

Advancements of the biosensing technologies for the preliminary biomarkers

Giulio Rosati^a, Celia Fuentes Chust^a, José Marrugo Ramirez^a, Massimo Urban^a, Gabriel Maroli^a, Leyla Karadurmus^b, Ahmet Cetinkya^b, Sibel Ozcan^b, Claudio Parolo^c, Christophe Junot^d, Stephanie Simon^d, Itziar de Lecuona^e, Arben Merkoçi^{a,f}

^aInstitut Català de Nanociència i Nanotecnologia (ICN2), Edifici ICN2 Campus UAB, 8193 Bellaterra, Barcelona Spain

^bFaculty of Pharmacy, Emniyet Mah. Döğol Cad. No: 4, Ankara University, 06560 Ankara, Turkey

^cInstituto de Salud Global de Barcelona, Rosselló, 132, 7^a, 08036 Barcelona, Spain

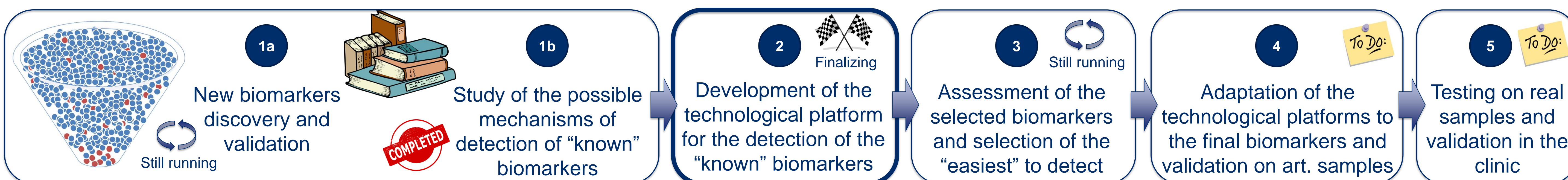
^dCEA Saclay, Gif-Sur-Yvette, 91191, Paris, France

^eUniversitat de Barcelona 08036 Barcelona, Spain

^fICREA, Passeig Lluís Companys 23 08010 Barcelona, Spain



STRATEGY OF THE PROJECT



Quinolinic and Kynurenic acids

m.w. 167.12 g/mol

m.w. 189.17 g/mol

Electropolymerization process: Template (Solution: monomer) on Electrode → Polymer film on Electrode → Template removal → MIP synthetic (bio)receptor on Electrode.

- The molecules (template) are used to synthesize a MIP on an electrode.
- The cavities obtained after the removal of the template from the polymer are "specific" to the template.
- The current recorded with electrochemical measurements in a redox solution is hindered in presence of the target.
- The current reduction is proportional to the target molecule concentration in the sample.

Phenylalanine

m.w. 165.19 g/mol

- Lateral Flow Assays (LFAs) typically use antibodies as bioreceptors, but this is an issue when the target is a small molecule.
- We designed a LFA based on an aptamer i.e. a short DNA sequence with a conformation allowing the binding of Phenylalanine (Phe).
- The binding of Phe releases an AuNP labelled sequence of DNA.
- The assay can be performed as a displacement or a competitive assay.

Neutrophil Gelatinase-ass. Lipocalin (NGAL)

m.w. 25 kDa

Square Wave Voltammetry (SWV) for fast and accurate detection

- Inkjet printed electrodes are functionalized with aptamers labelled with a methylene blue (MB) redox probe.
- The aptamers conformation changes upon NGAL binding and the distance between MB and the surface change as well.
- The different distance causes a variation of the electron transfer between the probe and the electrode surface, thus of the recorded signal, proportionally with the NGAL concentration.

Wireless smartphone readout

- We developed Near Field Communication (NFC) inkjet printed antennas for the wireless readout of our biosensors.
- The fabrication is easy and straightforward and the biosensors can be printed together with the antenna.
- The smartphone app allows both impedimetric and amperometric measurements.

CONCLUSIONS

- The technological platforms for the "known" biomarkers, i.e. Kynurenic acid, Quinolinic acid, Phenylalanine, and NGAL are at an advanced level and will be ready in few months.
- Innovative methods of biosensors fabrication, wireless readout at the point of care, and smartphone based data acquisition and analysis have been introduced and are ready to use. A new app will be soon developed thanks to a company and will be designed to be easy to use and effective.
- The list of the new validated biomarkers is urgently needed to define the final ones to adapt/redesign the developed detection platforms.

ACKNOWLEDGMENTS

We acknowledge the great work and support received by the group of Prof. Ozcan for the MIP system development, the support of our former group member Claudio Parolo for the development of the Phenylalanine biosensor.



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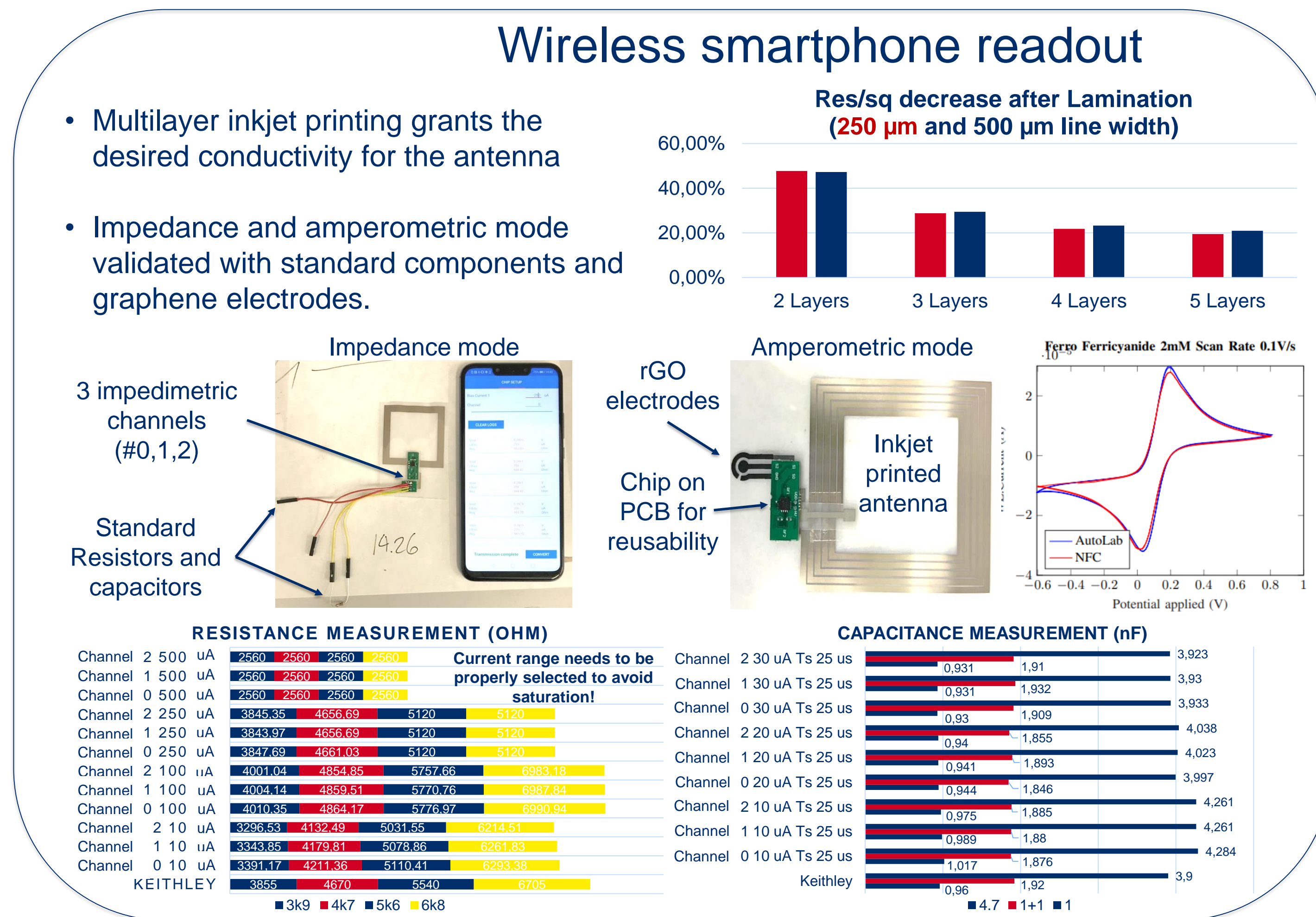
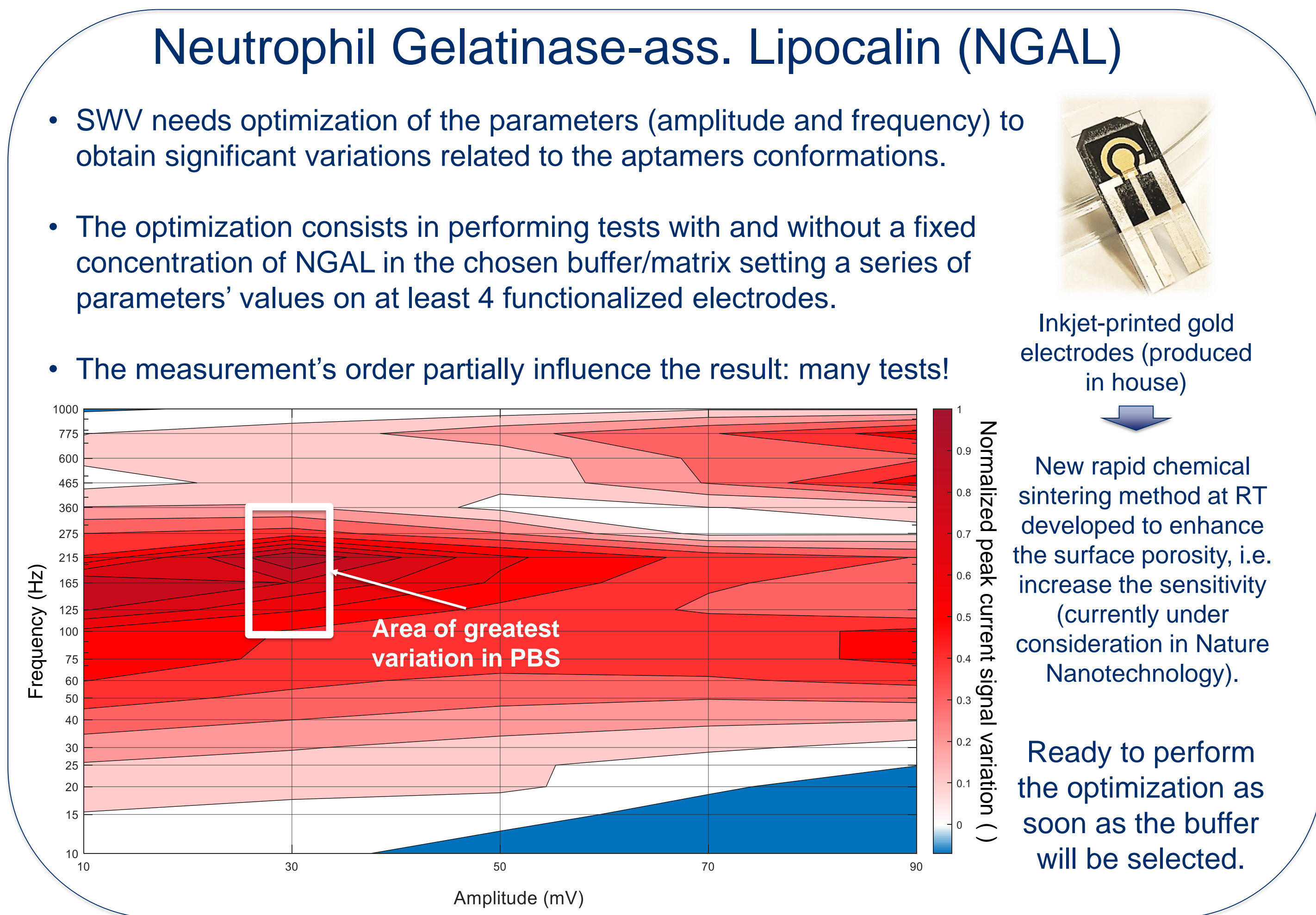
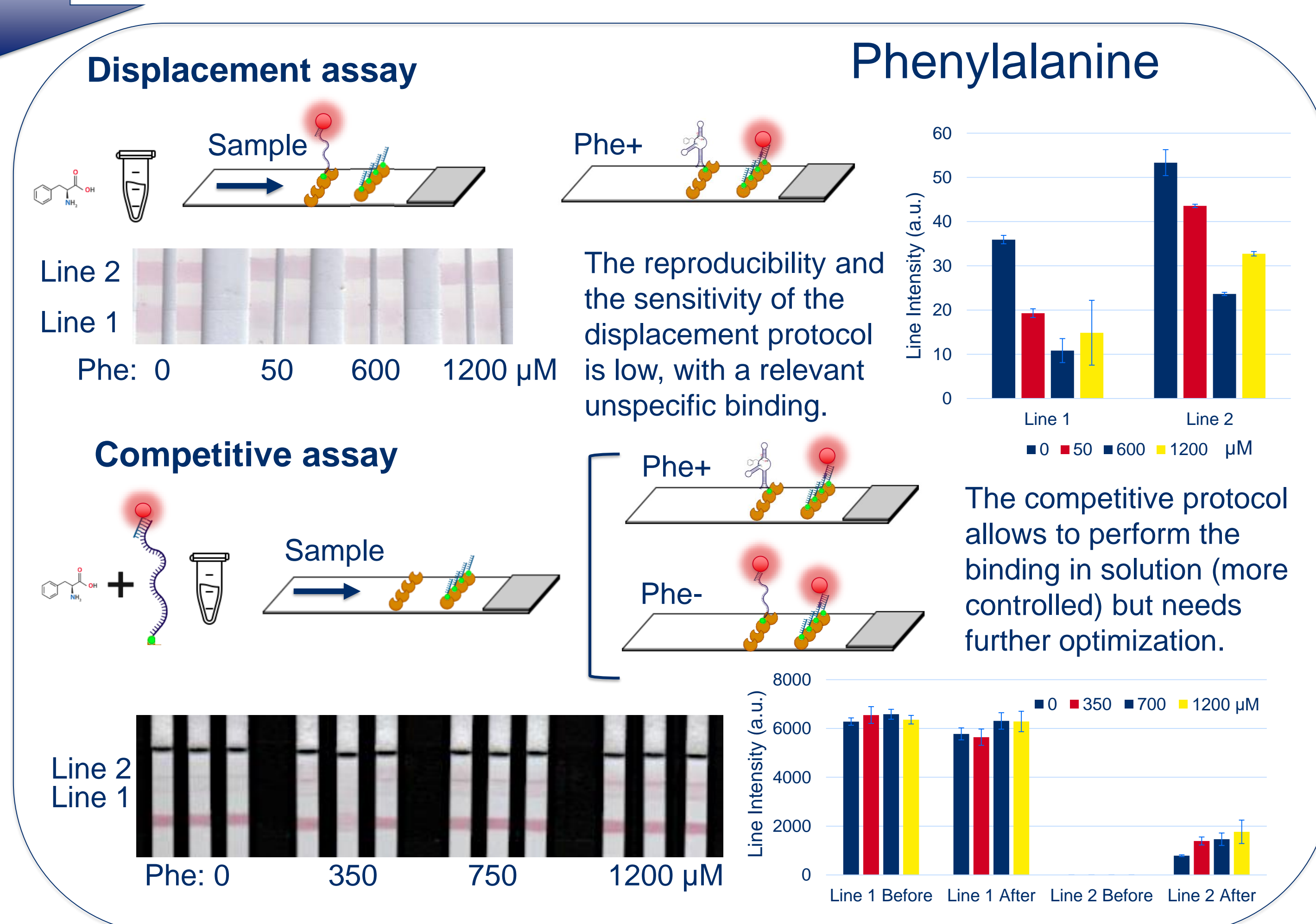
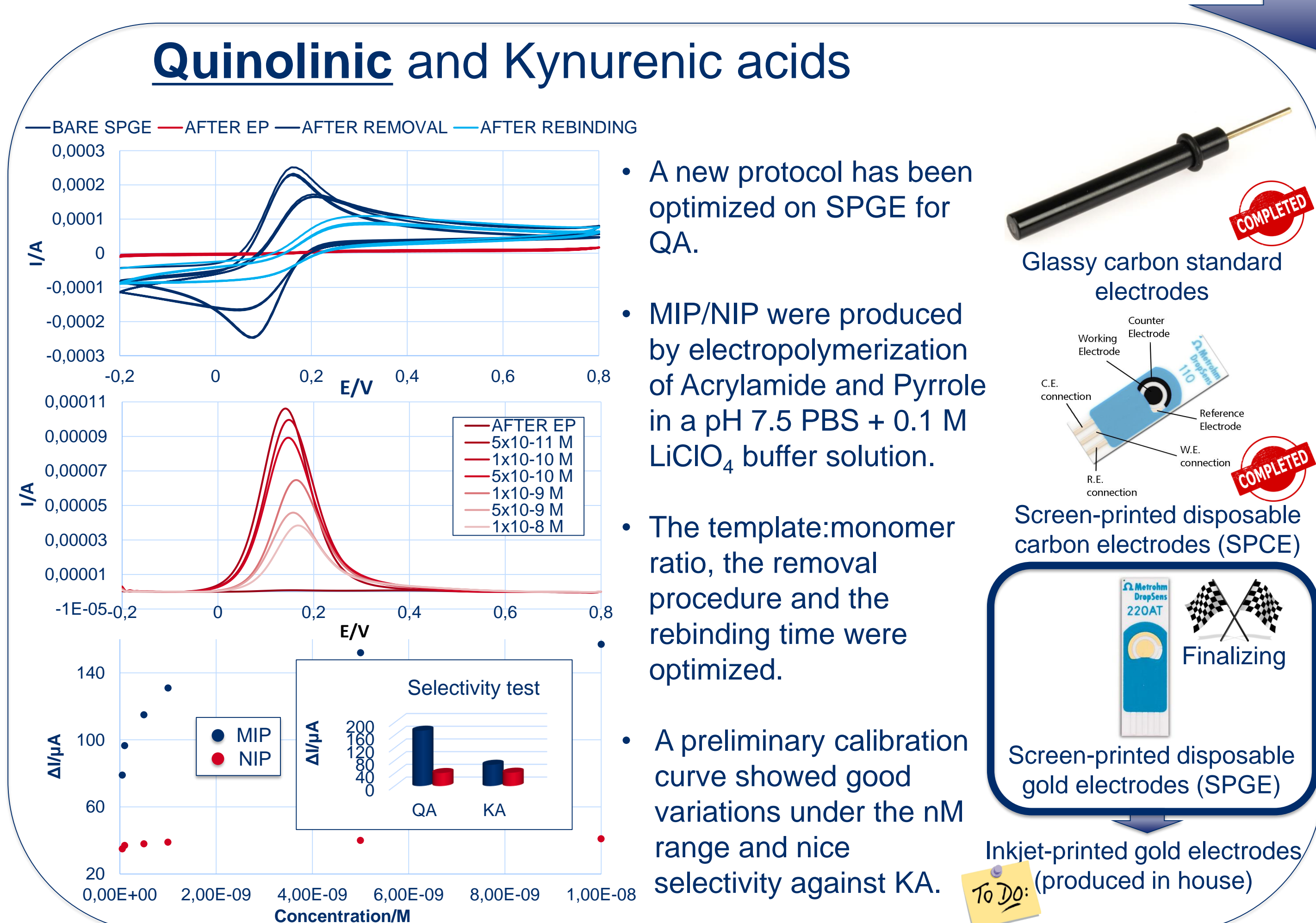
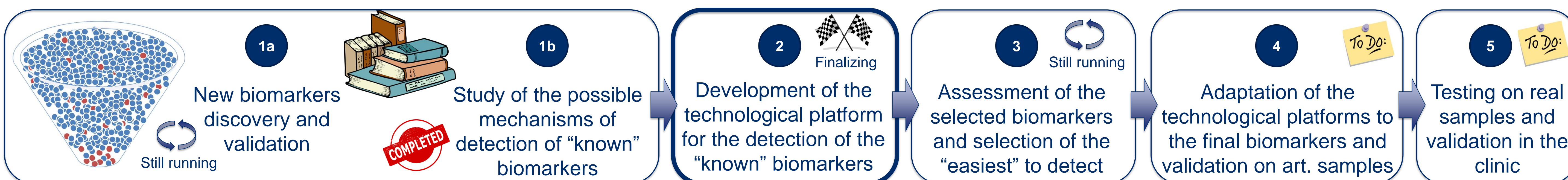
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