

Laser-Scribed Electrodes and Machine Learning for Label-Free L-Histidine Detection in Artificial Sweat

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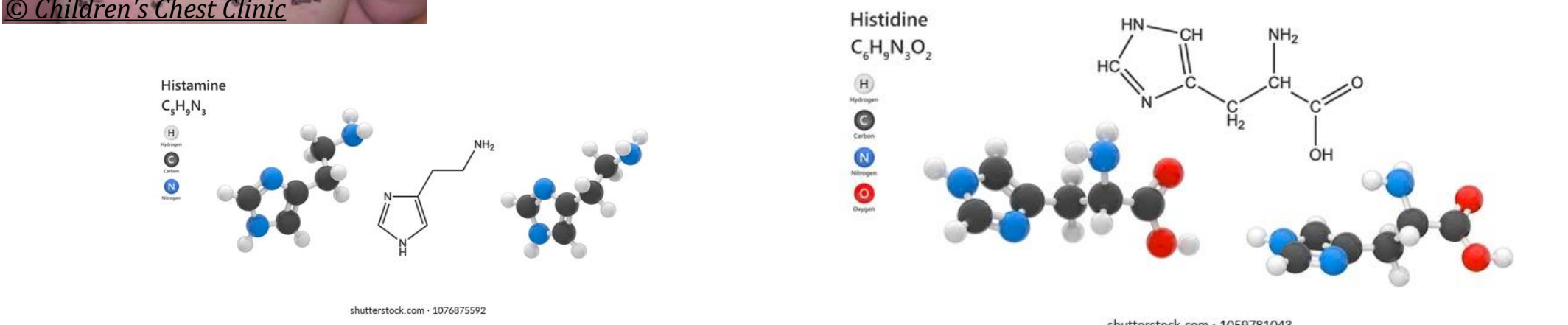
INTRODUCTION & AIM



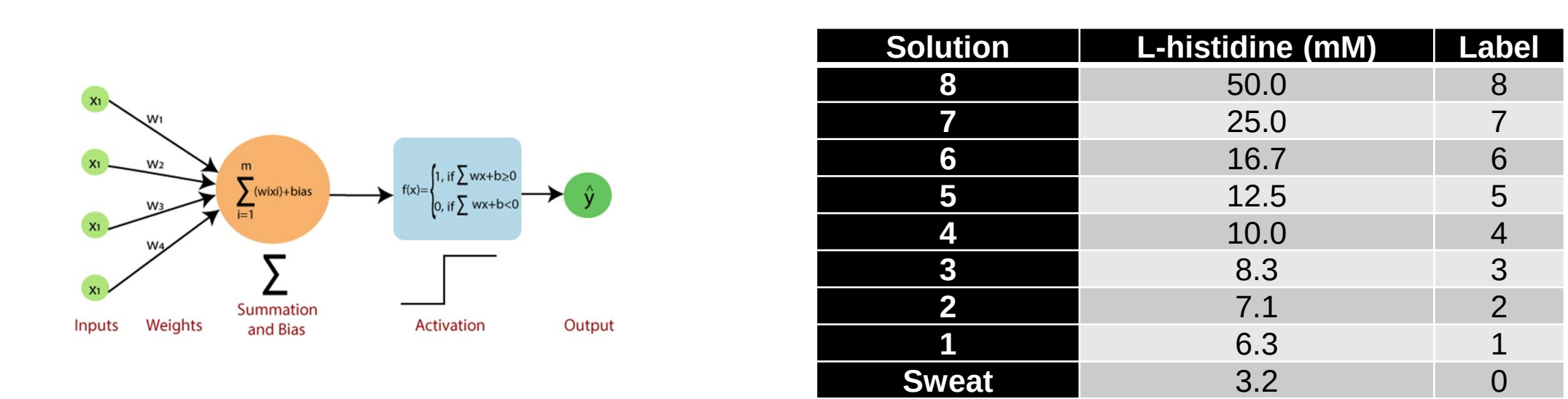
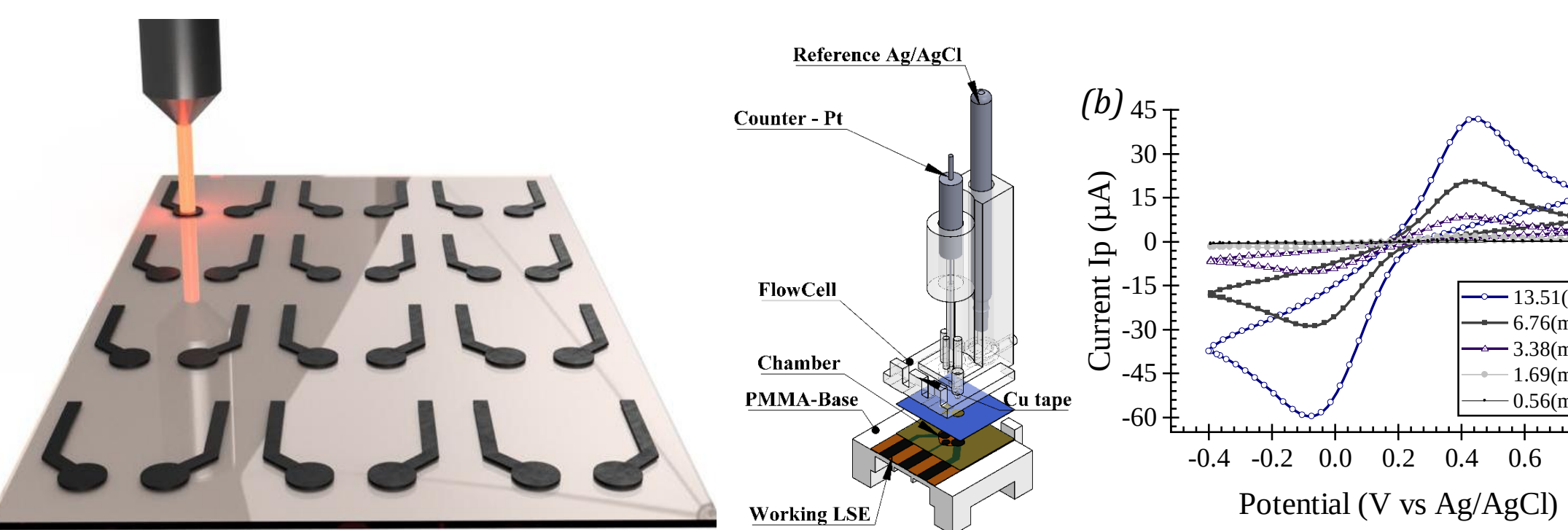
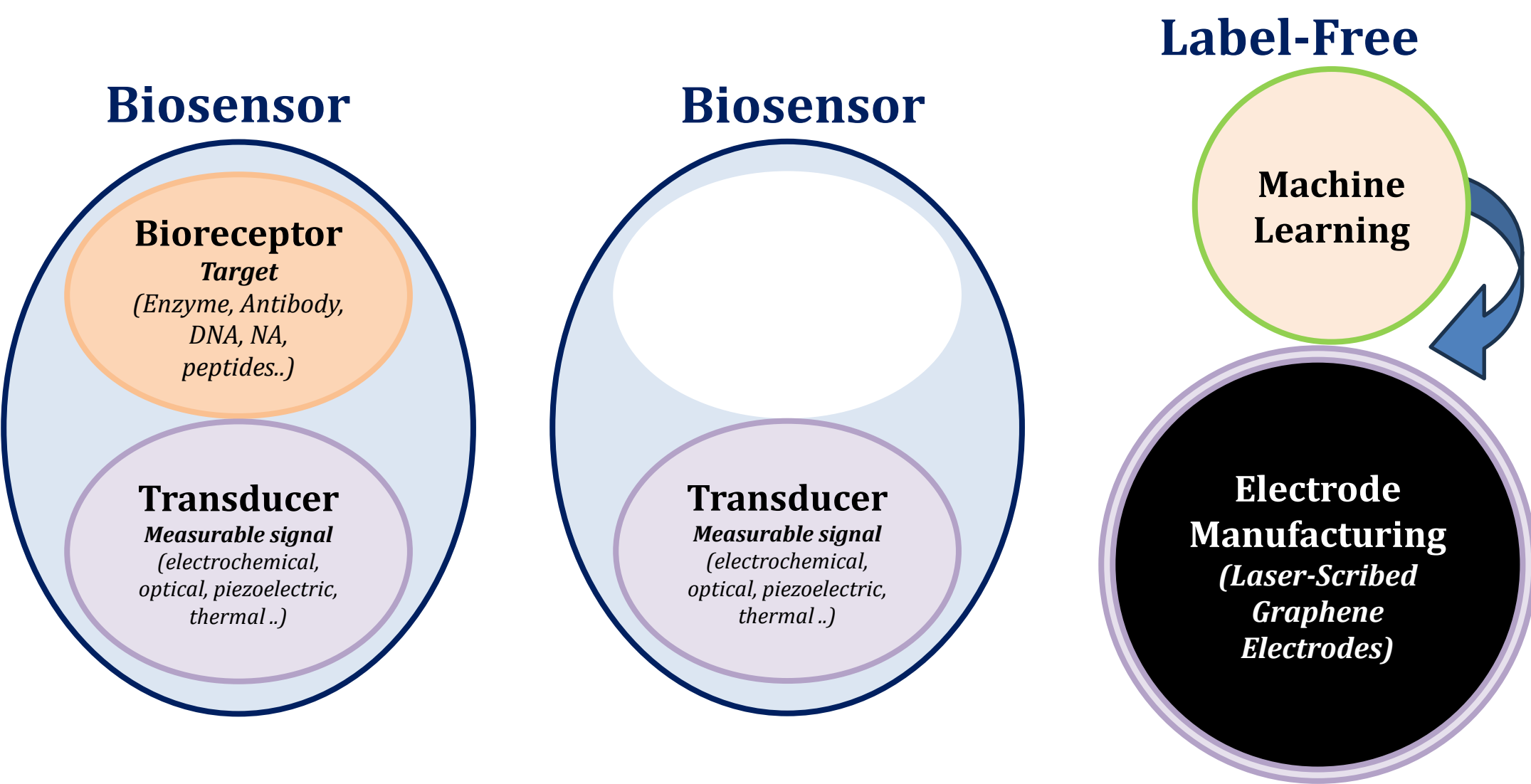
Table 12. Health conditions among children under age 18, by selected characteristics: United States, average annual, selected years 1997–1999 through 2016–2018

Characteristic	Food allergy 2016–2018	Skin allergy 2016–2018
	Percent of Children	Percent of Children
Under 18 years\3	6.4	12.7
Age group		
0–4 years	6.3	14.3
5–17 years	6.4	12.1
5–9 years	6.1	13.3
10–17 years	6.6	11.4
Sex		
Male	6.5	12.3
Female	6.3	13.1

	sec/patient	
Under 18 years	7	3



METHOD



Solution	L-histidine (mM)	Label
8	50.0	8
7	25.0	7
6	16.7	6
5	12.5	5
4	10.0	4
3	8.3	3
2	7.1	2
1	6.3	1
Sweat	3.2	0

RESULTS & DISCUSSION

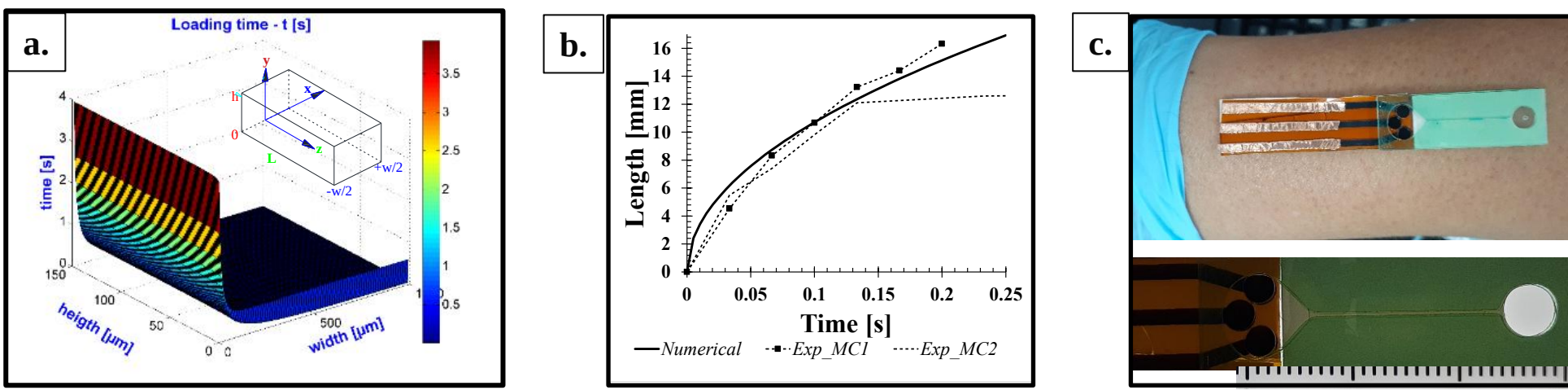


Figure 1. (a) Loading time as a function of channel dimensions, (b) Theoretical vs experimental capillary flow results, (c) Microfluidic assembly design.

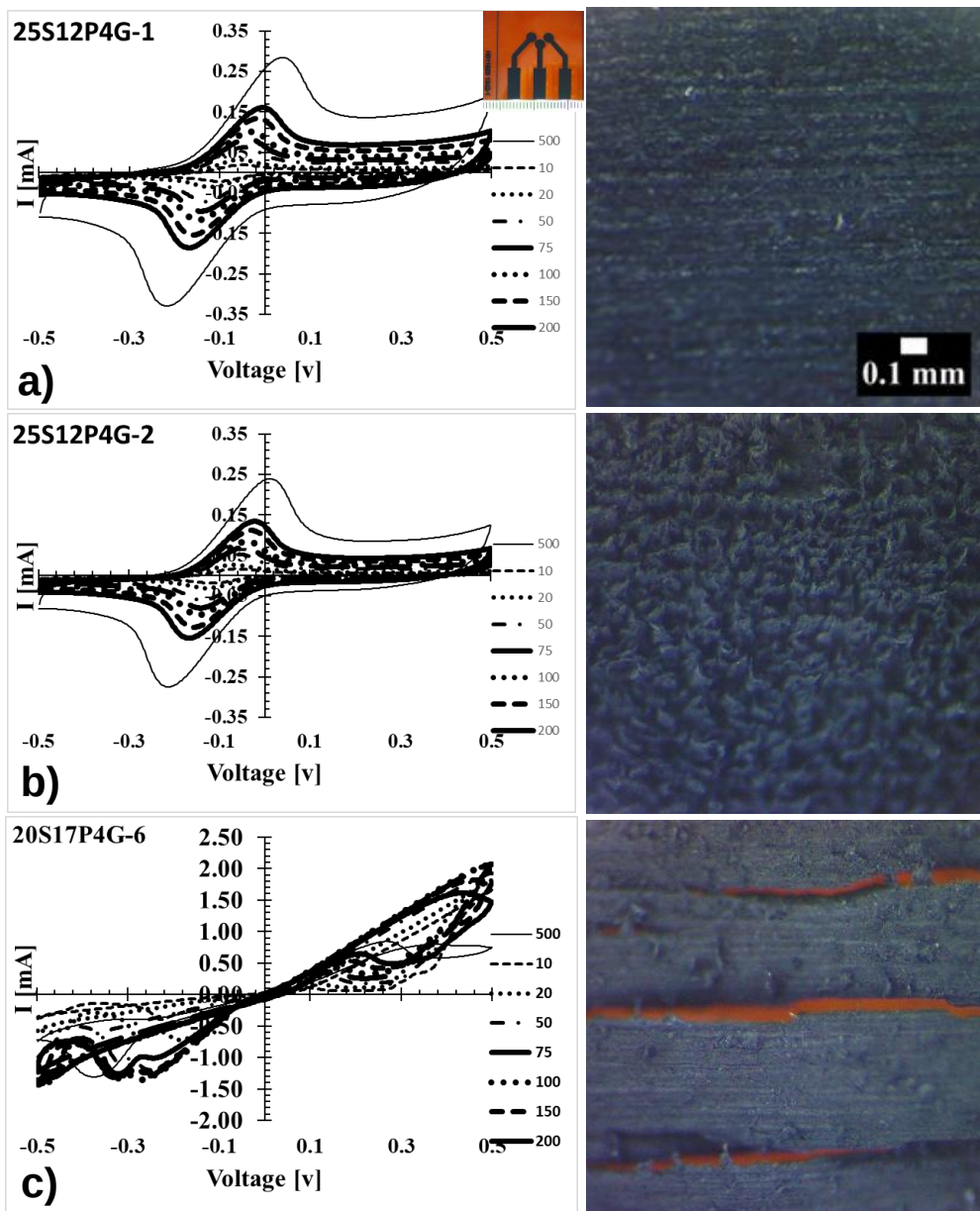


Figure 2. a-c) Voltammograms for different manufacturing parameters and the electrode surface measured with an optical microscope (6X).

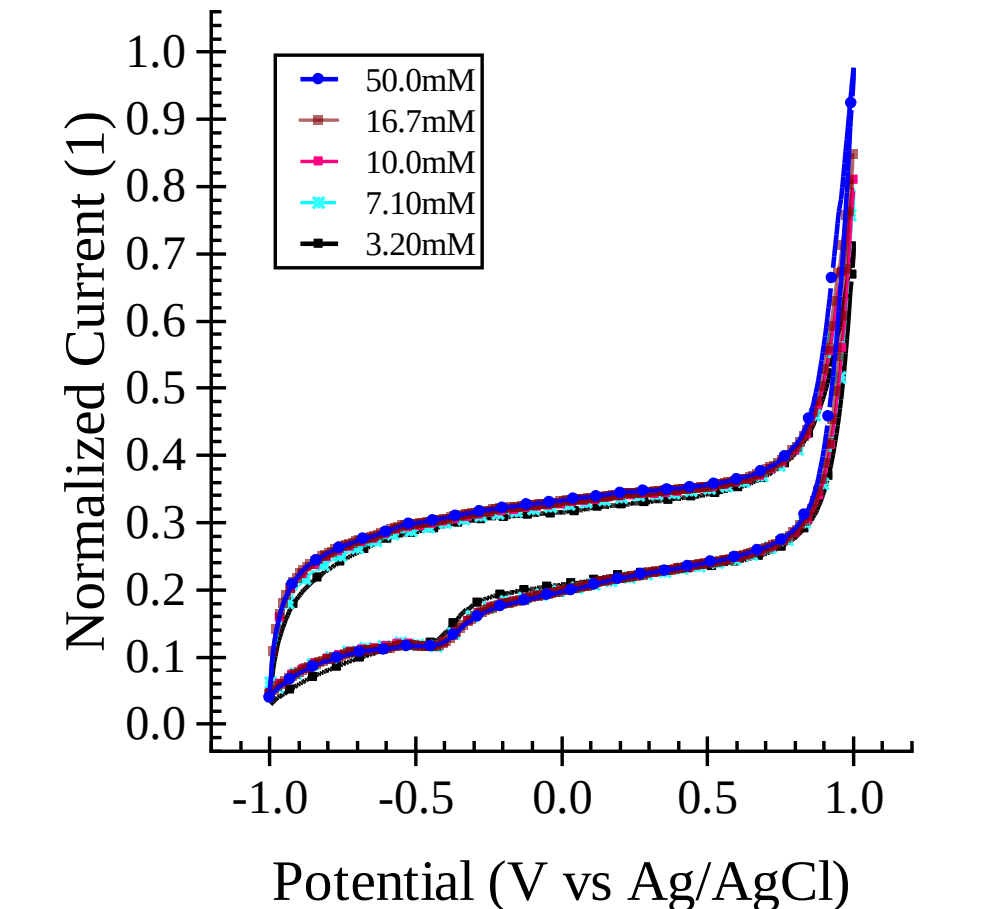


Figure 3. (a) Voltammogram for 10mM $K_3Fe(CN)_6$ in 0.1M KCl vs Ag/AgCl for the LSG electrode during the activation process using a 50mV/s scan rate. (b) Nyquist plot to monitor the activation process of the LSG electrode

CONCLUSION

- The optimal LSE manufacturing parameters were 25% speed, 12% power, 1200 DPI, focused laser, and 4pt width, and the preliminary step of normalization using the Z-score was critical in achieving good results.
- The evaluation of the MLPNN machine learning model revealed perfect classification accuracy, achieving optimal scores across all metrics (Precision, recall, and F1-Score).

FUTURE WORK / REFERENCES

- Monitor the real-time changes of L-Histidine in artificial sweat using the integrated flow cell and microfluidic device. The predictive power of Machine Learning Algorithms, specifically MLPNN, SVM, and RF, will be tested.