# Electrochemical screening of tyrosine and tryptophan as potential biomarkers for prostate cancer

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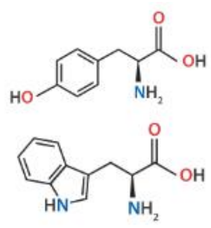
## Introduction

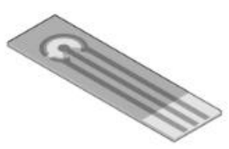
Detection of diseases at an early stage is important for an effective treatment, hence electrochemical biosensors for early detection of many diseases are on their way. Prostate cancer is one of the leading causes of cancer death. We developed an electrochemical method to measure tyrosine and tryptophan in urine and performed a pilot study to investigate their potential clinical use as biomarkers for prostate cancer.

## Methodology




1. Selection of tyrosine and tryptophan

2. Urine samples



3. Electrochemical detection

PS-Trace 4. Data analysis in PS-Trace

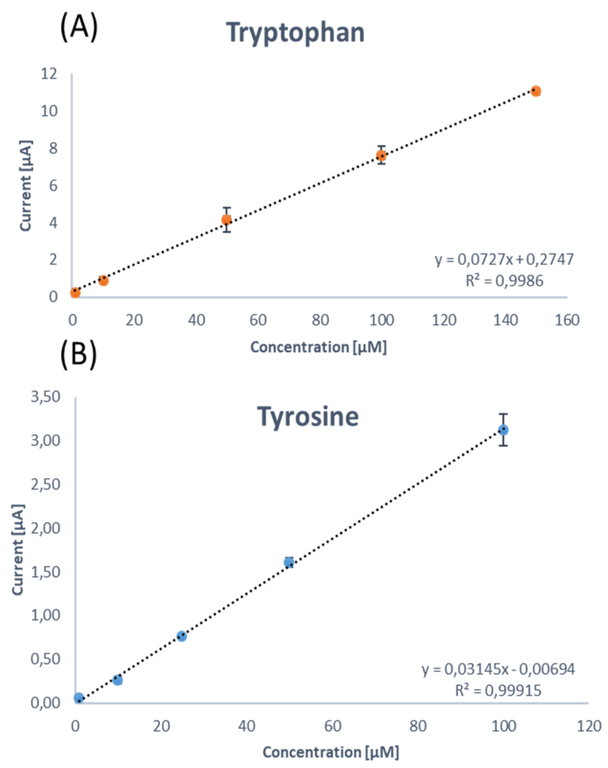



**Figure 2: Evaluation of the screen-printed carbon sensors. (A)** Calibration curve with R2 of 0.9986 for tryptophan. **(B)** Calibration curve with R2 of 0.99915 for tyrosine. Both calibration curve were obtained by measuring the increasing concentration of these two amino acids in PBS using SWV.

## Results

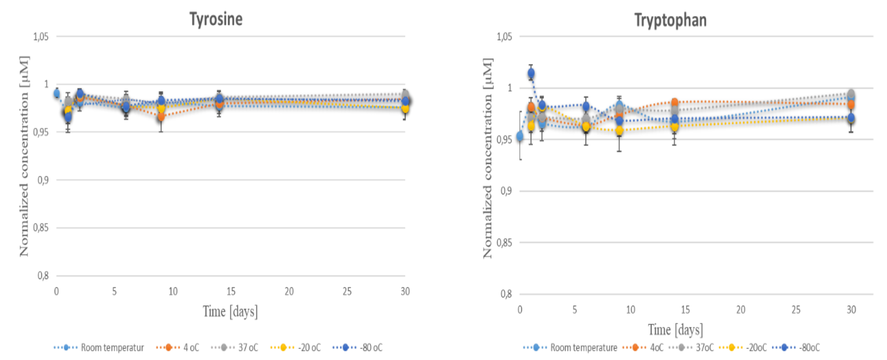



**Figure 3. Stability test of tyrosine and tryptophan.** These two amino acids were stored under different conditions for a period of 30 days. The graphs shows the recovery of tyrosine and tryptophan concentration from the initial value of 100 µM. The test demonstrated that tyrosine and tryptophan was stable under all conditions the whole period.

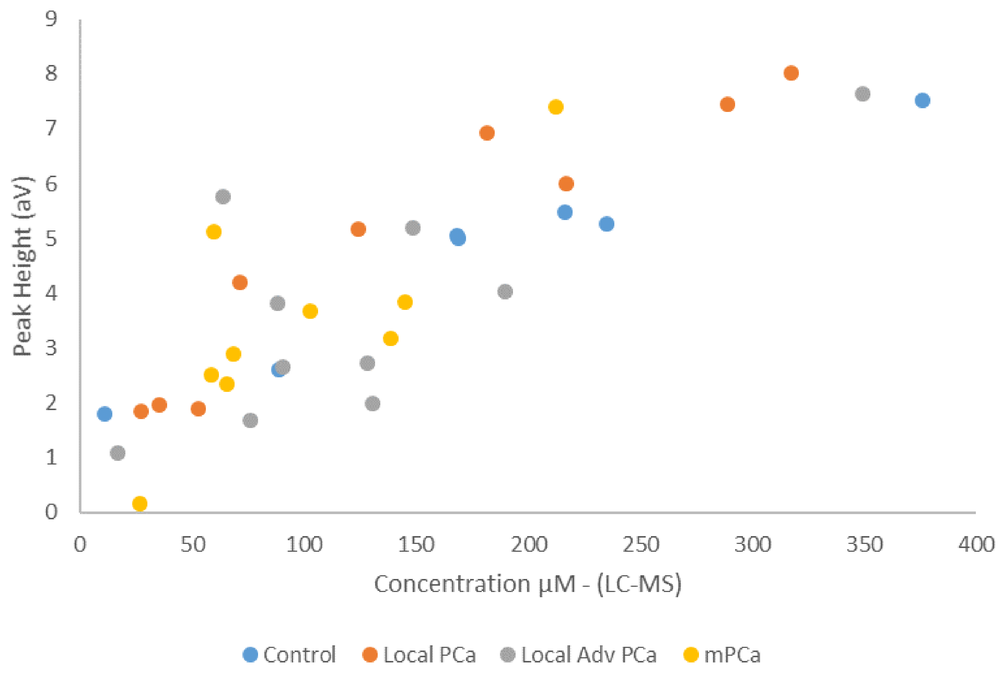



**Figure 4. Tyrosine and tryptophan quantified by Liquid Chromatography – Mass spectrometry and Square Wave Voltammetry.** For validation of the electrochemical SWV method, the samples were analyzed by LC-MS/MS. A linear relationship between the methods is demonstrated.

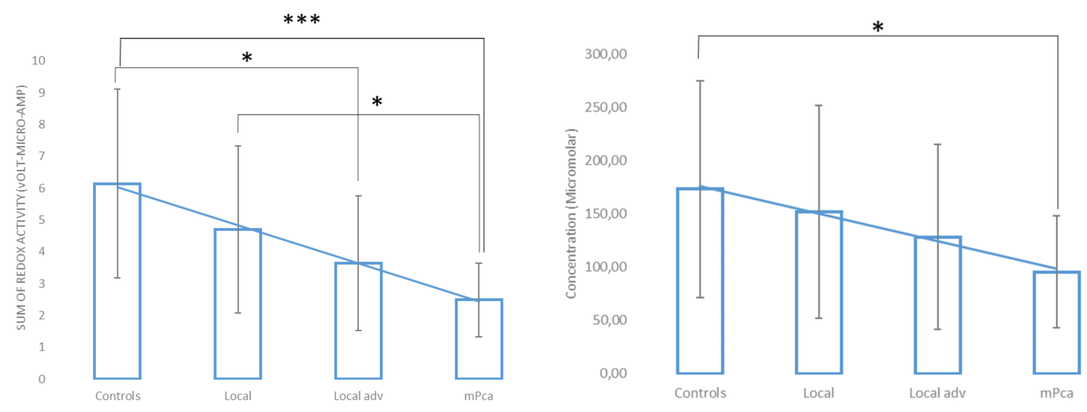



**Figure 5. Correlation of tyrosine and tryptophan with disease progression.** Tryptophan and tyrosine correlation with the stage of PCa was investigated by using SWV (A) and LC-MS/MS (B). Both analysis demonstrated that there is a correlation and showed that the concentration of these two amino acids decreases with the disease severity. * P≤0.05, *** P≤0.001.

## Conclusion

In summary, this work established a novel approach for electrochemical fast and direct detection of tyrosine and tryptophan in patients. In general, we demonstrated invers correlation between these two amino acids and the clinical stages of PCa. The role of tyrosine in cancer progression is yet unknown and further research is warranted. Furthermore, tryptophan catabolism may reflect disease activity in cancer.