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Enzyme Amperometric Sensors – Glucose and Lactate

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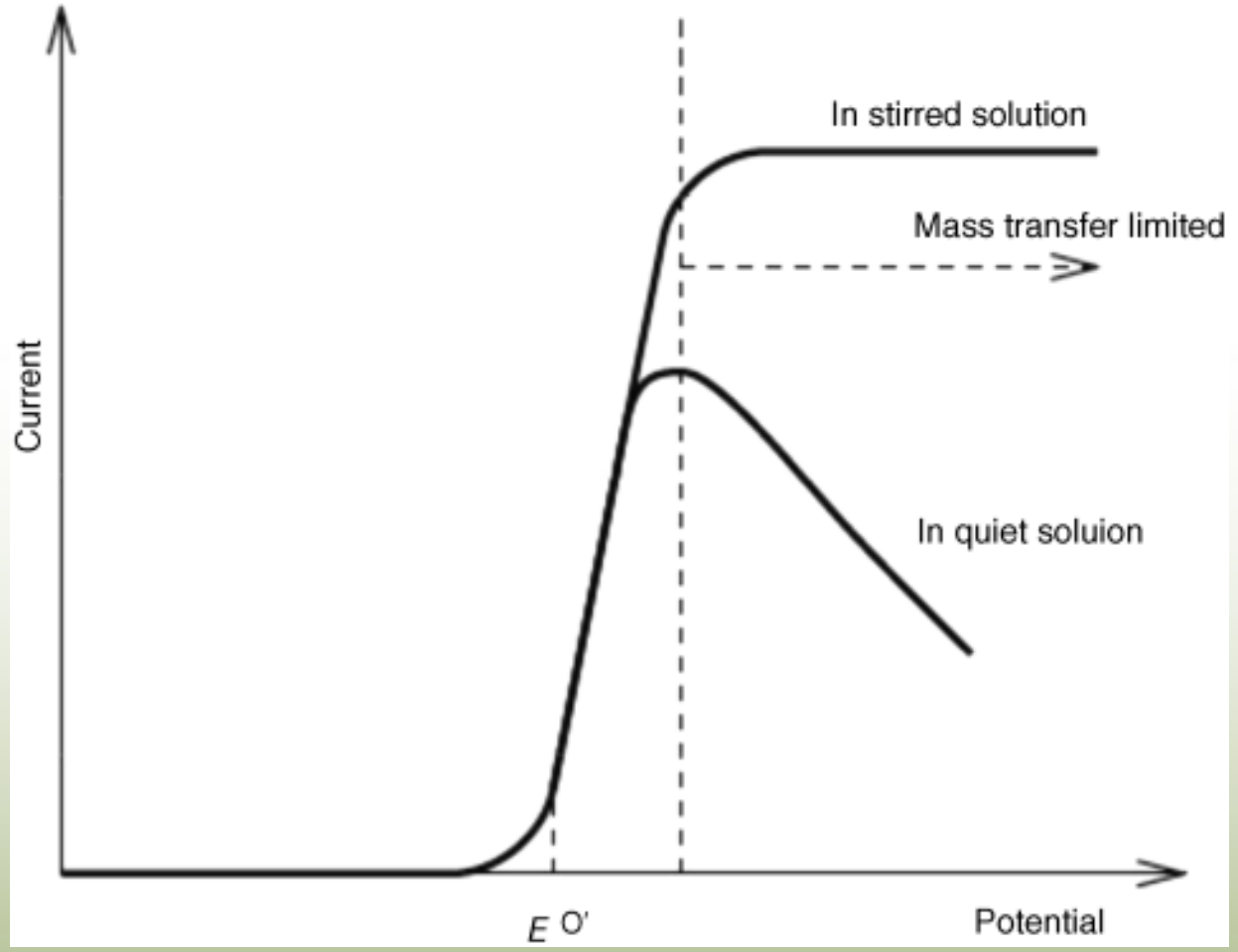
Glucose

Amperometric Glucose Sensor



$$i_L / A = k_L n F c^{\infty}$$

$$i = -\frac{nFAD^{1/2}C}{\pi^{1/2} t^{1/2}}$$

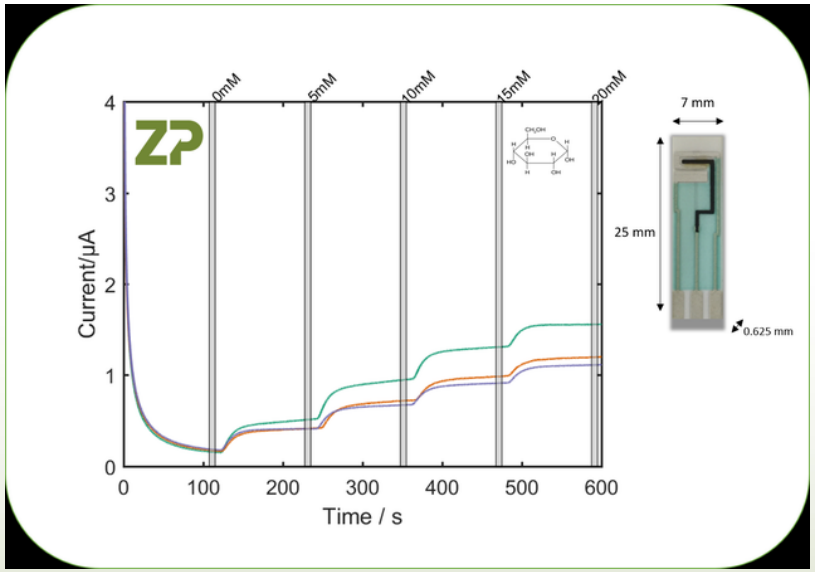
where D = diffusion coefficient
C = concentration of O in the bulk solution
A = electrode area

Electrochemical detection of glucose

Glu

ZP

- Description



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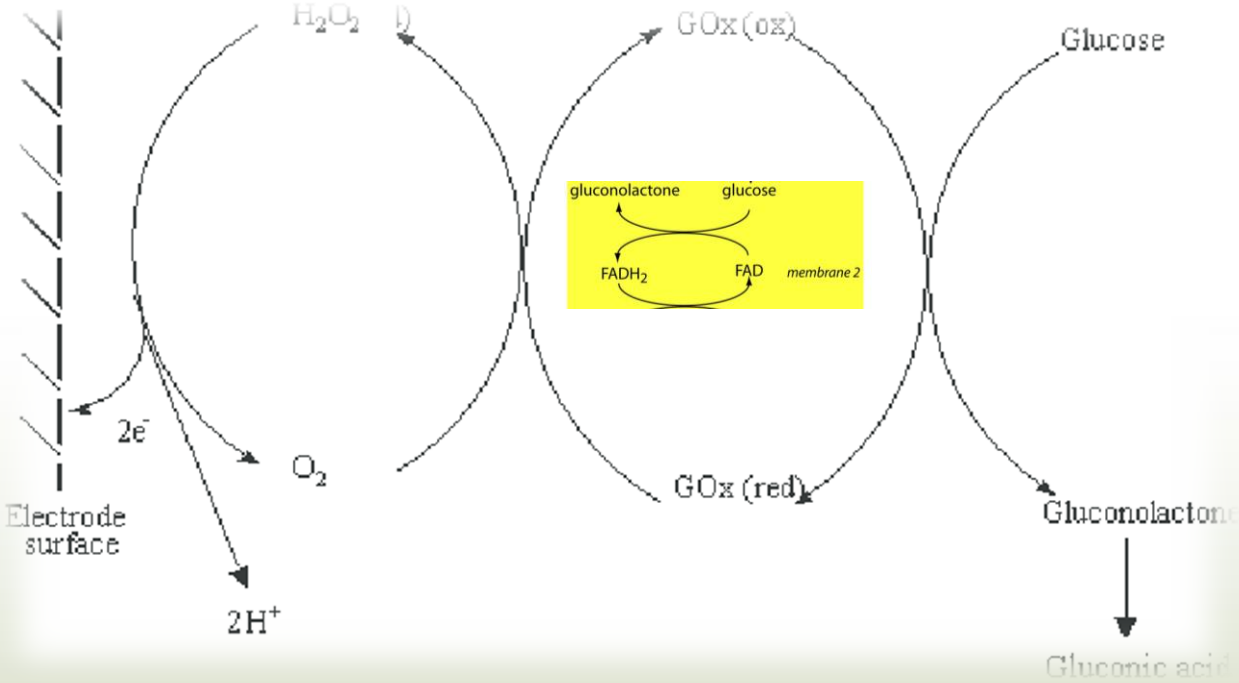
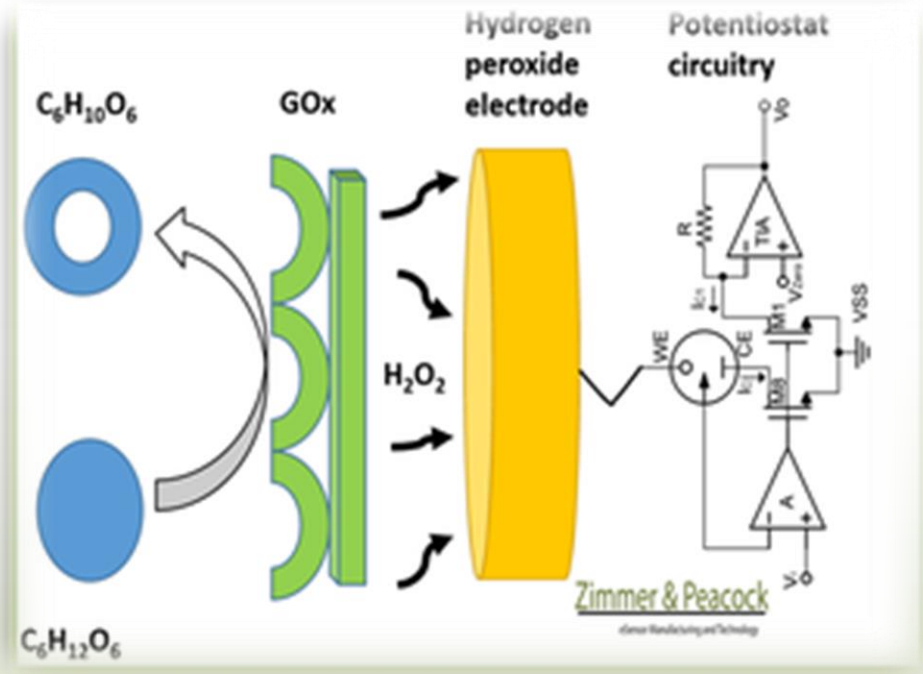
How is the type one glucose sensor working





Direction of electron flow

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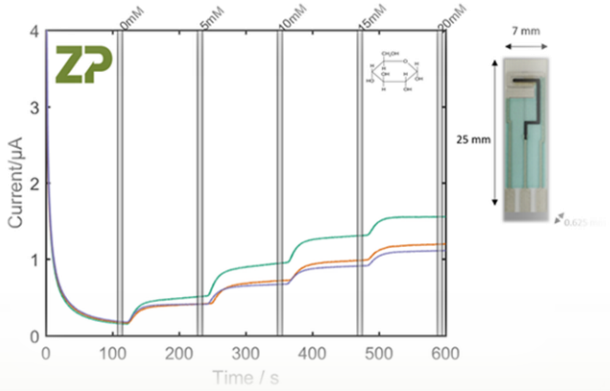
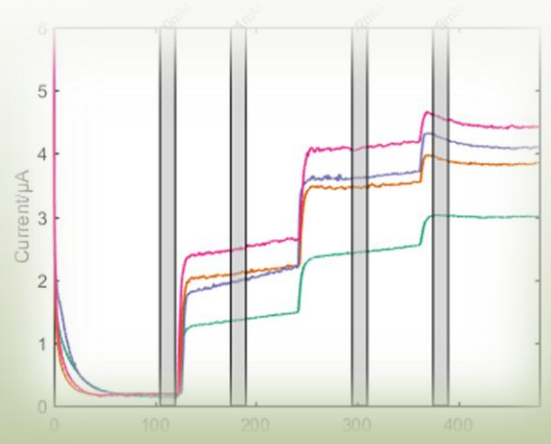
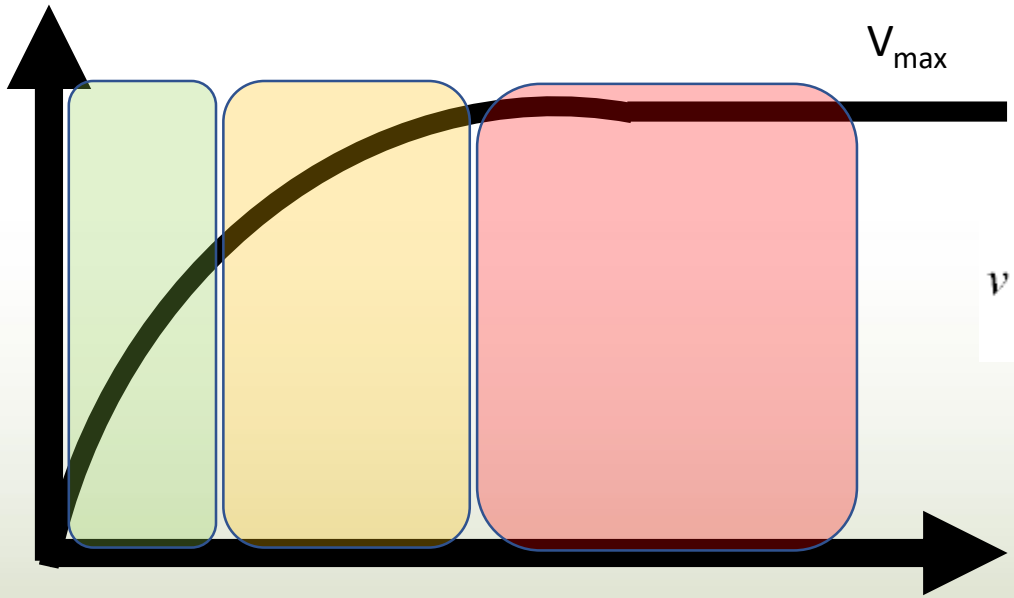
Michaelis Menten - Enzyme kinetics and rates of reaction





$$E + S \rightleftharpoons ES \rightarrow E + P$$

Rate of reaction



$$v = \frac{V_{max}[S]}{K_M + [S]}$$

Concentration of substrate

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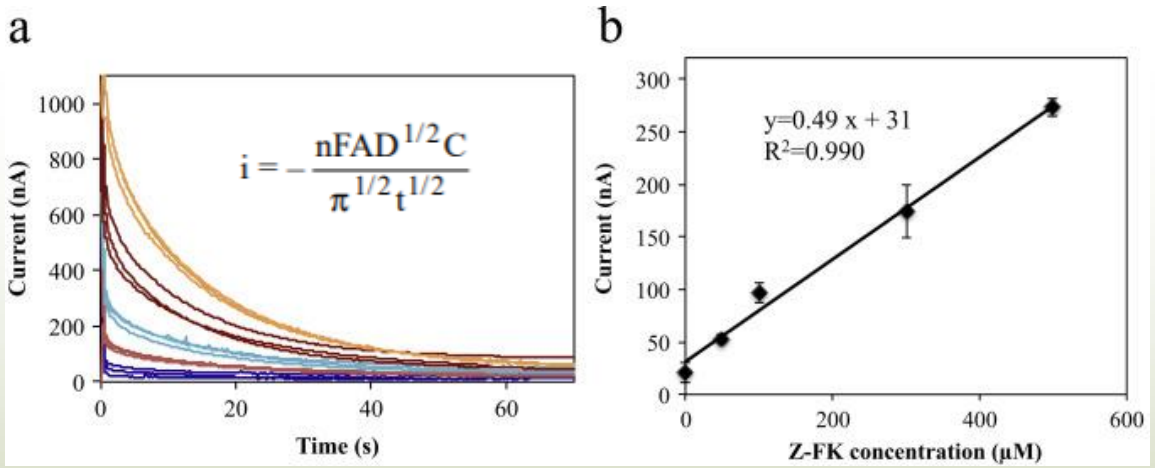
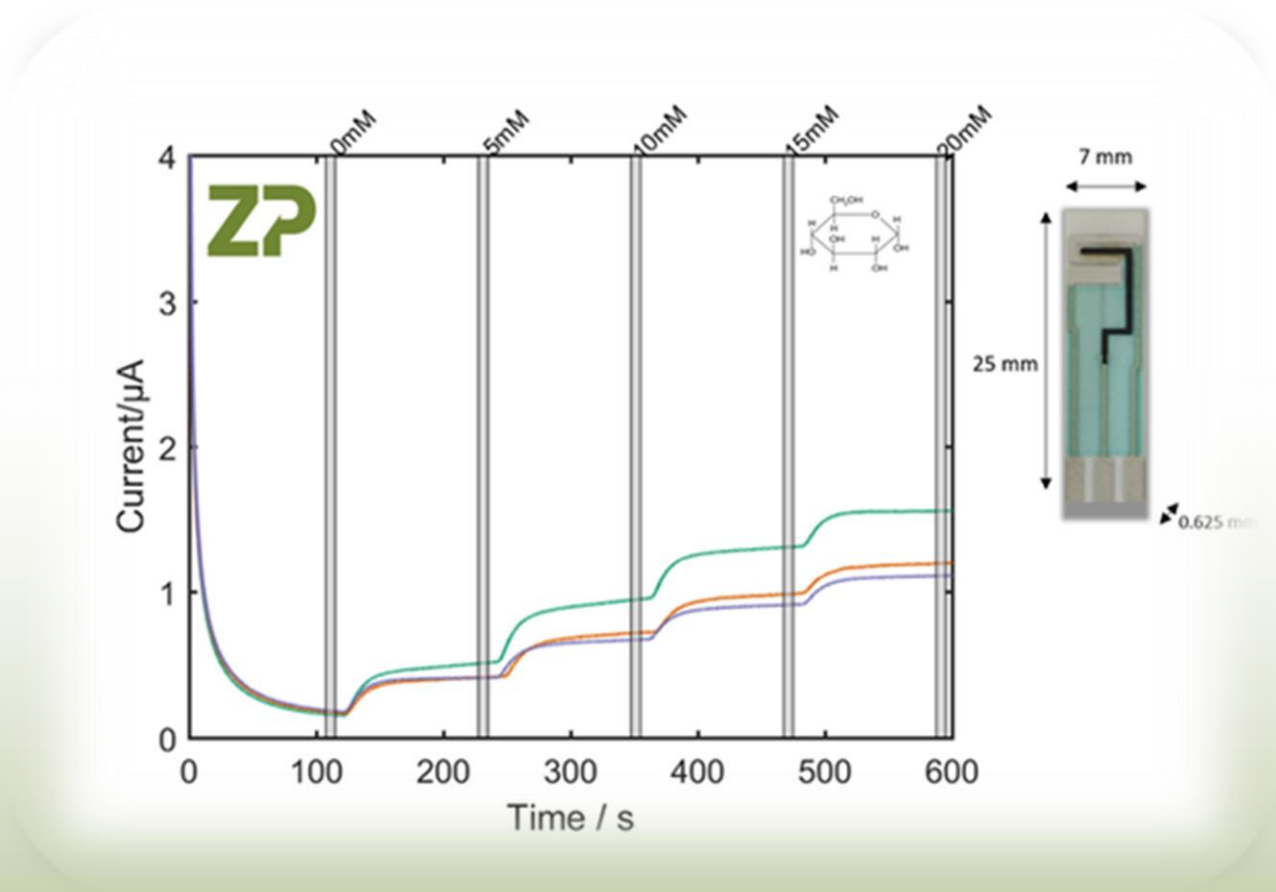
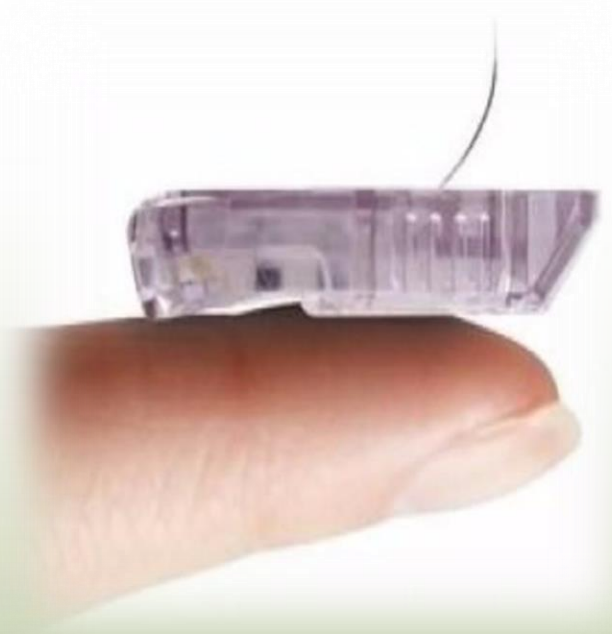
Diffusion controlled – Cottrell current– Ficks 2nd law of diffusion



Mass transport controlled



$$i_L/A = k_L n F c^{\infty}$$



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Lactate

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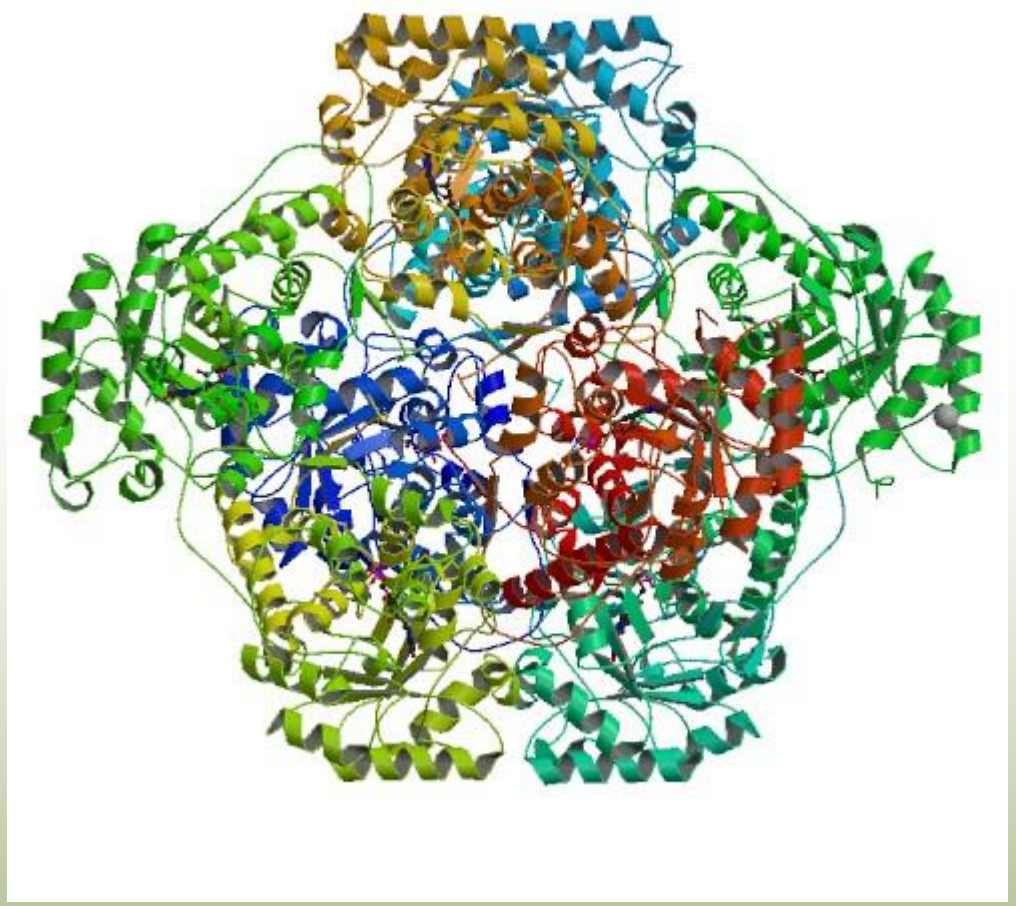
Lactate Oxidase



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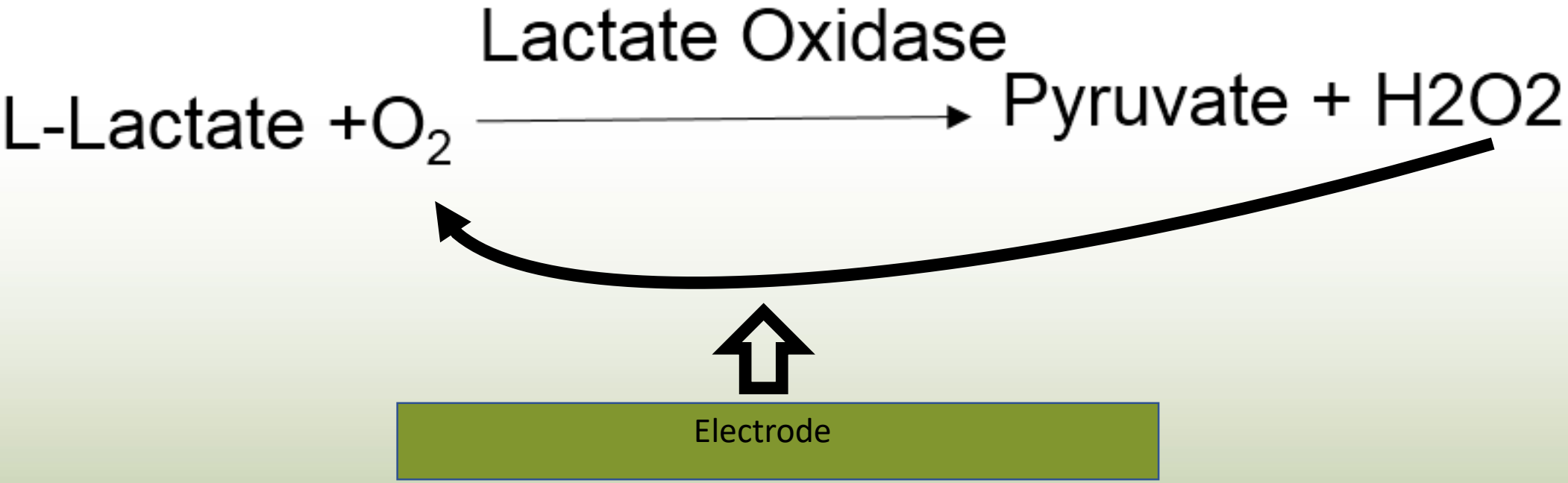
Lactate Oxidase
L-Lactate +O_2
Pyruvate + H2O2
Electrode

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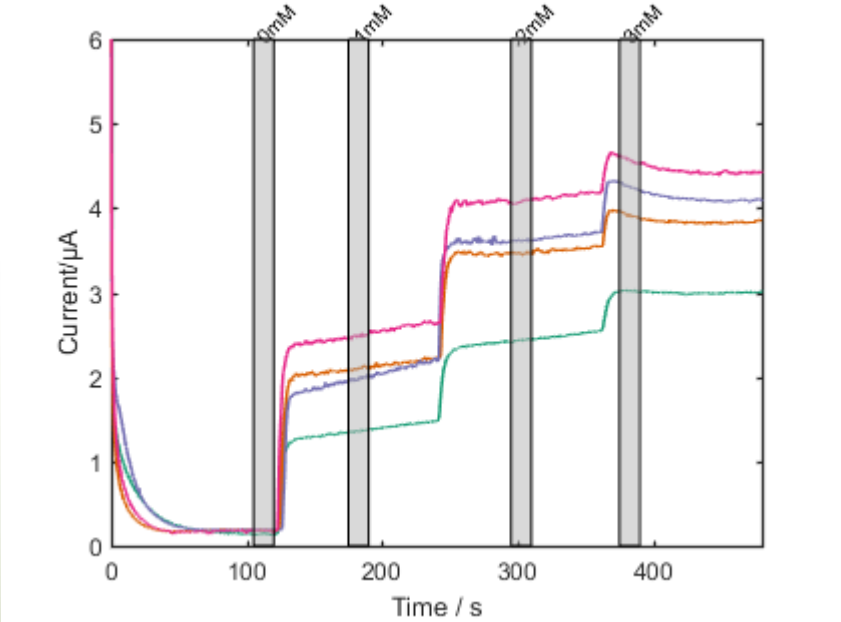
Electrochemical detection of glucose

Lac

- Description



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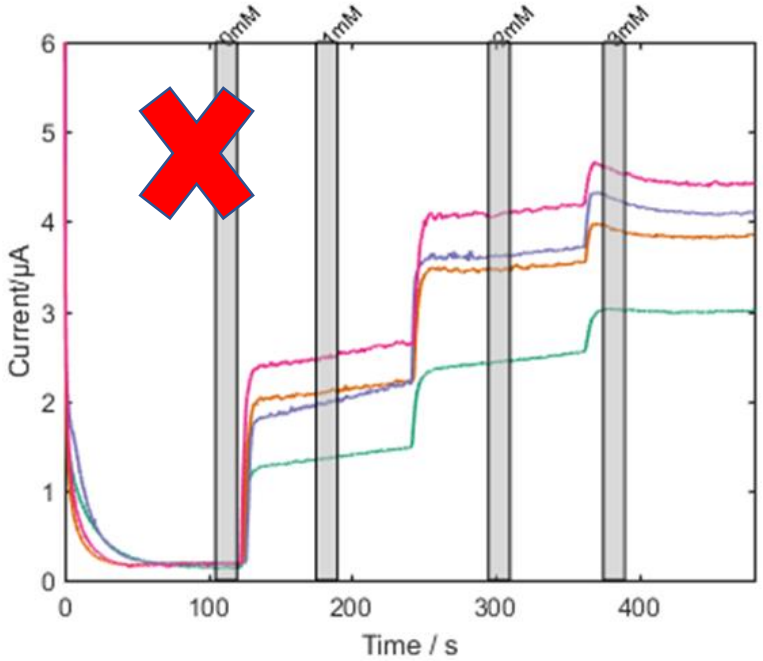
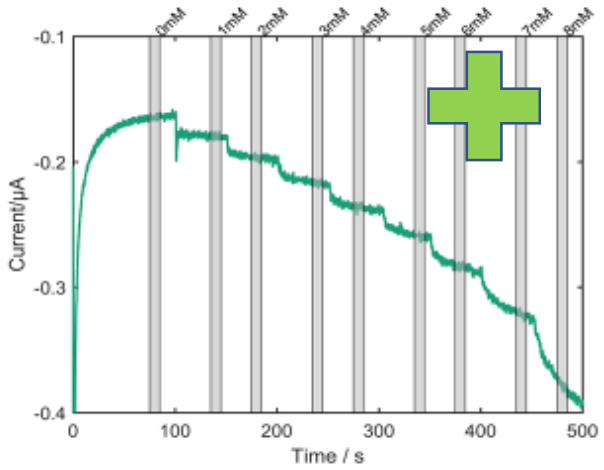
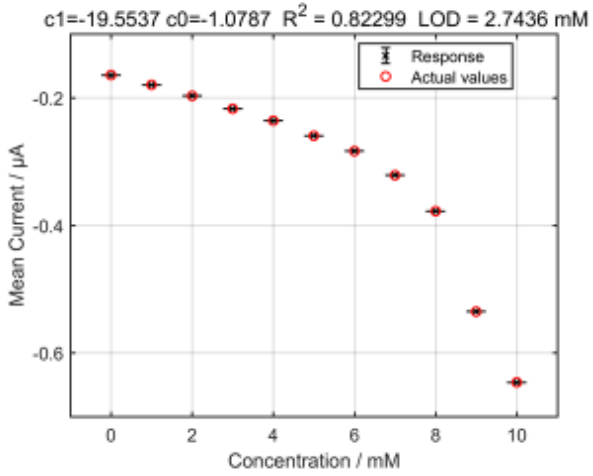


Type 1 Lactate Sensor





Type 2 Lactate Sensor

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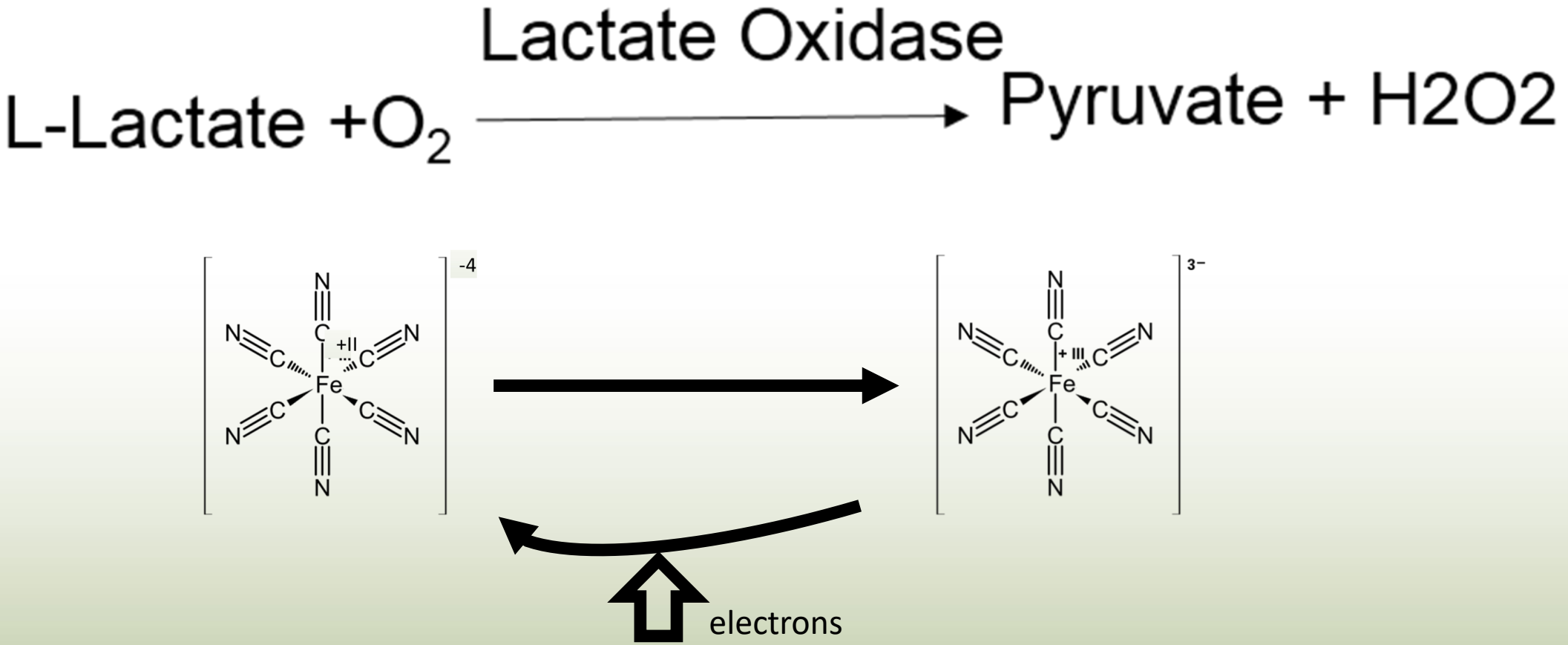
Type 2 Lactate Sensor



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Time for practical

- ONE – record a cyclic voltammogram of a glucose sensor without glucose present.
- TWO – record a cyclic voltammogram of a glucose sensor with glucose present.
- THREE - compare the two experiments and chose the lowest voltage where you think the signal is invariant with voltage.
- FOUR – From THREE above run a series of amperometric experiment at that voltage, with increasing amounts of glucose and see what happens as you go from solution to solution.
- Record the current at 5 seconds and plot current versus concentration.