



# Electrochemical Study of Poly(Azure A)-Film Manganese-Hexacyanoferrate-Complex modified Electrodes for Histamine Detection

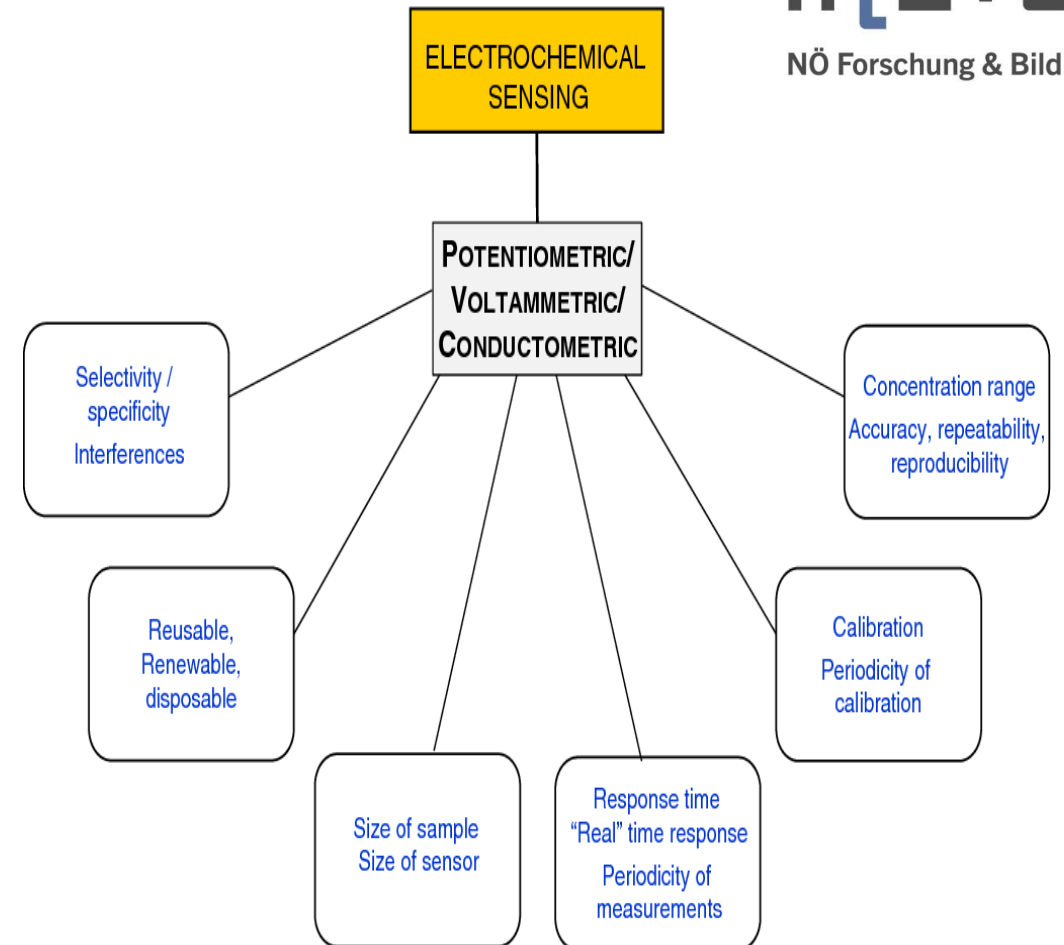
**Ms. Lakshmi Devi Chakkarapani**

**Under guidance of  
Dr. Martin Brandl**

**Donau-Universität Krems  
Zentrum für Wasser- und Umweltsensorik  
Dr.-Karl-Dorrek-Straße 30  
3500 Krems  
Österreich**

# Introduction

- ❖ Sensor is a device with a transducer which helps to recognize the bioamines and convert the results in the form of signals.
- ❖ Electrochemical sensors are a class of sensors in which the electrode is the transducer element. These devices are now found in a wide range of commercial applications. These sensors are notable because of several factors: no generation of waste; miniaturization in portable devices; analyses with microvolumes of samples; fast analysis; and low production cost.
- ❖ Sensor, an eminent tool in electro analysis are small and active that recognized a compound with signal transducer and used for direct measurement of the analyte in the sample matrix.
- ❖ The sensor device transforms chemical and biochemical activity into an analytically useful signal.
- ❖ Intensive research for designs electrochemical sensors are capable of providing better analytical characteristics in terms of sensitivity, selectivity, ease of fabrication, utility and low cost.



## Bio-amines

- ❖ A bioamine is a biogenic substance with one or more amine groups which play an important role in human pathology and physiology. For example human brain activity, regulation of body temperature and stomach pH, gastric acid secretion, the immune response and cell growth.
- ❖ Higher concentration level of bioamines may causes toxic reactions in a human body, which means maintaining controlled level of bioamines are highly important.
- ❖ The determination of biogenic amines is a time-consuming process that required sample extraction, purification of extracts, and derivatization.

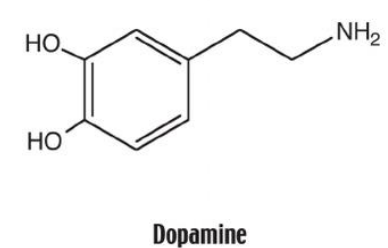
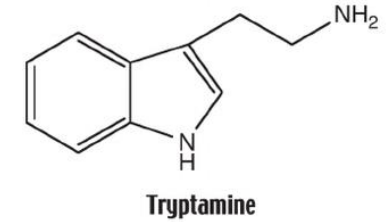
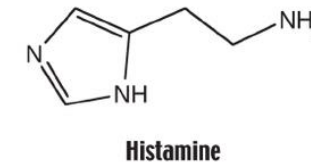


Image 1: shows the structure of the most common biogenic amines

## Which foods contain bioamines?



- ❖ Biogenic amines have been found in a variety of foods, including seafood, fish, meat products, milk products, and some fermented products such as beer and wine.
- ❖ Biogenic amines in low concentrations are essential for many physiological functions, but when they reach at high concentrations, they may cause some serious health issues. Several symptoms occur following excessive oral intake of biogenic amines, such as headaches, hypo-or hypertension, nausea, cardiac disease and death.

## What is the Purpose of developing Chemically modified electrodes



Scheme 1. Various electrode materials used for sensor development

- ❖ Unmodified electrode surface has no desirable electron transfer reaction occur selected experimental condition. To over come such a obstacle electrode surface modified by different mediator.
- ❖ Various electrochemical techniques used for electrode surface modification and convert the unmodified surface to active surface.
- ❖ Electrochemical polymerization, drop casting, dip-coating, deposition spin-coating, and layer by layer coating techniques are used for surface development.
- ❖ Nanomaterials, graphene, metal oxides, metal complexes, polymers and nano particles act as a mediators over the electrode surface.
- ❖ These mediators initiates the electron transfer reactions.

## Electrochemical sensor modification

- ❖ Electrochemical analyses of bioamines were initially analyses using screen-printed electrodes (SPEs) have gone through significant improvements over the past few decades with respect to both their format and their printing materials.
- ❖ Thus, SPEs have been successfully applied for detection of analytes in a wide range of sample matrixes due to their advantageous material properties, such as disposability, simplicity, and rapid responses.

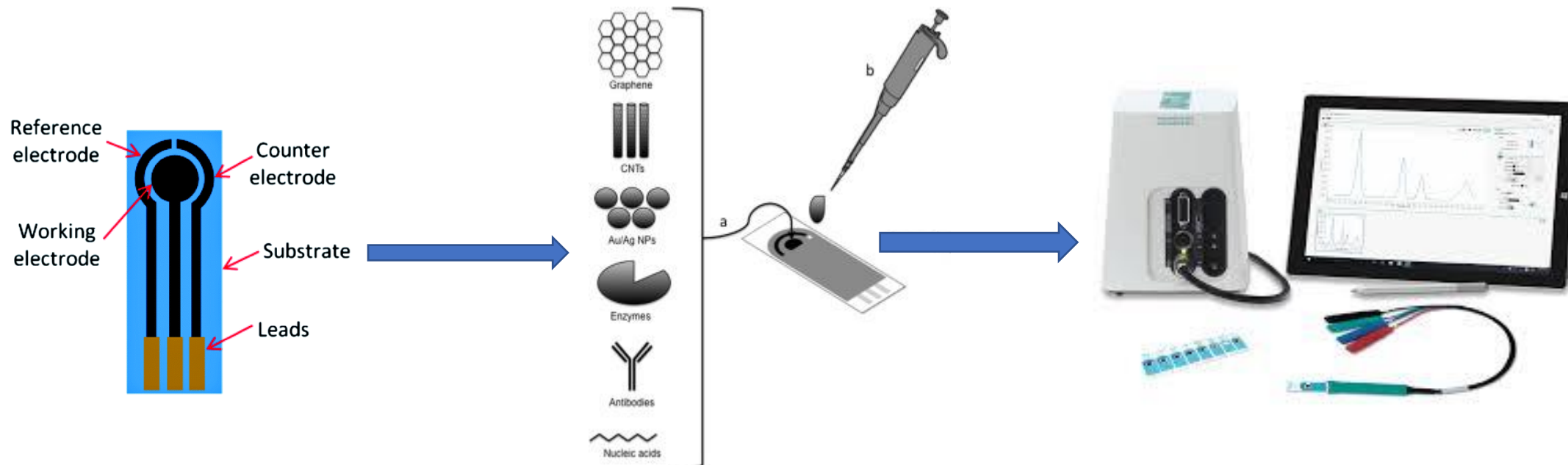
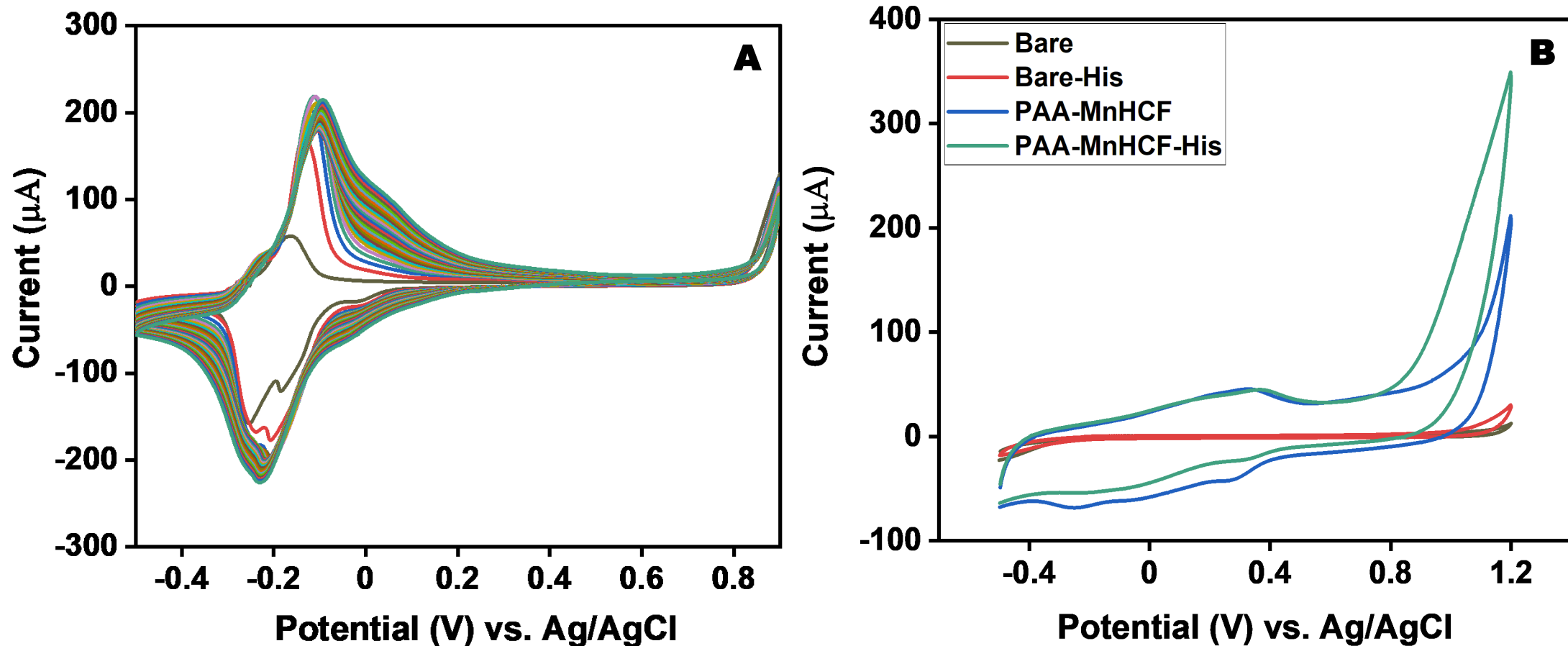


Image 2: shows the modification of screen printed electrode

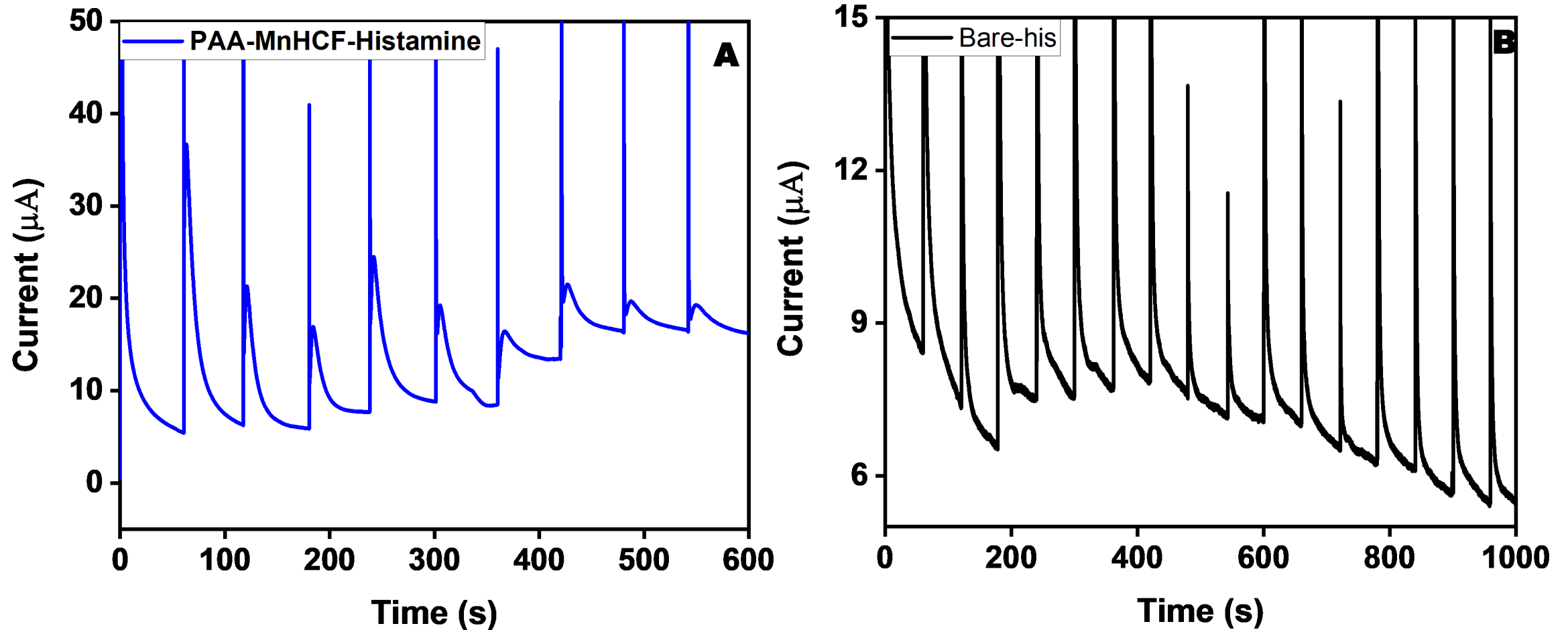
## Polymerization and Electrochemical detection of histamine



**Figure 1.A.** Cyclic Voltammogram for the electro polymerization of 1 mM AA monomers in 0.1 M phosphate buffer solution pH 7.4 at unmodified Carbon screen printed electrodes. Scan rate: 50 mV/s.

**Figure 1.B.** CVs obtained at (black) carbon screen printed electrode, (red) containing tyramine, (blue) polymer coated screen printed modified, (green) containing Histamine in 0.1 M PBS pH 7.4 and scan rete 50 mV/s.

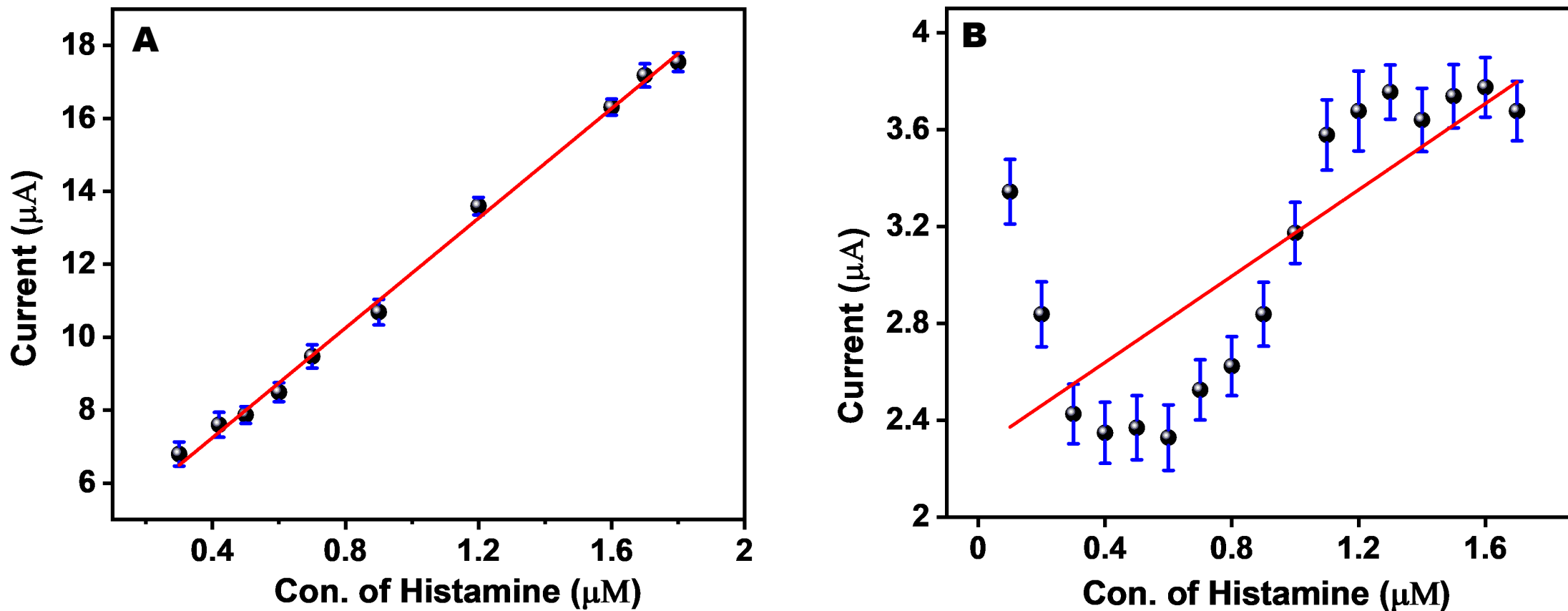
# Chrono amperometric detection of histamine



**Figure.2** Chrono response of PAA-Carbon screen printed electrode (A) and bare (B) with successive additions of histamine (0.3 to 1.81 μM) in 0.1 M PBS of pH 7.4 at the scan rate of 50 mV/s.



# Calibration plots of Chrono amperometric detection



**Figure 3.** Chrono response of PAA-Carbon screen printed electrode (A) and bare (B) with successive additions of histamine (0.3 to 1.81  $\mu\text{M}$ ) in 0.1 M PBS of pH 7.4 at the scan rate of 50 mV/s.



Thank you