

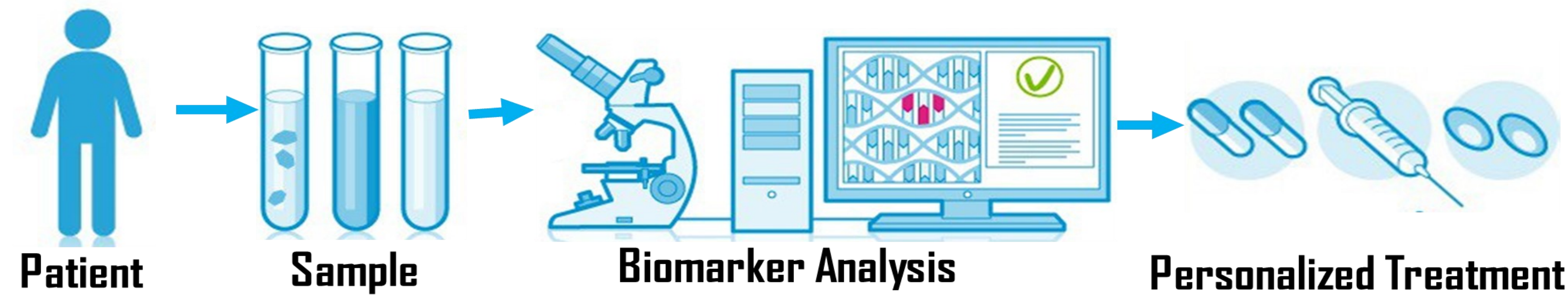
An electrochemical immunosensor based on ensemble protein labelling for point-of-care diagnostic applications

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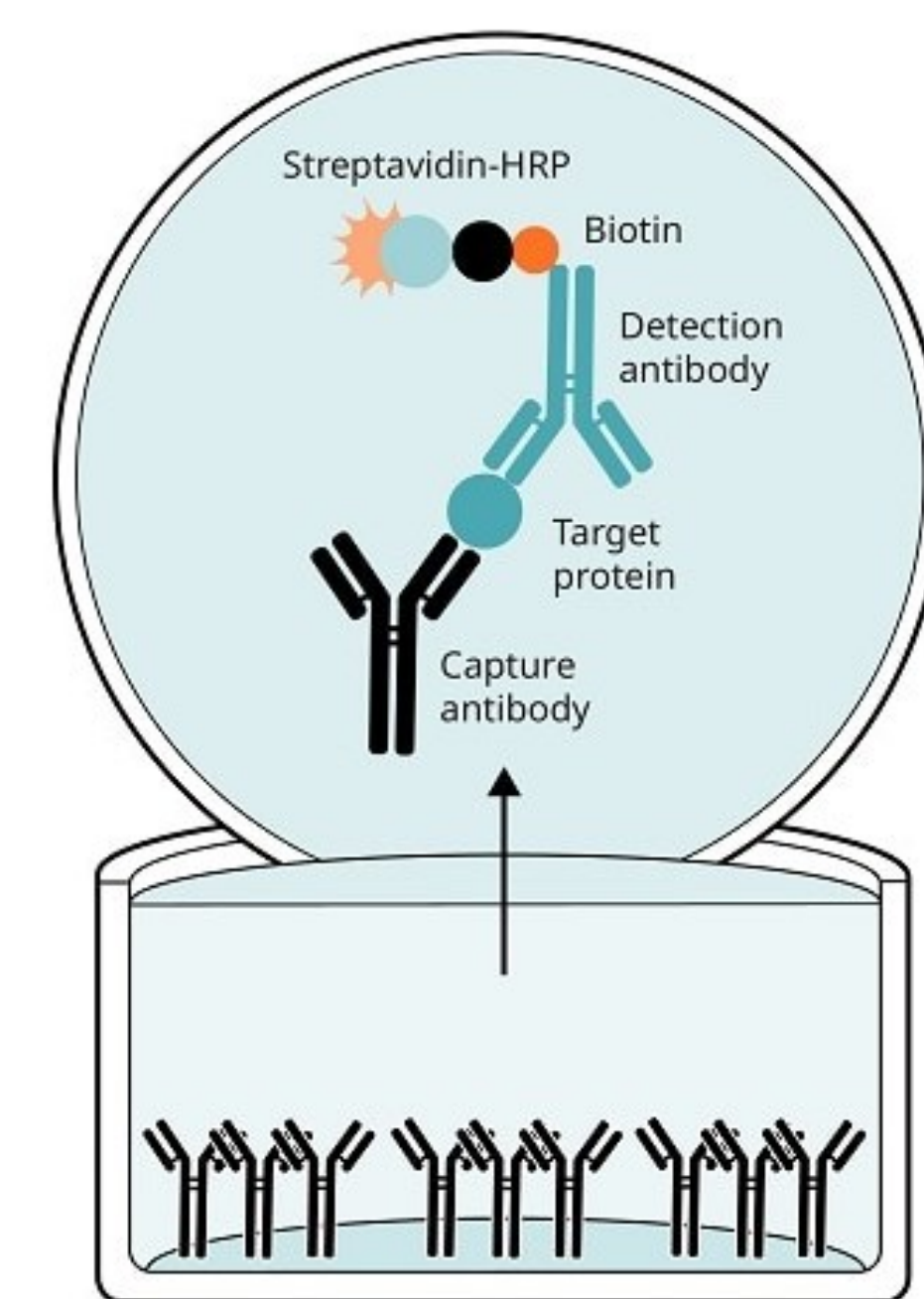
Introduction

- Running diagnostic tests at the “**Point-of-Care**” (POC) is a great asset that can allow:
 - Healthcare providers decide on the best treatment options
 - Monitor patients’ health at home
 - Fast assessment of the patient’s response to therapeutic interventions
- POC sensors** require minimum labor and are user friendly that can be easily run by end-user at low cost and fast turnaround time
- POC sensors are one of the corner stones of **Digital Health** transformation where clinical data are communicated between different bodies instantly minimizing the need for manual processing and improving data logistics
- Biomarker** is “A characteristic that is measured as an indicator of normal biological processes, pathogenic processes, or a response to an exposure or intervention”
- Protein biomarkers** are the main targets for analysis in most clinical settings
- A validated library of proteins is available and is being used daily across the world to provide critical information on disease detection, progression, and response to treatment plans



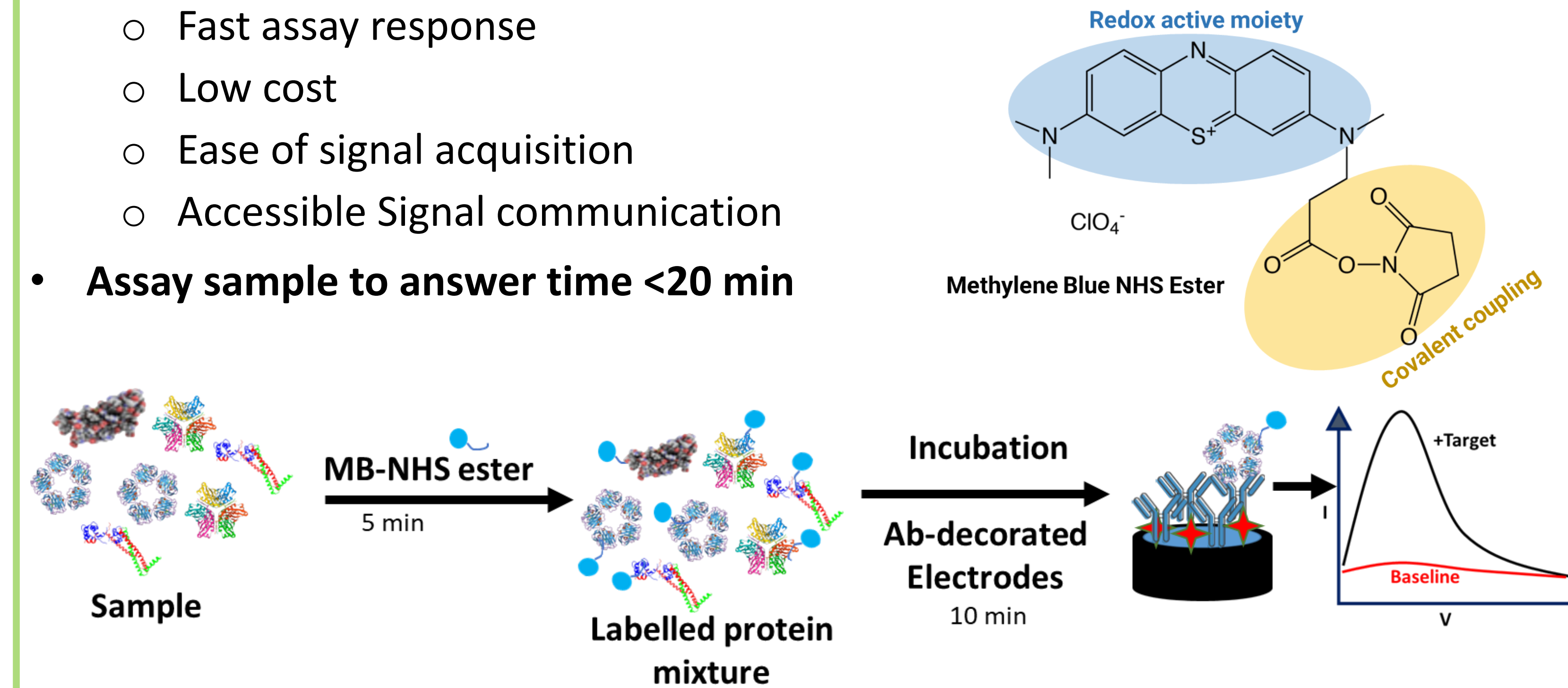
Status quo of protein biomarker sensors

- Current technology for protein biomarker detection rely mainly on the 1980s **ELISA** format
- While different instrumentation can achieve certain degree of assay automation, they are:
 - Usually bulky instruments that are limited to laboratory environment
 - Expensive
 - Time consuming
 - Require paired antibodies



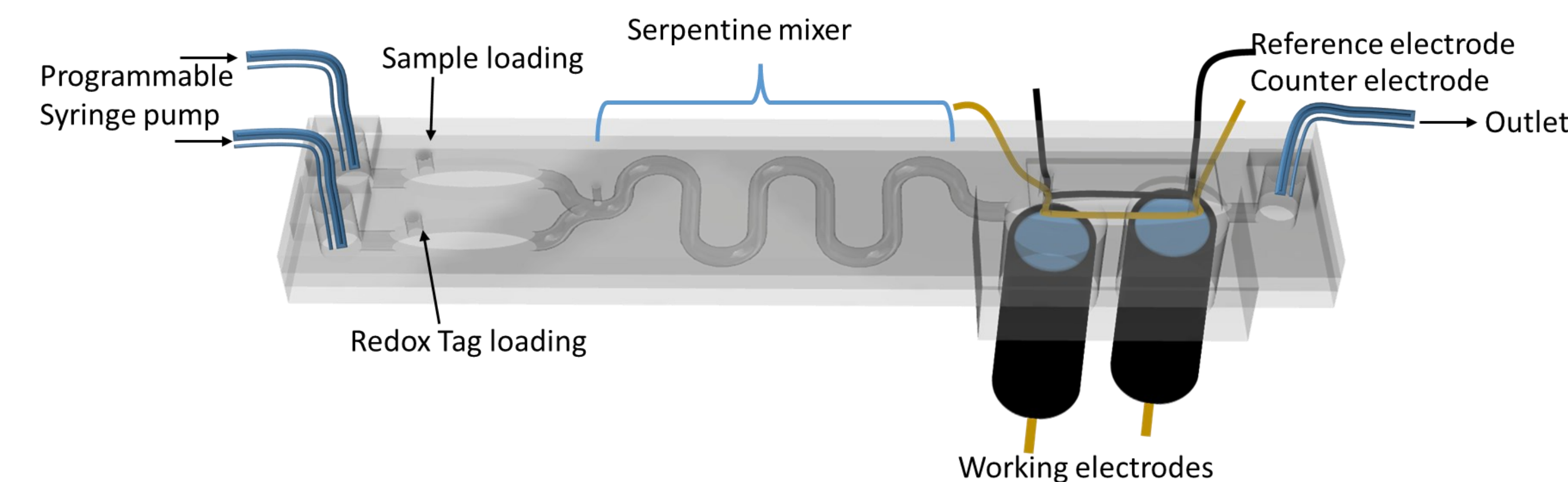
Our Approach

- Ensemble protein labelling** with **Redox active tags** (MB-NHS ester) enable **single antibody**-based detection of protein biomarkers in **electrochemical** platform
 - Fast assay response
 - Low cost
 - Ease of signal acquisition
 - Accessible Signal communication
- Assay sample to answer time <20 min**



Automation

- Assay was integrated within a **3D printed microfluidic chip** for automation
- The end-user introduces the sample (serum) into the loading chamber, then an automated series of procedures is initiated allowing:
 - Mixing of sample with the redox tag (serpentine mixer)
 - Delivery of the labelled proteins to detection chamber
 - Washing of uncaptured proteins
 - Electrochemical signal assessment

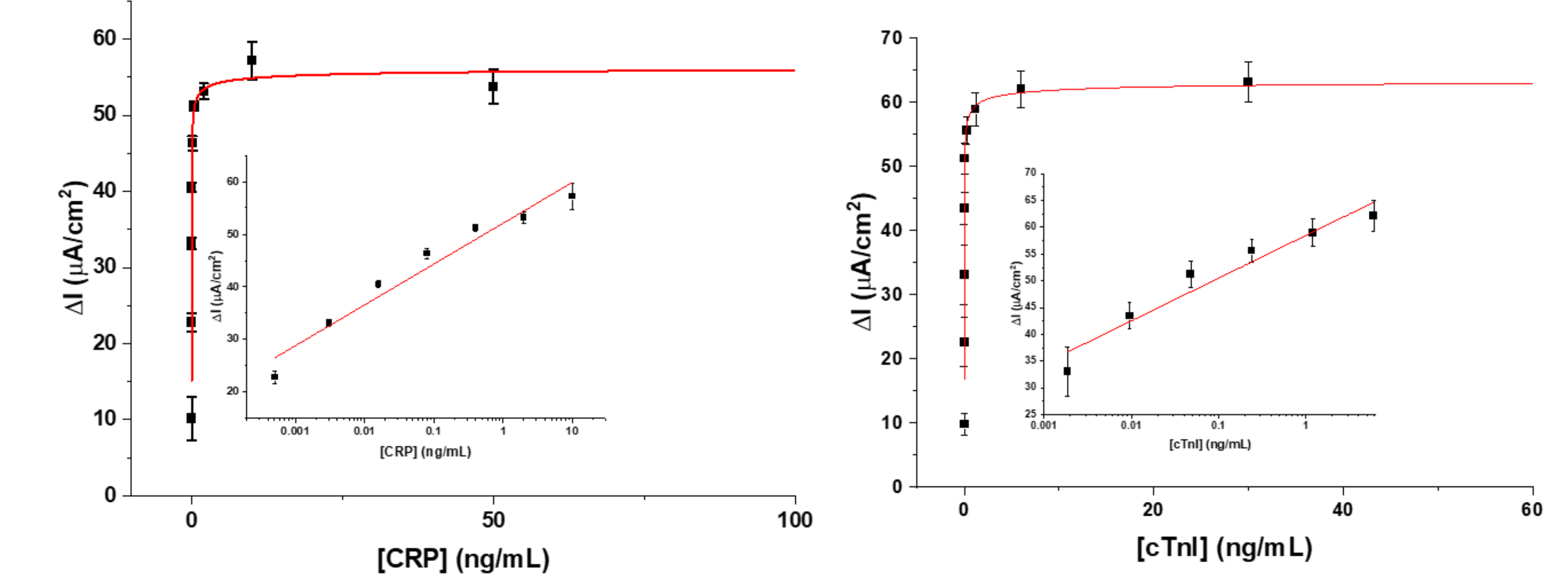


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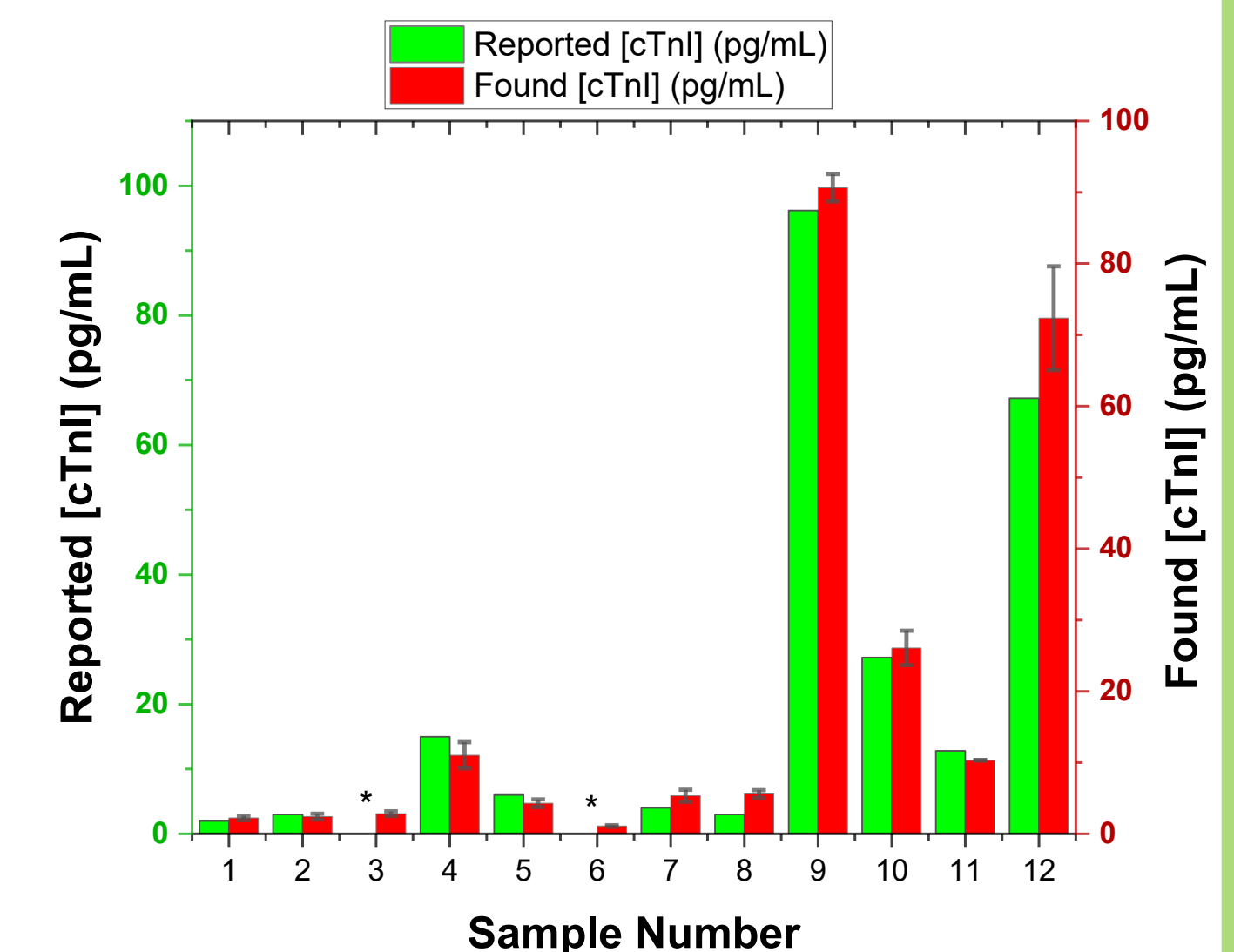
Results

- Using this approach, we were able to analyze **2 protein biomarkers**, commonly used for **cardiovascular diseases**, **simultaneously**, from **<25 μ L samples**
- C-reactive protein (CRP)** was quantified down to 1 ng/mL
- Cardiac troponin-I (cTnI)** was analyzed at concentrations down to 3 pg/mL



Conclusions and Future directions

- When applied to real sample analysis:
 - Showed strong correlation to a reference commercial method (Abbott Architect®)
 - Were able to detect concentrations not detected using the commercial reference methods (e.g., samples 3 & 6)
- This assay format can offer:
 - A generic platform for protein biomarker analysis in an automated, highly sensitive, portable, and user-friendly interface
 - Easily designed towards other biomarkers (only one antibody required)
 - Output electrical signal can be easily translated to concentrations and communicated directly to healthcare provider or other interested parties
 - The low-cost and minimum equipment footprint can support applications in low-resource setting and remote areas



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