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# ***Affisensors: a choice for healthy ageing***

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**BIOSENSORI INNOVATIVI PER  
L'AMBIENTE E LA SALUTE**

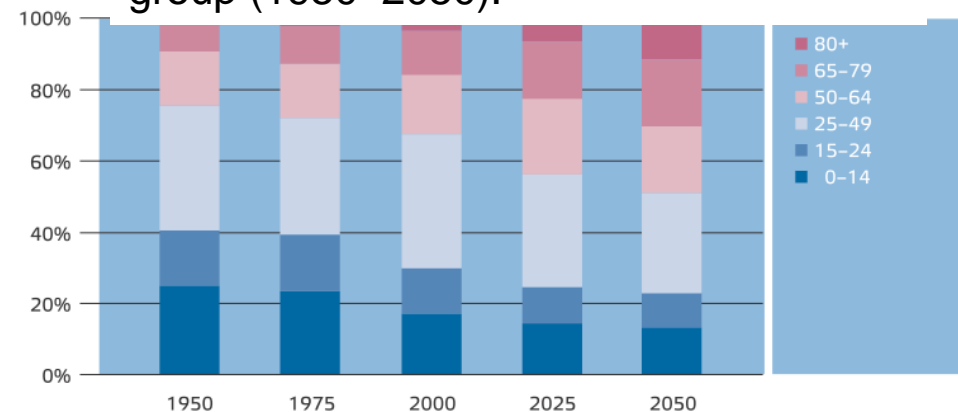
**14 Novembre 2014 - Roma**



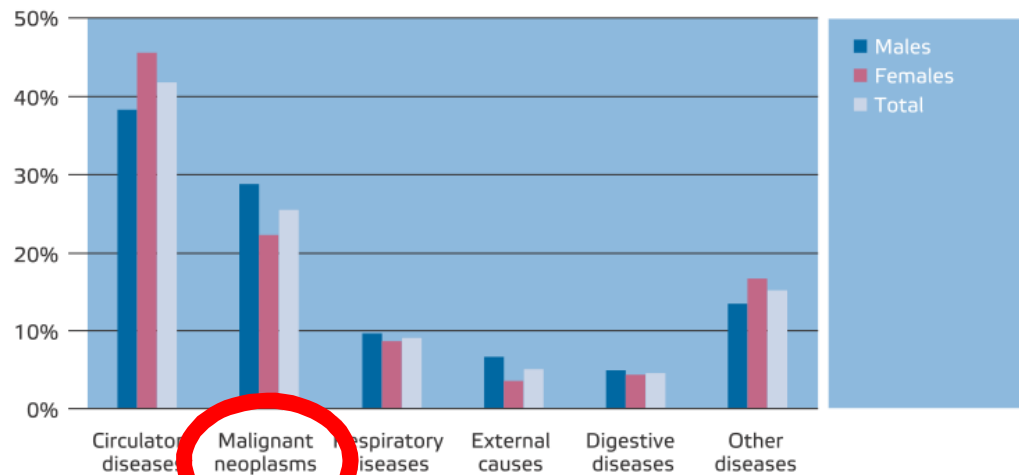
By 2060 one in three Europeans will be over 65.

The ratio of working people to the 'inactive' others is shifting from 4 to 1 today to 2 to 1 by 2060.

Population distribution in EU by age group (1950–2050).



Deaths by selected cause and by sex, EU.



The single greatest risk factor for developing cancer is aging.

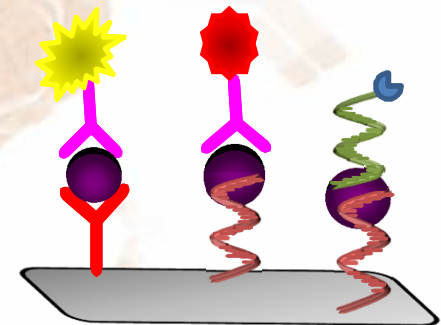
In fact, more than 60% of cancers occur in people age 65 and older.

source: the 2012 Ageing Report

## Cancer biomarkers are used in clinical analysis

Earlier cancer detection and accurate diagnosis are critical for improving the outcomes for cancer patients. The possibility to detect a panel of biomarkers of a given pathology offers clinicians a complete information of high diagnostic and prognostic value.

It is necessary to develop a miniaturized platform suitable for the analysis of a panel of analytes with different bioreceptors: antibodies, aptamers, affibodies etc.



### POCTs...

“... biosensors have played an important significant role in the transition towards point-of-care diagnostic devices...”

- Simple
- Easy to use
- Low cost
- Results in non-laboratory settings



# Affisensors main references

Full Paper

ELECTROANALYSIS

## Amplified Electrochemical DNA Sensor Based on Polyaniline Film and Gold Nanoparticles

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Received: August 8, 2012

Accepted: December 10, 2012

Full Paper

ELECTROANALYSIS

## CA 125 Immunosensor Based on Poly-Anthranilic Acid Modified Screen-Printed Electrodes

Zahra Taleat,<sup>a</sup> Andrea Ravalli,<sup>b</sup> Mohammad Mazloun-Ardakani,<sup>a</sup> Giovanna Marrazza<sup>a,b</sup>

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Received: August 3, 2012

Full Paper

ELECTROANALYSIS

## Nanostructured Screen Printed Graphite Electrode for the Development of a Novel Electrochemical Genosensor

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Received: October 14, 2012

Accepted: November 21, 2012

Published online: January 23, 2013

Clinica Chimica Acta 425 (2013) 128–138



Contents lists available at ScienceDirect

Clinica Chimica Acta

journal homepage: [www.elsevier.com/locate/clinchim](http://www.elsevier.com/locate/clinchim)



Invited critical review

## Electrochemical immunosensors in breast and ovarian cancer

Iulia Diaconu<sup>a,b,c,d</sup>, Cecilia Cristea<sup>e</sup>, Veronica Hârceagă<sup>e</sup>, Giovanna Marrazza<sup>f</sup>, Ioana Berindan-Neagoe<sup>e,g</sup>, Robert Săndulescu<sup>e,\*</sup>



Anal Bioanal Chem

DOI 10.1007/s00216-012-6476-7

ORIGINAL PAPER

## Electrochemical detection of miRNA-222 by use of a magnetic bead-based bioassay

Francesca Bettazzi · Ezat Hamid-Asl ·  
Carla Lucia Esposito · Cristina Quintavalle ·  
Nello Formisano · Serena Laschi · Silvia Catuogno ·  
Margherita Iaboni · Giovanna Marrazza ·  
Marco Mascini · Laura Cerchia · Vittorio De Francis ·  
Gerolama Condorelli · Ilaria Palchetti

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**Journal of  
Nanoscience and Nanotechnology**  
Vol. 15, 3411–3416, 2015  
[www.aspbs.com/jnn](http://www.aspbs.com/jnn)

## A DNA Aptasensor for Electrochemical Detection of Vascular Endothelial Growth Factor

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Sensors and Actuators B 179 (2013) 194–200



Contents lists available at SciVerse ScienceDirect

Sensors and Actuators B: Chemical

journal homepage: [www.elsevier.com/locate/snb](http://www.elsevier.com/locate/snb)



## New label free CA125 detection based on gold nanostructured screen-printed electrode

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## ...Nanostructures

..The ultrahigh sensitivity of nanoparticle-based electrochemical sensing protocols opens up the possibility of detecting cancer markers that cannot be measured by conventional methods and could lead to an early detection of the disease..”

➤ Gold nanoparticles (AuNPs)

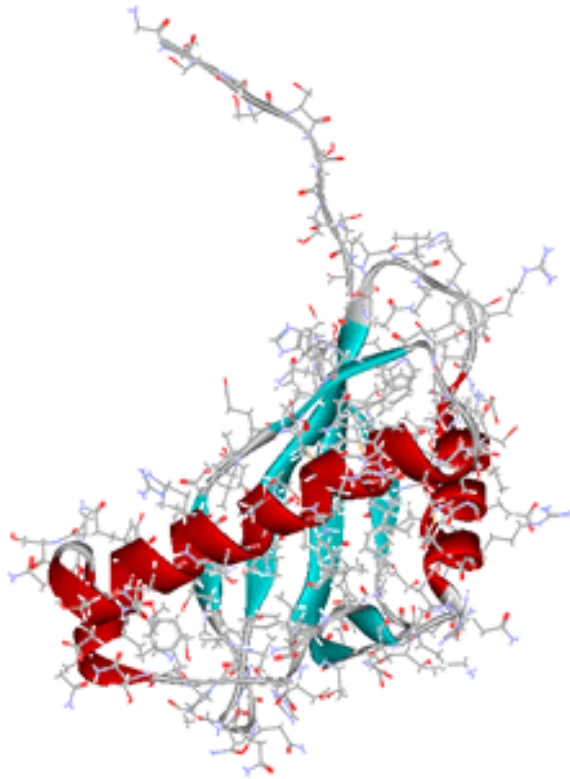
They can be modified with biospecific recognition molecules such as antibodies, aptamers, peptides and DNA probes.







# Carbohydrate Antigen 125 (CA125 or MUC 16)

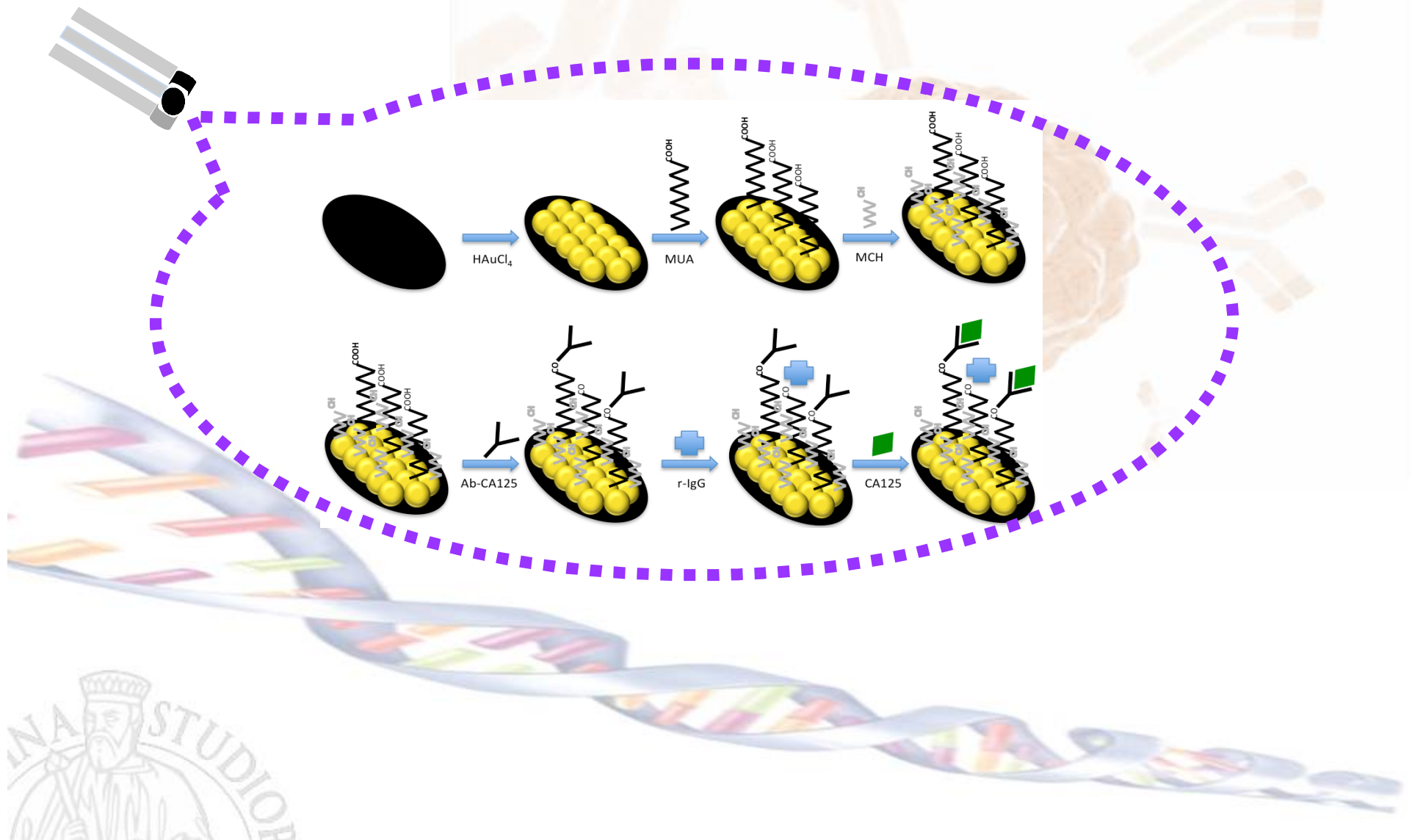


CA125 is a membrane glycoprotein. The protein exists in the cells of normal and cancerous tissues of ovarian. The release of proteolytic fragments of CA125 leads to elevation of CA125 level in bloodstream, which is associated with progression of ovarian cancer. The antigen has **diagnostic and prognostic value** in patients with ovarian cancer. The normal range is 0-35 kU/L.

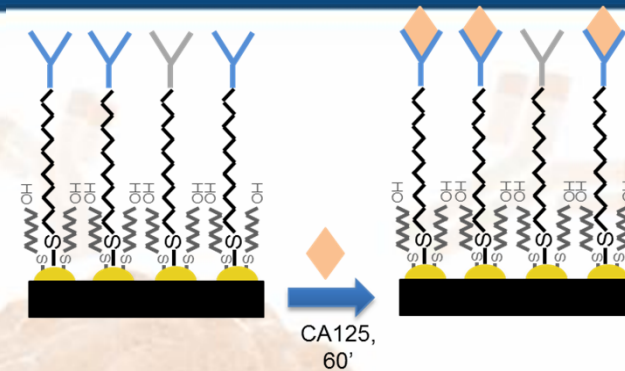




# Label free affisensor CA125 tumour marker



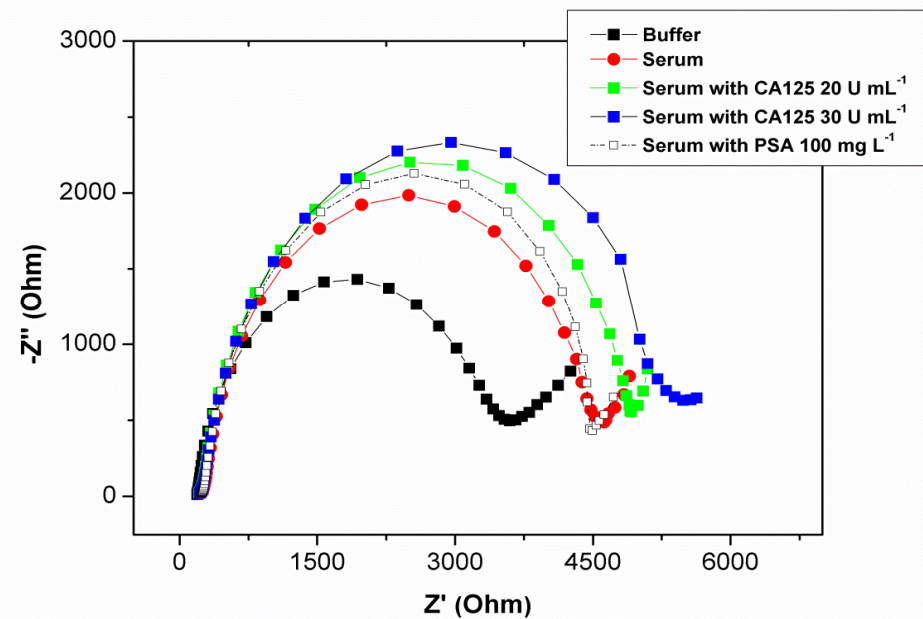
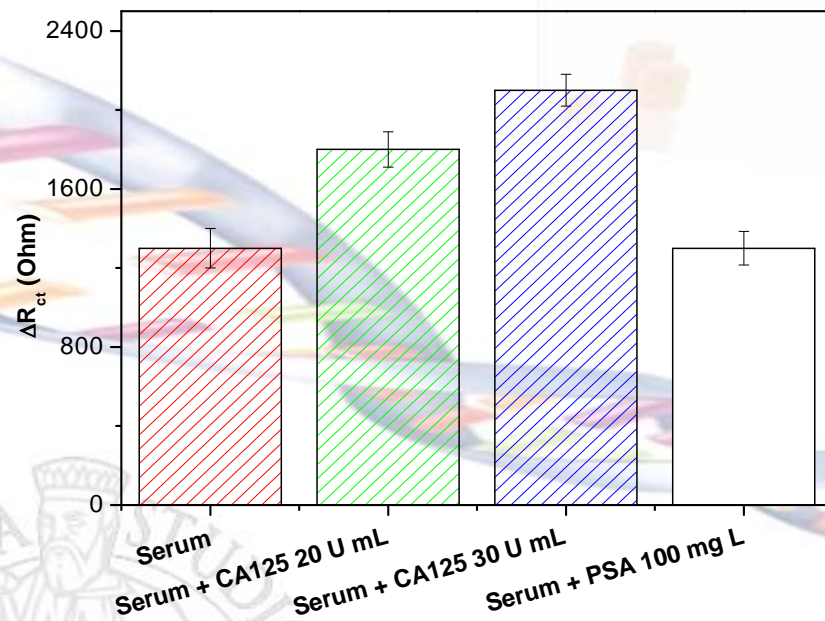
- Range: 0 – 50 U mL<sup>-1</sup>
- LOD: 6.7 U mL<sup>-1</sup>
- CV: 5%



Redox mediator:

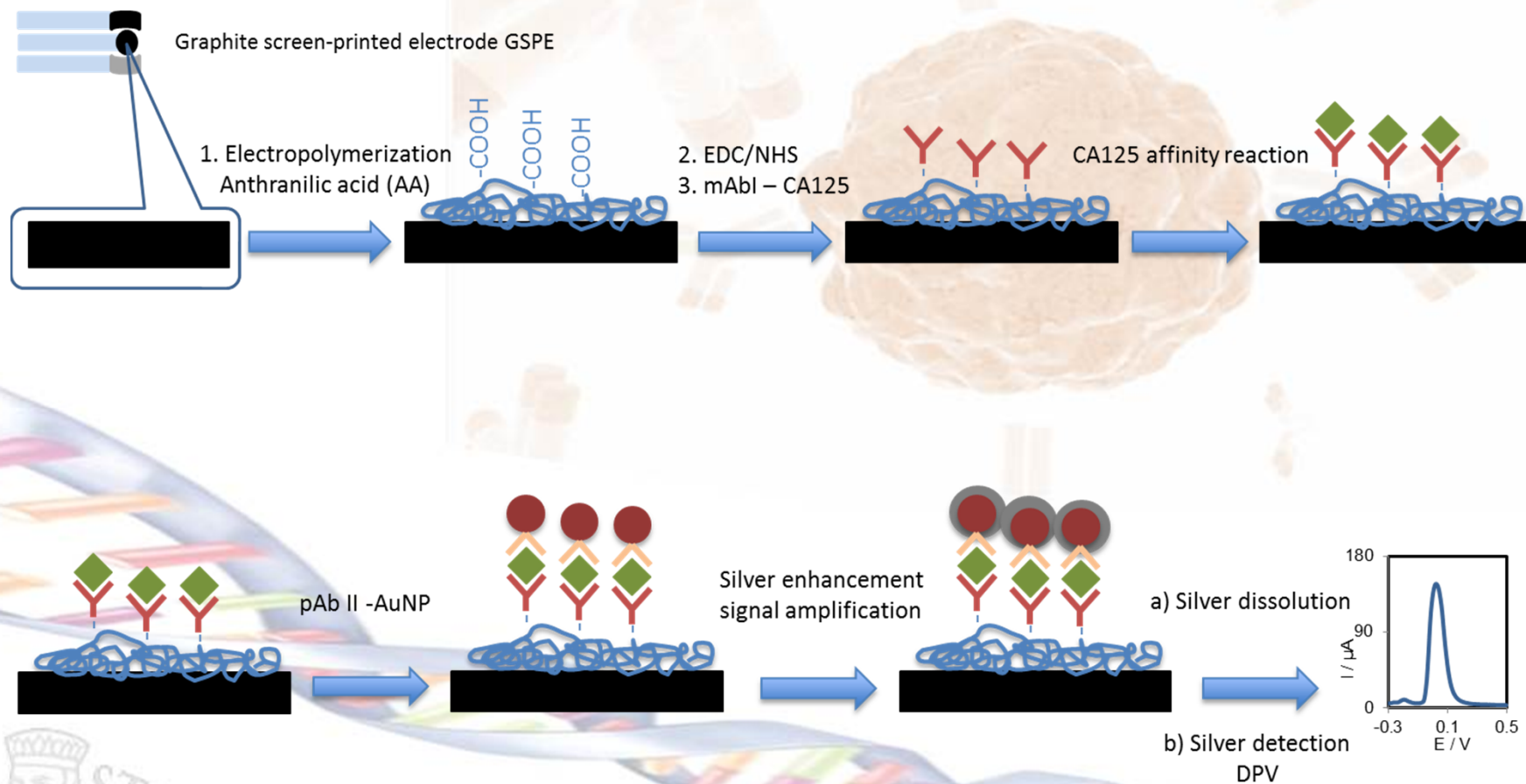
$K_3Fe(CN)_6/K_4Fe(CN)_6$  10 mM, in PBS  
0.1 M, pH = 7.4

### Serum samples:



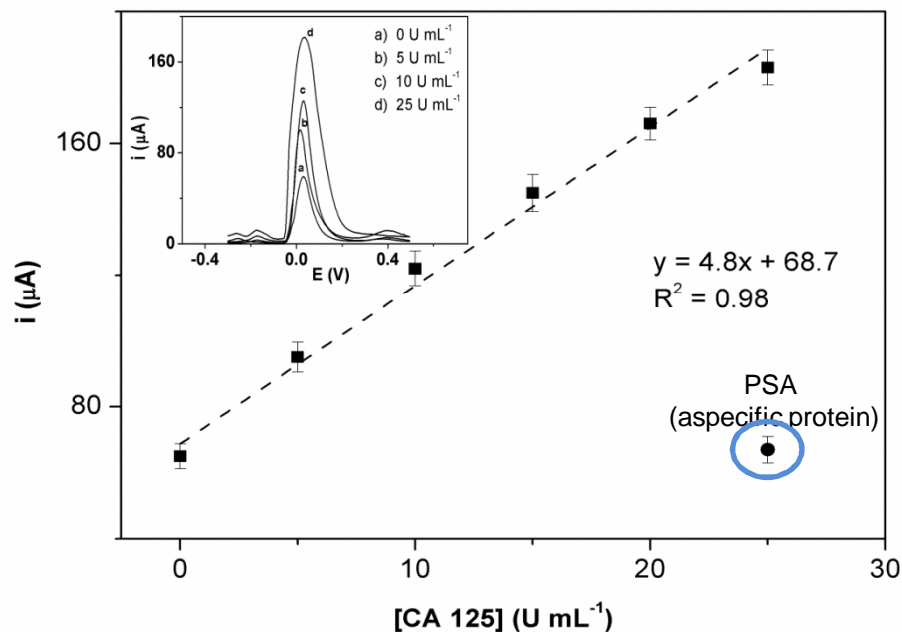
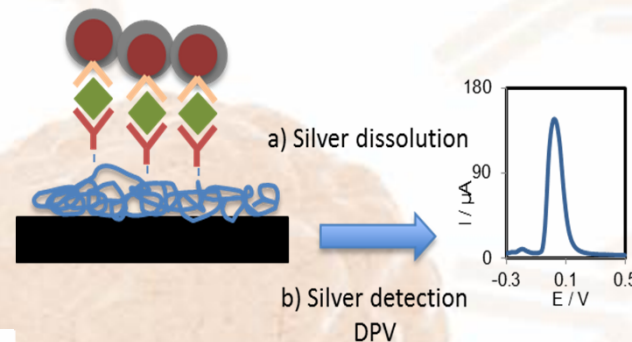


## CA125 detection based on AuNP silver enhancement



### ASV silver determination:

1.  $\text{HNO}_3$  1 M, KCl 0.1 M, 5'
2.  $E = -0.2$  V, 3'
3. ASV measurements



Linear range: 0 – 25 U/mL

LOD: 2 U/mL

### ASV parameters:

- $E$ : - 0.3 – + 0.5 V
- Scan Rate: 50 mV
- Mod. time: 0.05 s
- Interval time: 0.15 s
- Modulation Amplitude: 70 mV



## Group's expertise

1. Development and evaluation of sensors and biosensors based on the coupling of electrochemical, optical and piezoelectric sensors with enzymes, antibodies, bacteria, whole tissues and nucleic acids
2. Solving analytical problems in clinical chemistry, experimental medicine, food chemistry and environmental analysis
3. Development of new immobilization chemistries of biomolecules (enzymes, proteins, nucleic acids, etc.) and in analytical procedures suitable for use with biosensor devices, i.e. flow injection analysis, flow systems, and microdialysis



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**Thanks for your attention!**