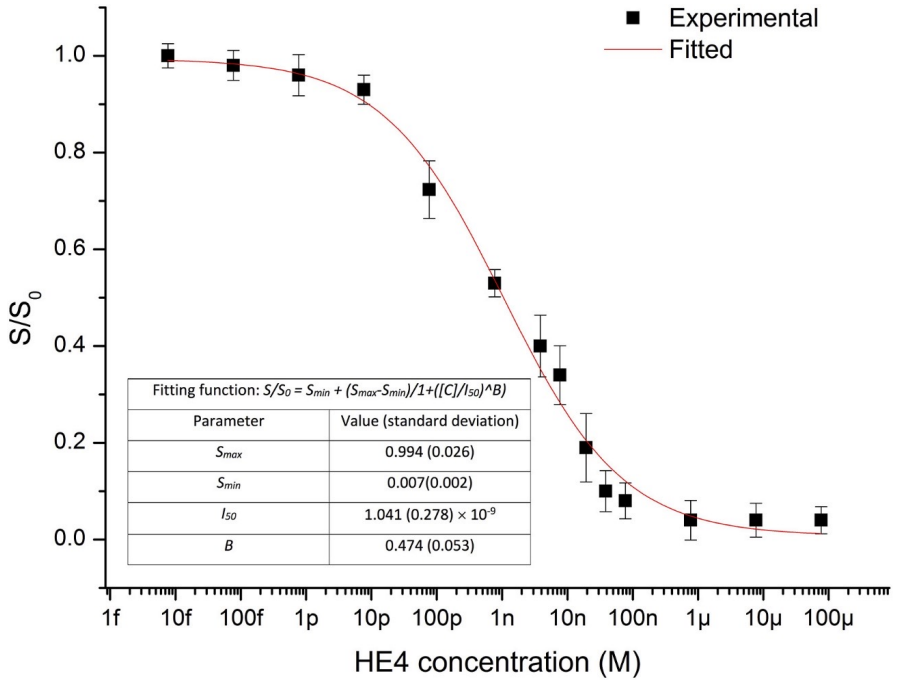
Article

A Self-Calibrating IoT Portable Electrochemical Immunosensor for Serum Human Epididymis Protein 4 as a Tumor Biomarker for Ovarian Cancer

Valentina Bianchi [1], Monica Mattarozzi [2,*], Marco Giannetto [2,*], Andrea Boni [1], Ilaria De Munari [1] and Maria Careri [2]







ACS APPLIED MATERIALS & INTERFACES

www.acsami.org Research Article

A Folding-Based Electrochemical Aptasensor for the Single-Step Detection of the SARS-CoV-2 Spike Protein

Federica Curti,[#] Simone Fortunati,[#] Wolfgang Knoll, Marco Giannetto, Roberto Corradini, Alessandro Bertucci,* and Maria Careri