Departamento de Química Física y Analítica

UNIVERSIDAD DE OVIEDO

MONITORING AND VERIFICATION OF FOOD SAFETY AND QUALITY: SCREENING TECHNOLOGY FOR FRUITS AND VEGETABLES

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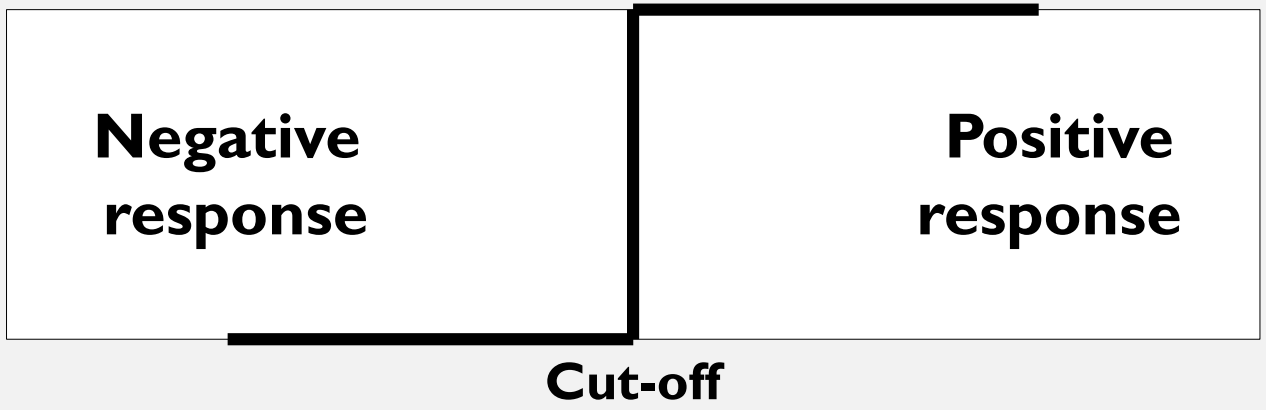
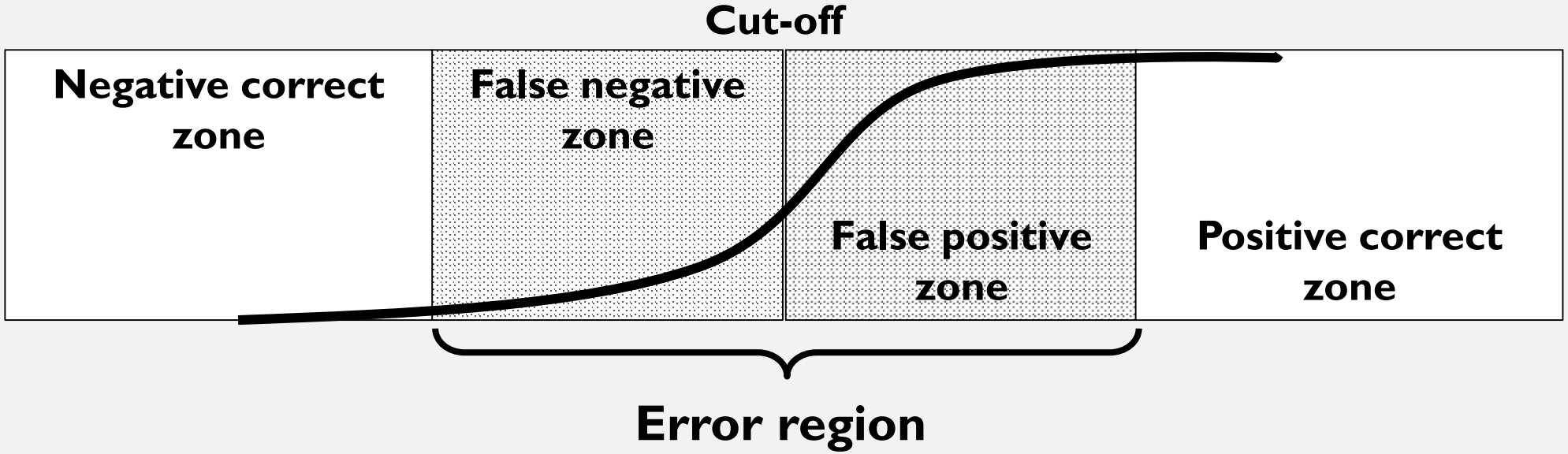
5. IMMUNOSENSORS (IMIDACLOPRID)

1.ANALITYCAL METHODS OF SCREENING

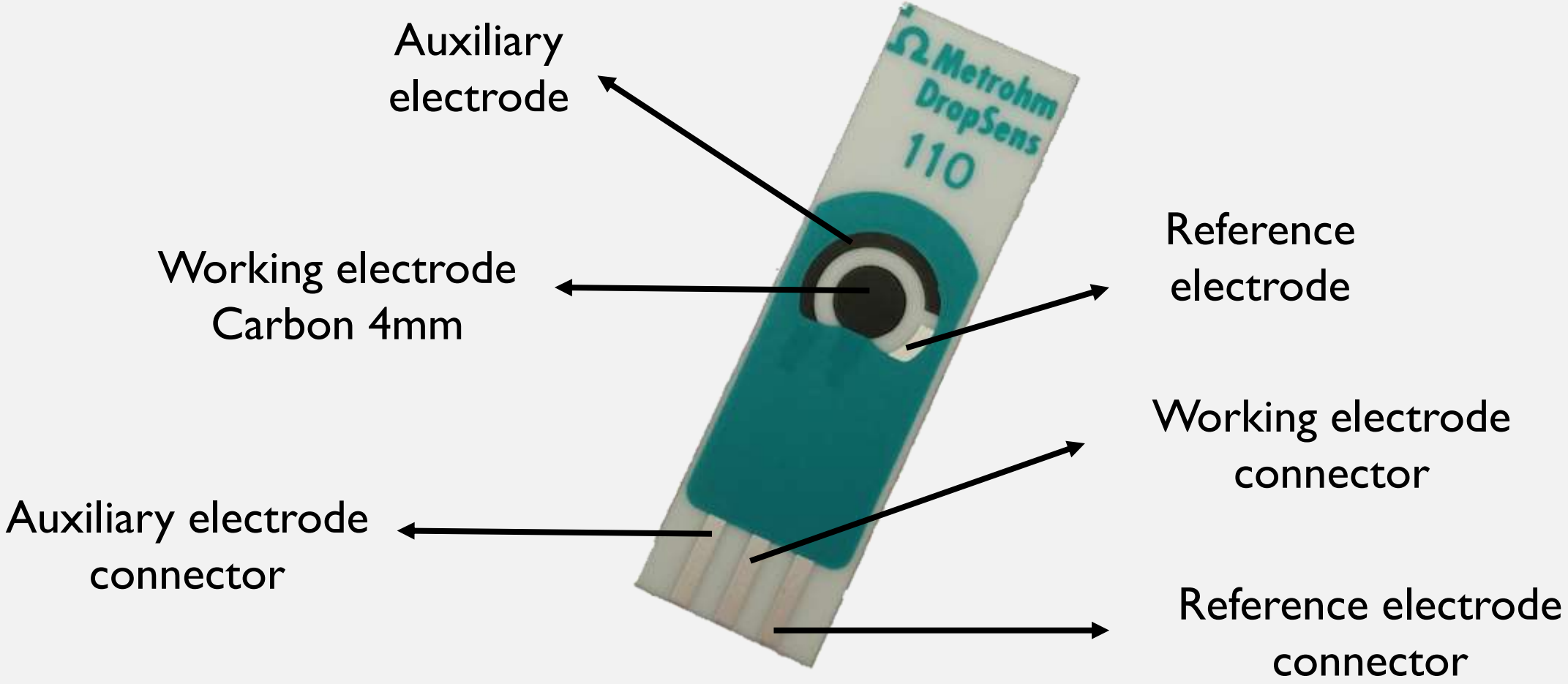
THEORETICAL RESPONSE OF A TEST KIT



EXPERIMENTAL RESPONSE OF A TEST KIT



SCREEN-PRINTED CARBON ELECTRODES (SPCE)



MINIATURIZATION

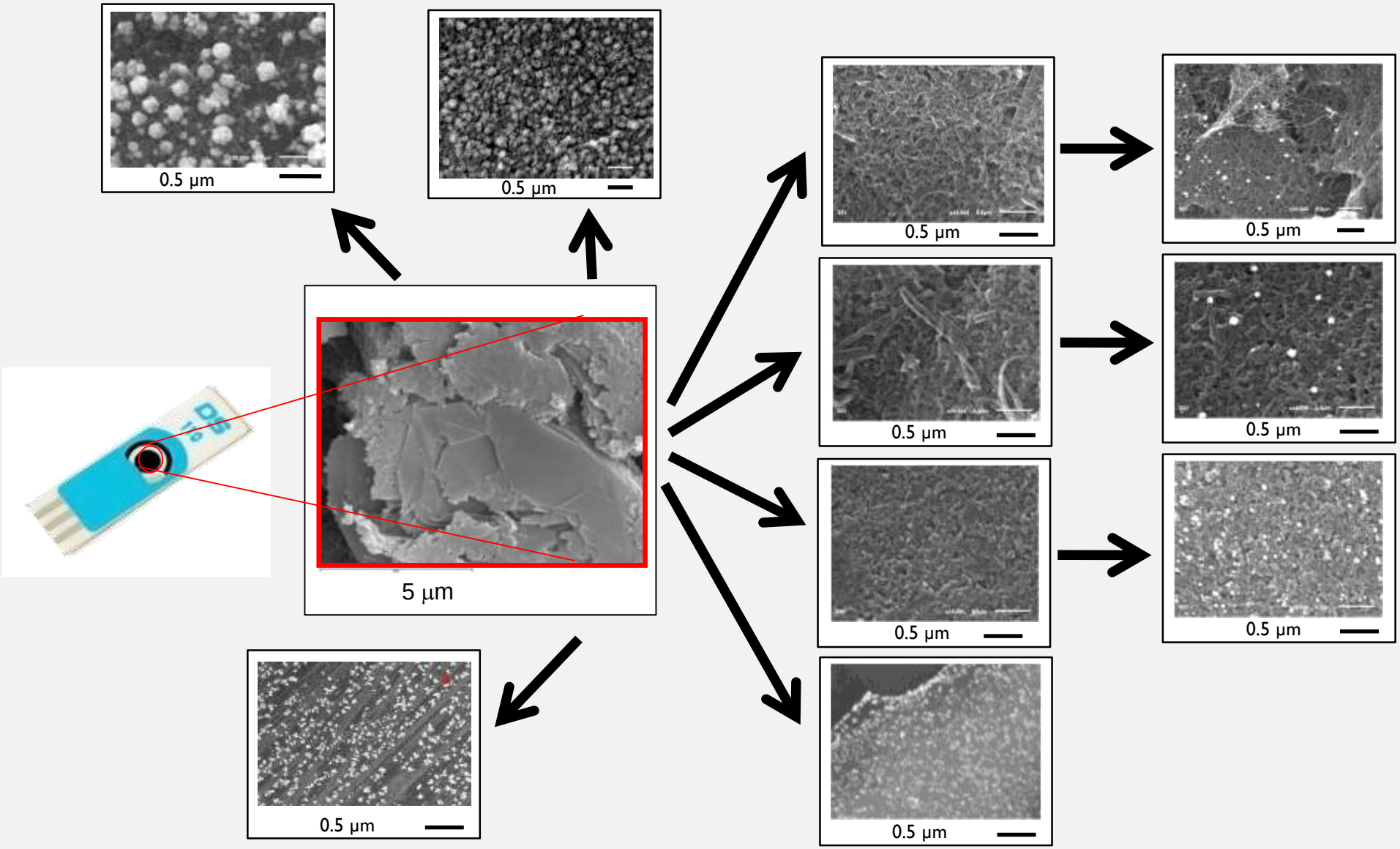
PORTABILITY

MINIATURIZATION

LOW SAMPLE VOLUME

FLOW CELL

TRANSDUCER MODIFICATIONS

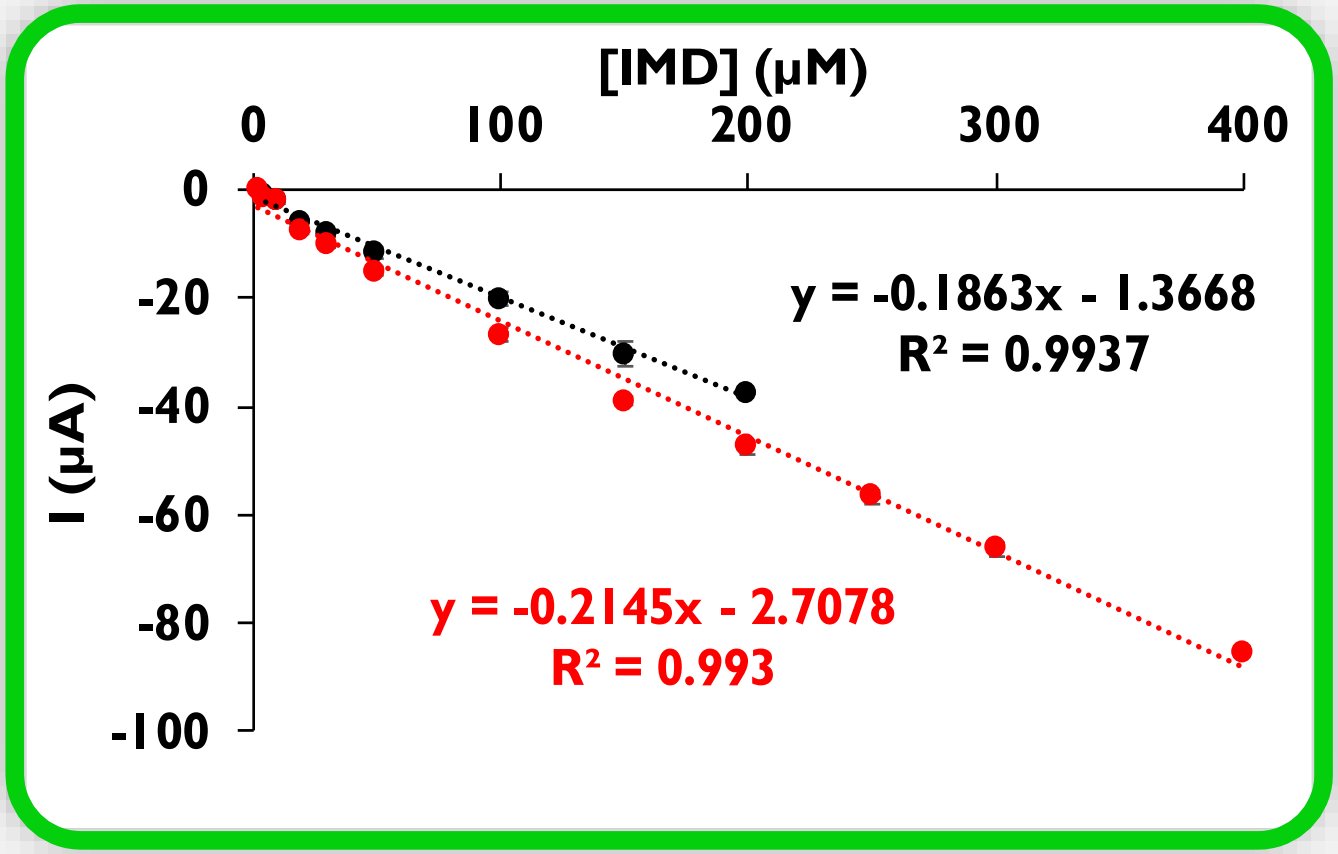


2. DIRECT MEASUREMENT

Nanoestructuration	Pesticides
Mercury Film	Imidacloprid, Atrazine, Pyrethroids
Bismuth Film	Imidacloprid, Acetamiprid
Silver nanodendrimers (AgNDs)	Imidacloprid
Cobalt (II) phthalocyanine	Chlorpyrifos
Gold nanoparticles (AuNP)	Hydrazine, Methyl parathion, Malathion, Chlorpyrifos
Copper oxide nanoparticles (CuONP)	Atrazine, Methyl parathion, Malathion, Chlorpyrifos
Titanium oxide (TiO_2)	Cypermethrin
Magnetite nanoparticles (Fe_3O_4 – NP)	Malathion, Chlorpyrifos
Copper and Titanium oxide (CuO-TiO_2)	Methyl parathion
Nickel oxide nanoparticles (NiONP)	Parathion

2. DIRECT MEASUREMENT

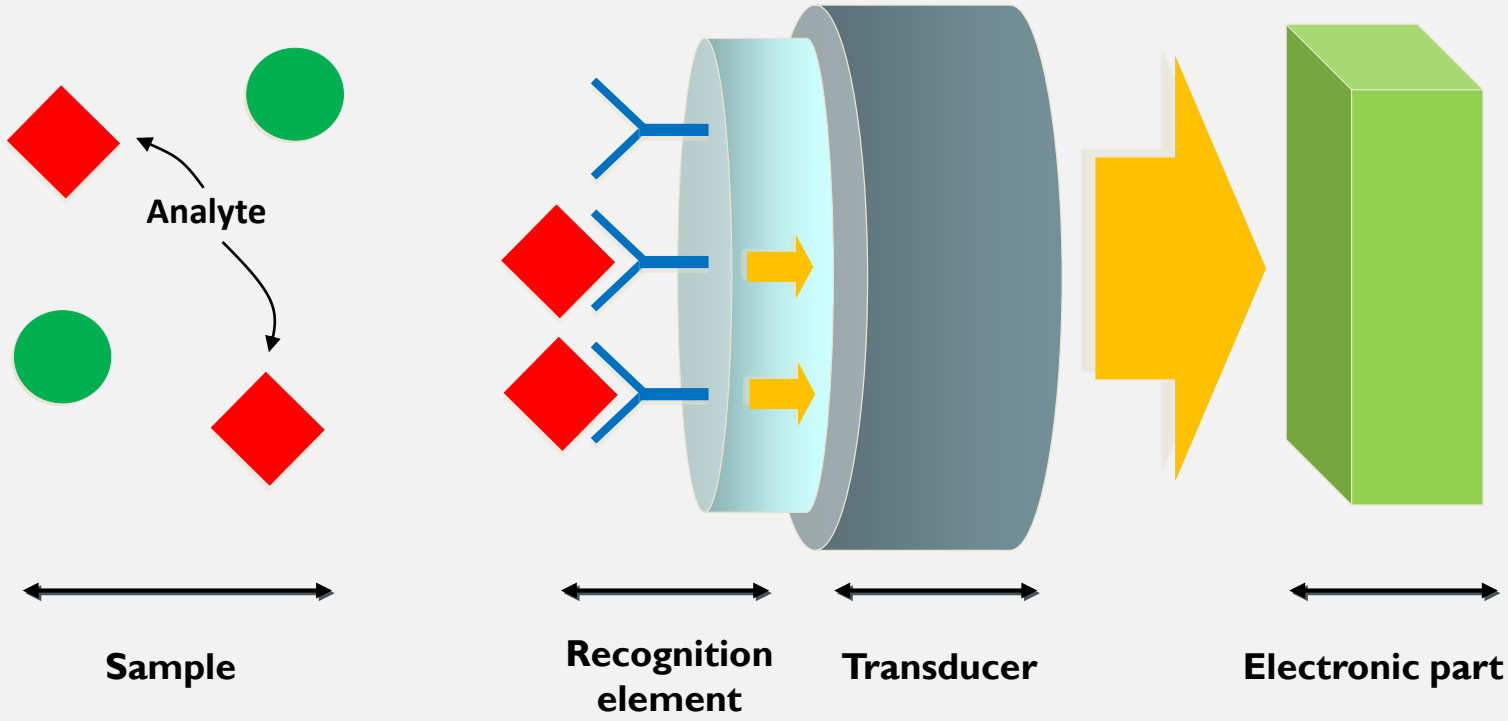
IMIDACLOPRID DETERMINATION (SPCE or Hg-SPCE)



Sensor	Linear Range
SPCE	5 – 200 μM
Film Hg-SPCE	2,5 – 400 μM

3. ENZYMATIC SENSORS

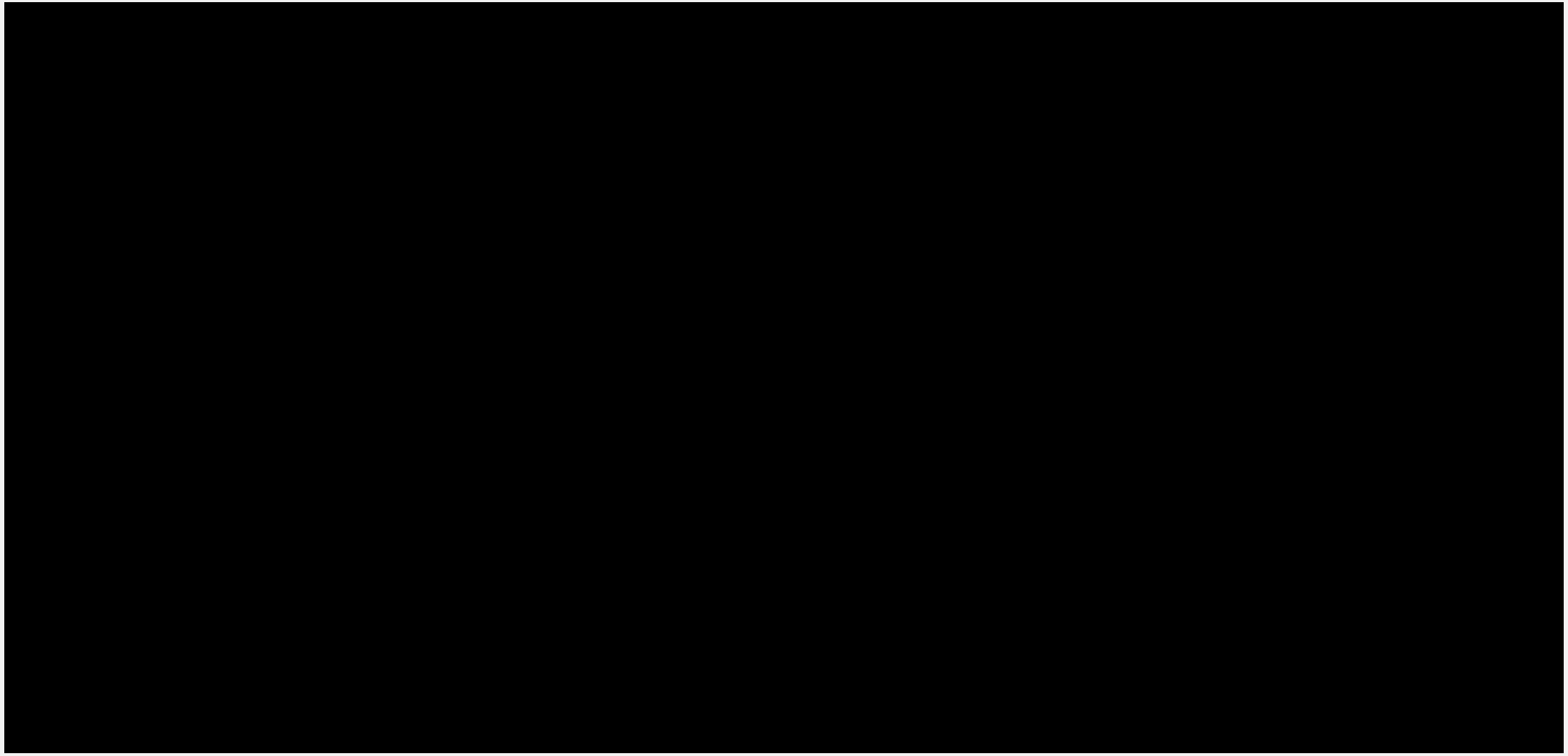
Basic components



Recognition elements

- Enzymes
- Antibodys

3. ENZYMATIC SENSORS



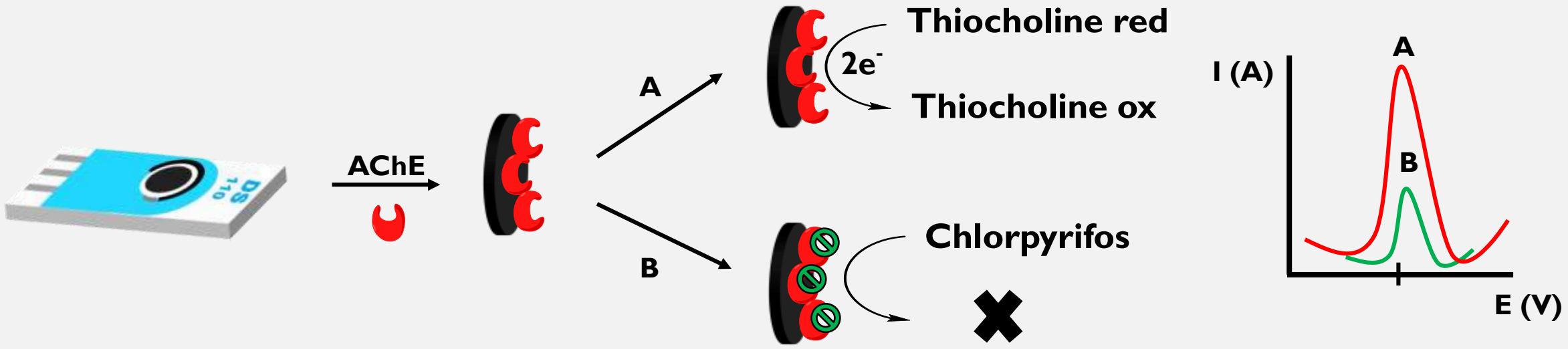
ACETYLCHOLINESTERASE (AChE)

ENZYMATIC INHIBITION: ORGANOPHOSPHORUS PESTICIDES

$$Acetylthiocholina + H_2O \xrightarrow{AChE} Thiocholine + Acetic\ acid$$

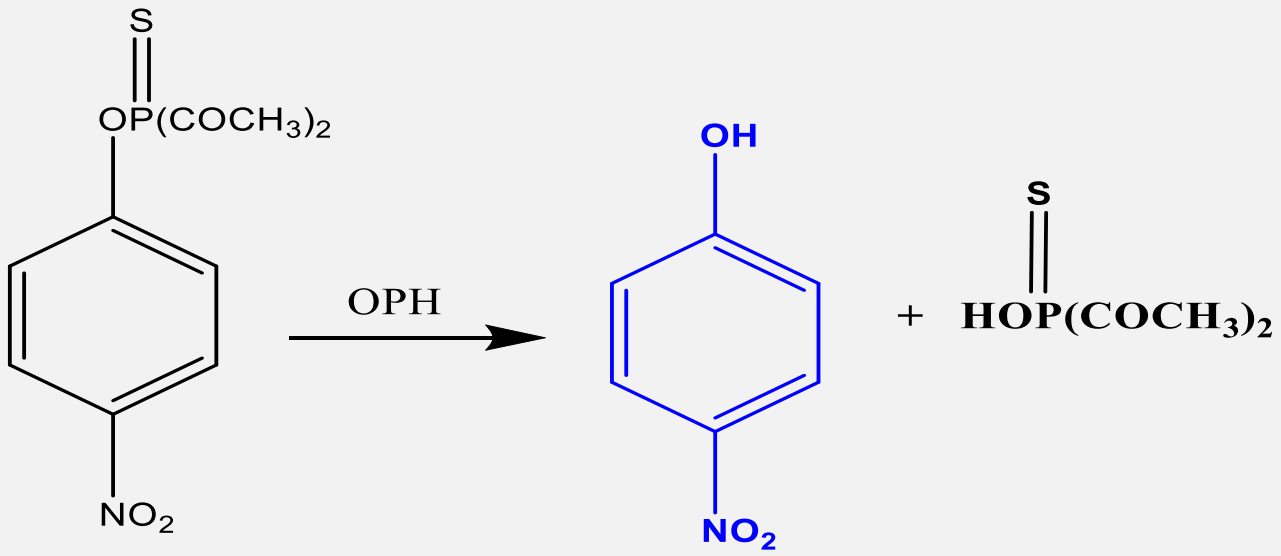
$$2\ Thiocholine_{red} \rightarrow Thiocholine_{ox}\ (dimer) + 2H^+ + 2e^-$$

CHLORPYRIFOS (LD: 0,1 pM)

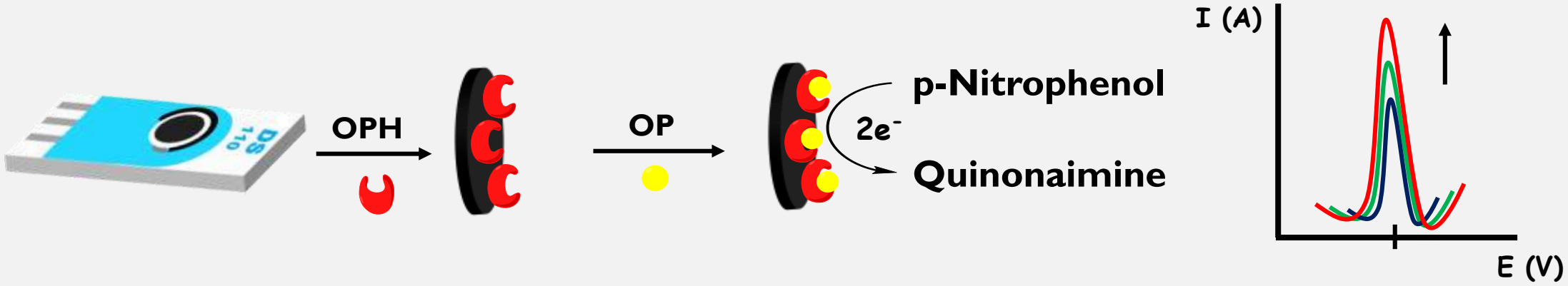


ORGANOPHOSPHORUS HYDROLASE (OPH)

DIRECT DETERMINATION OF p-NITROPHENOL

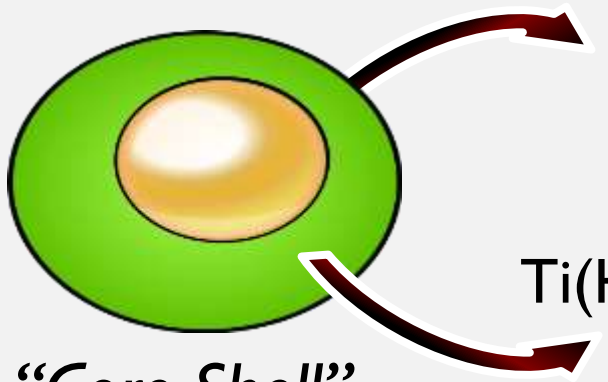


PARATHION (LD: 3,4nM)



4. MAGNETIC PARTICLES (MP)

TITANIUM PHOSPHATE NANOPARTICLES



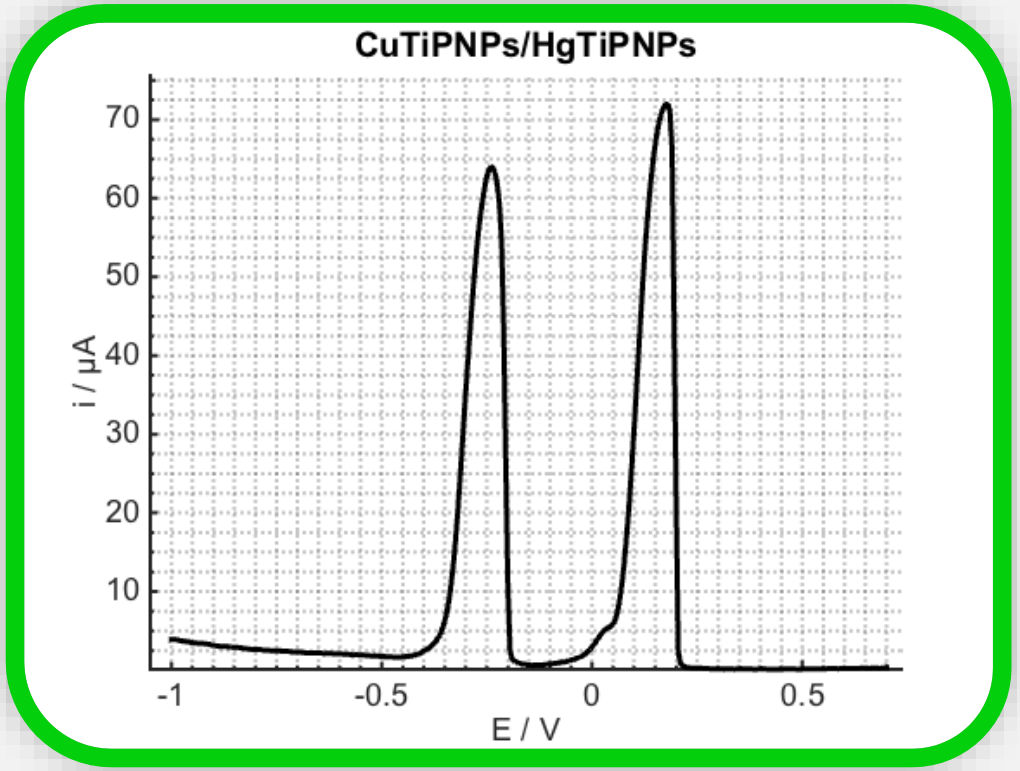
$NaTi_2(PO_4)_3$

$Ti(HPO_4)_2$ & $Ti(H_2PO_4)_4$

"Core-Shell"
Nanoparticles

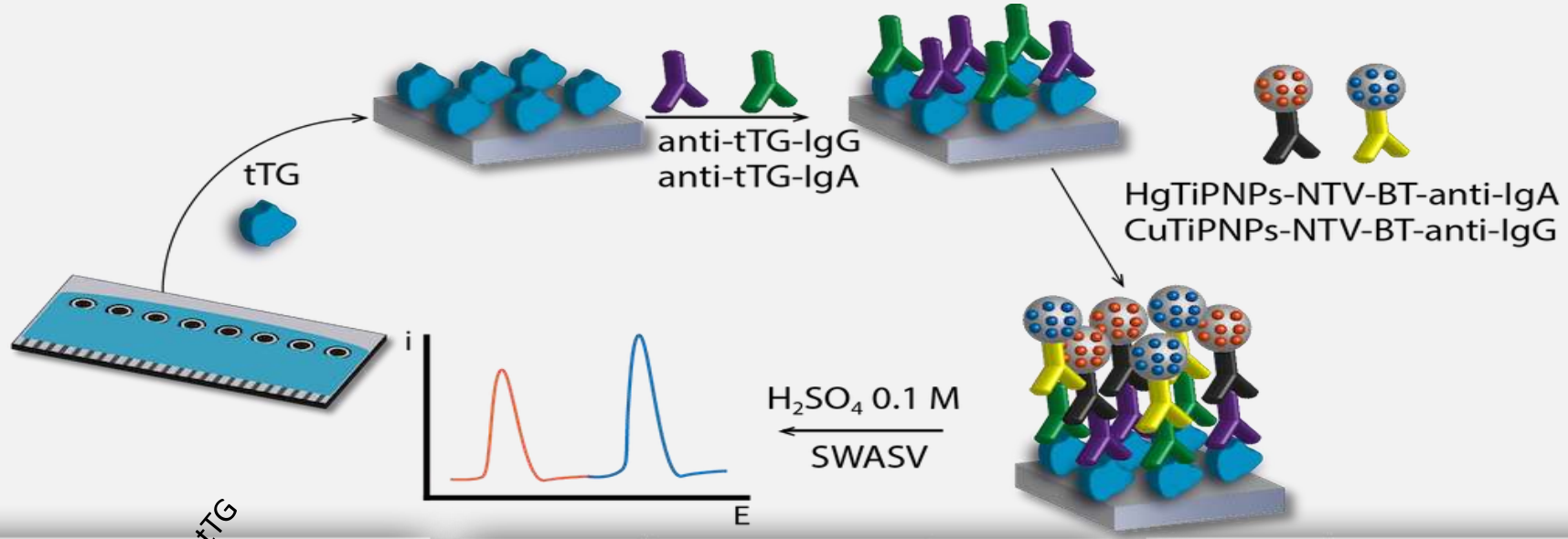
"Core": crystalline
"Shell": non-crystalline, high porosity
Ion exchange properties

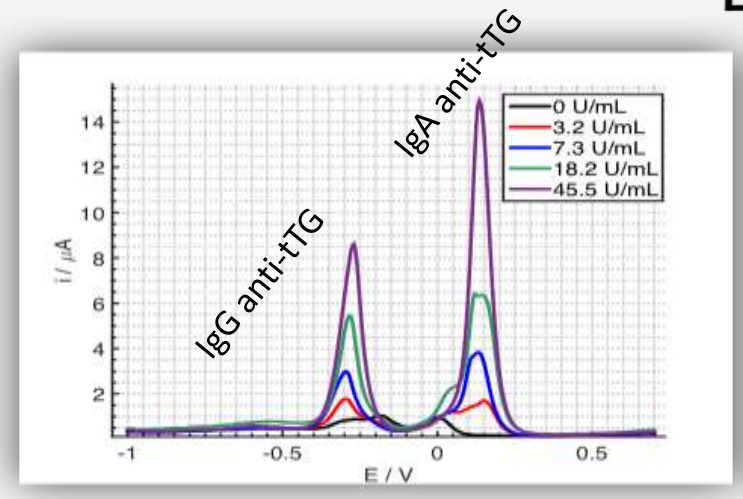
Cations inserted in the structure		
Ag (I)	**Hg (II)**	**Cd (II)**
Cu (II)	**Bi (III)**	**Zn (II)**

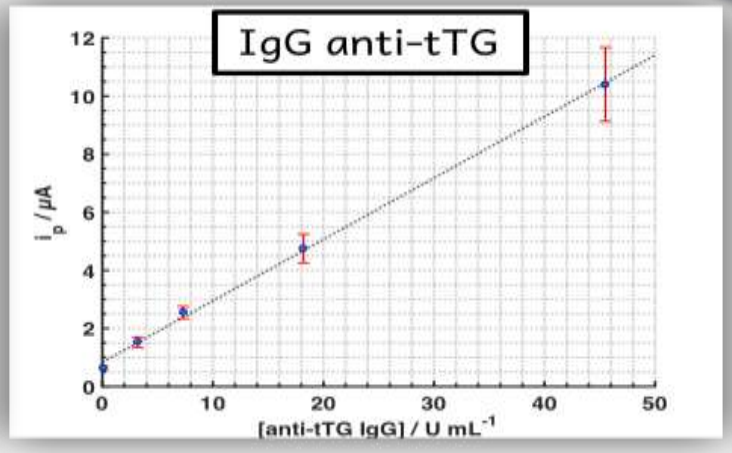


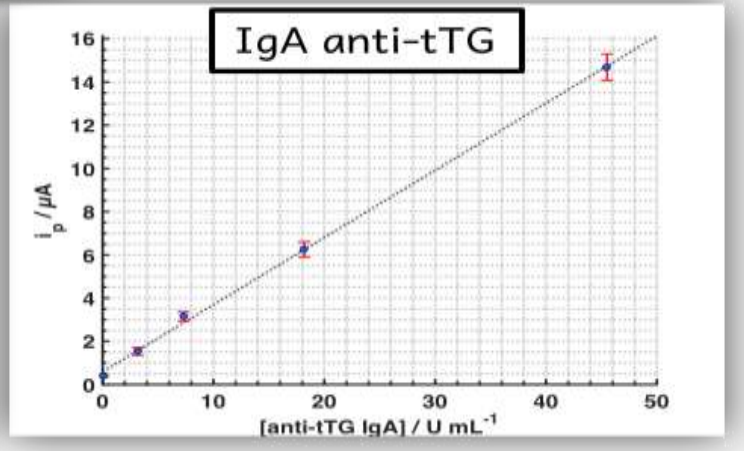
4. MAGNETIC PARTICLES (MP)

MULTIPLEX DETECTION OF anti-tTG IgA AND anti-tTG IgG



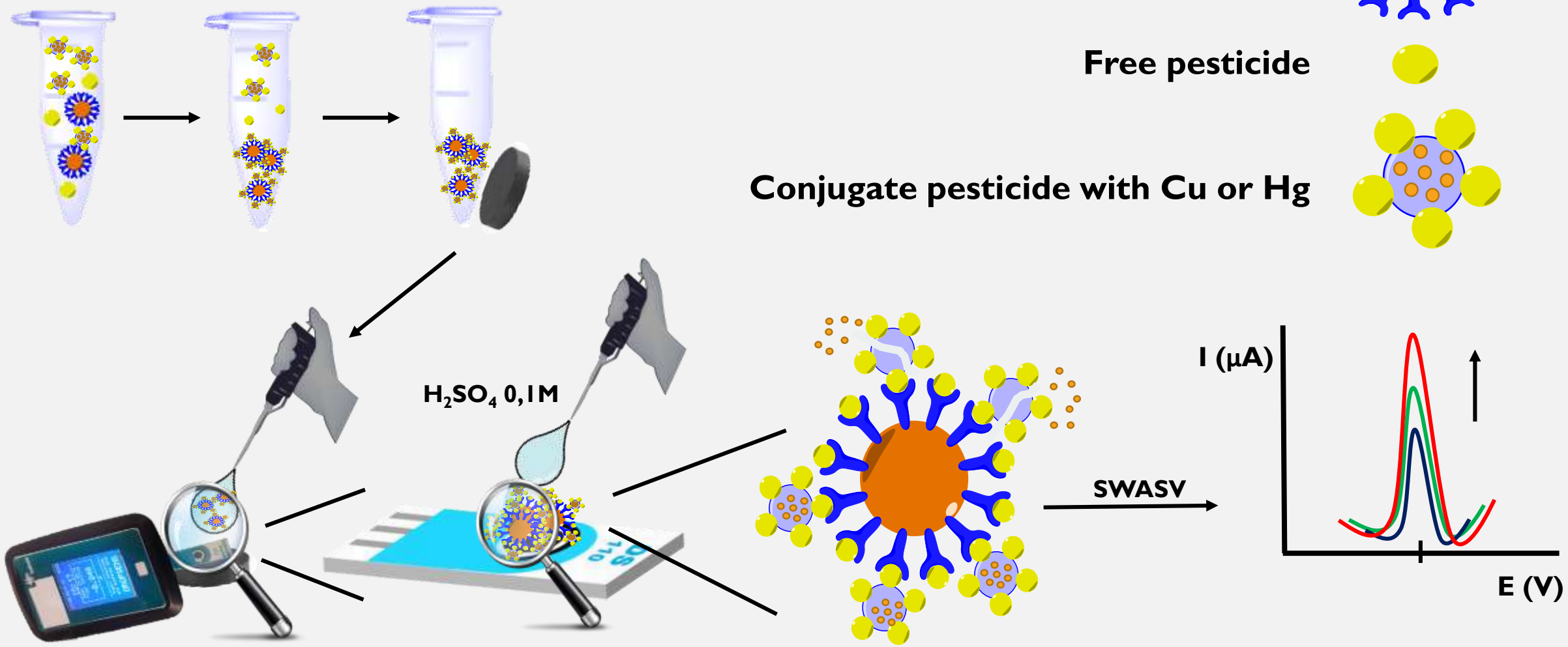






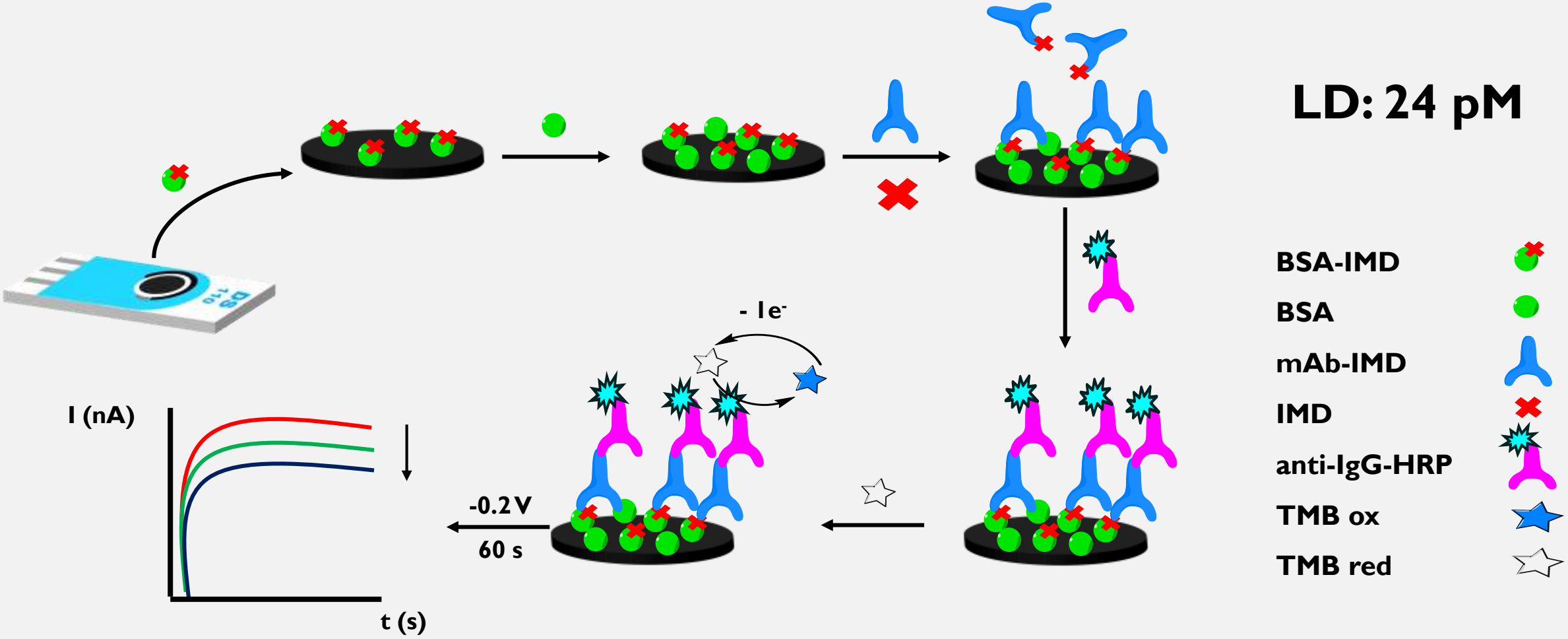
4. MAGNETIC PARTICLES (MP) (KIT)

COMPETITIVE ASSAY



5. INMUNOSENSOR IMIDACLOPRID

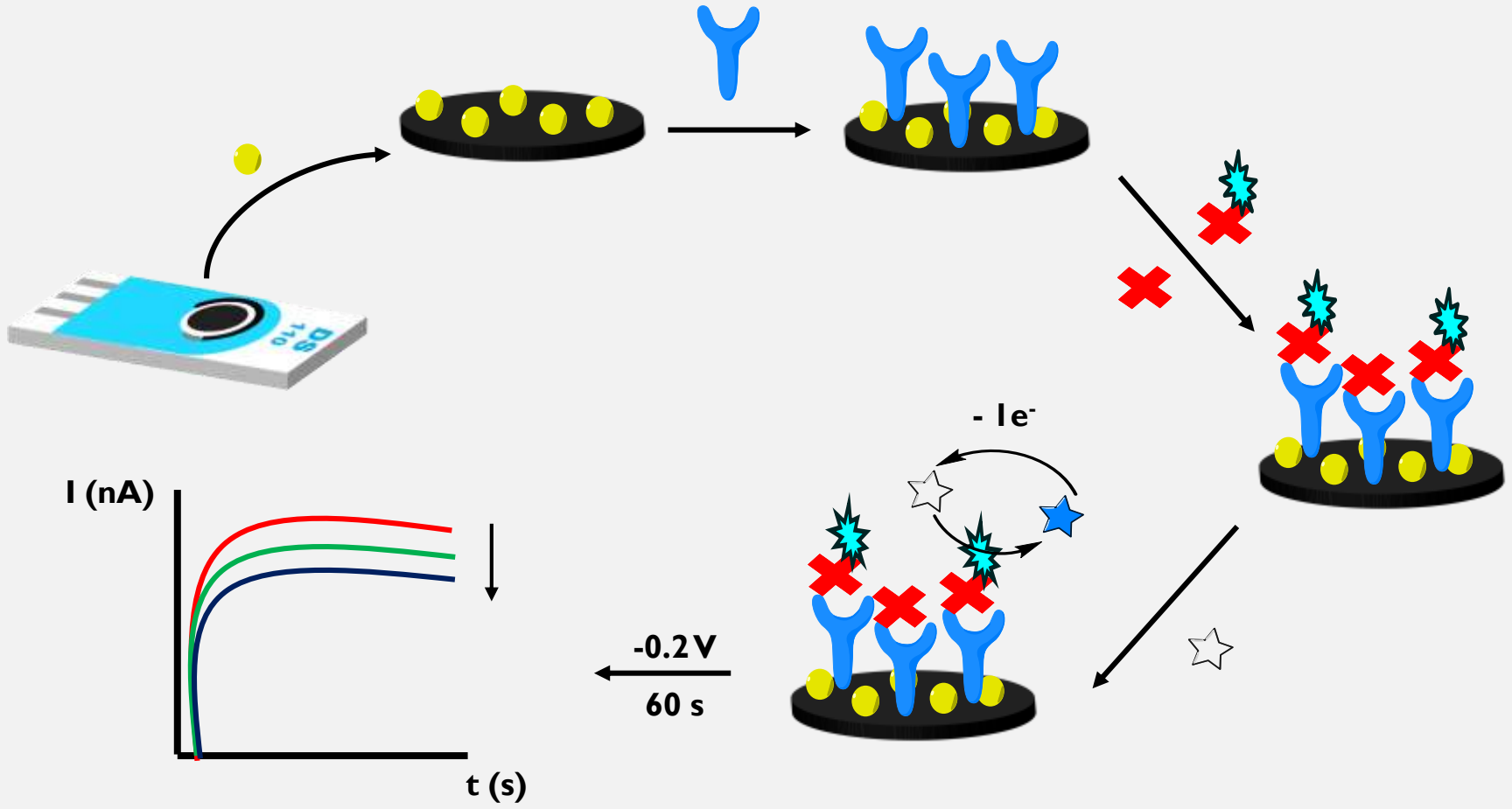
INDIRECT COMPETITIVE METHOD (Analyst 2019, 144, 2936-2941)



LD: 24 pM

5. INMUNOSENSOR IMIDACLOPRID

DIRECT COMPETITIVE METHOD



LD: 25 pM

AuNP
mAb-IMD
IMD-HRP
IMD libre
TMB ox
TMB red

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!!!THANK YOU¡¡¡

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