

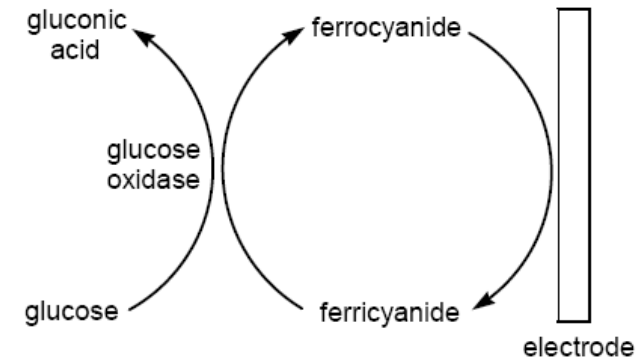
Generating Low-cost Educational Materials for Teaching Electrochemical Biosensors

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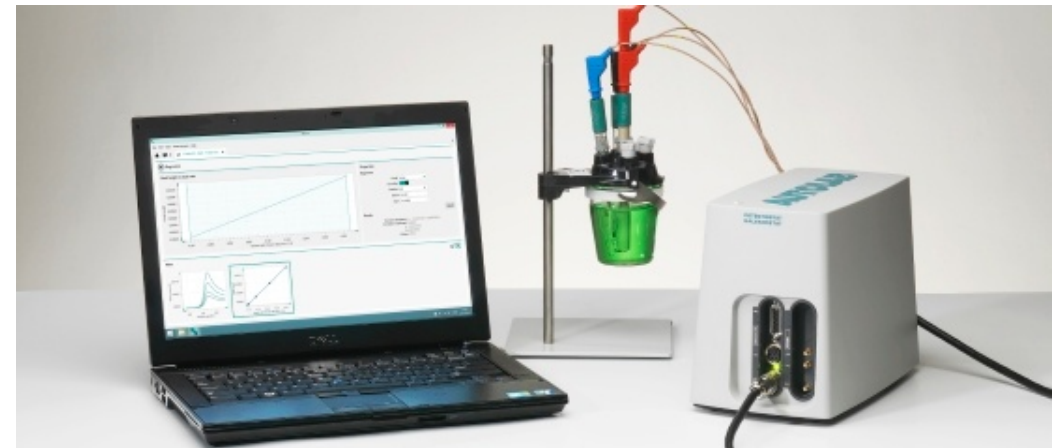


Electrochemical biosensors

- Translate biological recognition to electrical signal
- Useful diagnostic tools
- Most popular electrochemical biosensor:
 - Glucometer
- Their implementation in courses is limited by the equipment accessibility (usually expensive)



Glucometer chemical reaction



Metrohm Autolab electrochemical equipment

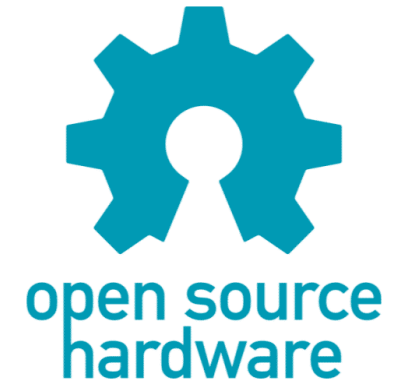
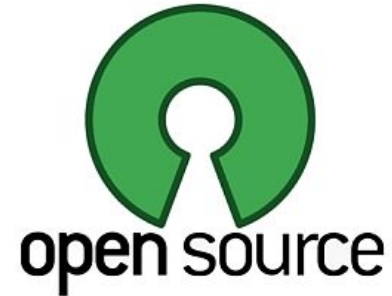
Open source technologies

- Advantages

- Flexibility to adapt or modify
- DIY approach is useful for teaching
- Can be 5 to 20 times cheaper than conventional ones

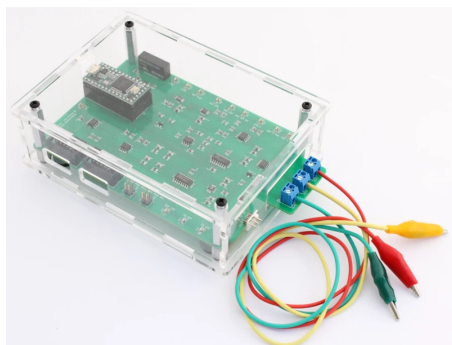
- Disadvantages

- The performance can be lower
- Sometimes the implementation requires time and knowledge



Our experience a Tecnológico de Monterrey

- Low-cost and portable educational kit:
 - Commercial open source potentiostat: rodeostat
 - Low-cost reagents and electrodes
 - Demonstrations can be performed outside the laboratory



Rodeostat (Open source electrochemical equipment)



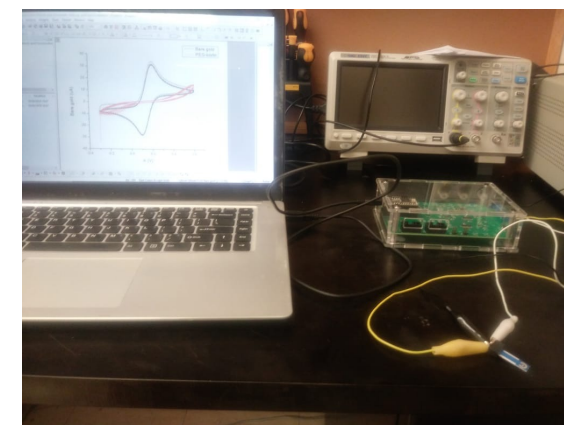
BVT screen printed disposable electrodes

```
Voltamtria cidica.py - C:\Users\user\Desktop\Rodeostat\20082019\Voltamtria cidica.py (3... - □ ×
File Edit Format Run Options Window Help
# Create dictionary of waveform parameters for cyclic voltammetry test
test_param = {
    'quietValue' : 0.0,
    'quietTime' : 0,
    'amplitude' : amplitude,
    'offset' : offset,
    'period' : period_ms,
    'numCycles' : num_cycles,
    'shift' : shift,
}

# Create potentiostat object and set current range, sample rate and test paramet
dev = Potentiostat(port)
dev.set_curr_range(curr_range)
dev.set_sample_rate(sample_rate)
dev.set_param(test_name, test_param)

# Run cyclic voltammetry test
t,volt,curr = dev.run_test(test_name,display='pbar',filename=datafile)
```

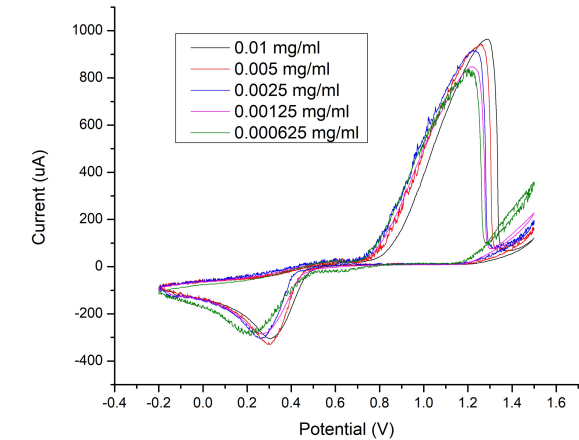
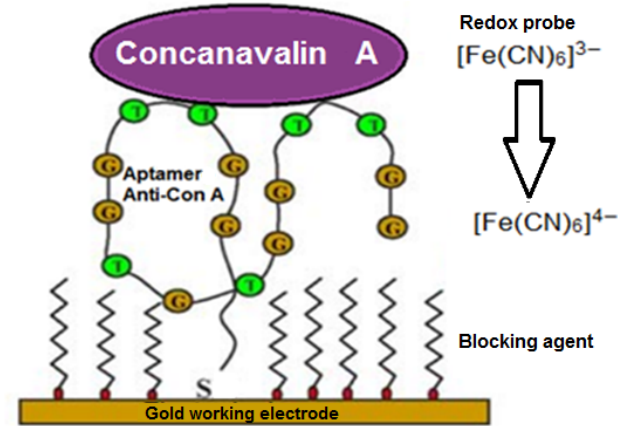
Python interface for programming the Rodeostat



Portable and easy to implement with a laptop computer

Our experience a Tecnológico de Monterrey

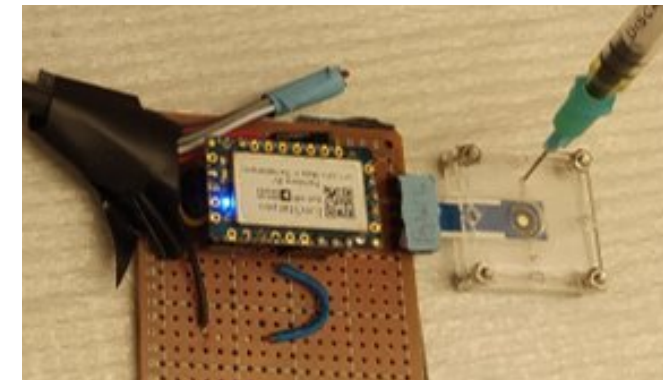
- Teaching the fundamentals of biosensors design and electrochemistry
- Implementation on undergraduate students from Biotechnology Engineering
- Participation in international competitions with biosensor's research projects since 2016



Electrochemistry and biosensors fundamentals



Participation in BIOMOD international competition at UCSF



Integration with microfluidics

Contact information and acknowledgements



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Acknowledgements



Dr. Grisel Fierros Romero
Dr. Ashutosh Sharma
Dr. Marcos de Donato Capote
Dr. Omar Gonzalez Peña



Dr. Goldie Oza



BRIGHAM AND
WOMEN'S HOSPITAL

Dr. Natalie Artzi

**Thank you
for your attention**