Low-cost open-source hardware designs for biopotential amplification for neuroscience, prosthetics and more

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## Things you are going to learn today!

<table>
<thead>
<tr>
<th>WHAT</th>
<th>HOW</th>
<th>WHY</th>
</tr>
</thead>
<tbody>
<tr>
<td>What are Biopotentials? EEG, ECG, EMG, &amp; EOG.</td>
<td>How to design hardware for Biopotential signal Amplification?</td>
<td>Why do we need affordable BioAmp hardware?</td>
</tr>
</tbody>
</table>
Biopotentials are electrical signals (voltages) that are generated by physiological processes occurring within the body. They are produced by the electrochemical activity of a type of cell, called an excitable cell. Excitable cells are found in the nervous, muscular, and glandular systems in the body. When an excitable cell is stimulated, it generates an action potential, which is the essential source of biopotentials in the body.
EEG - Brain
ECG - Heart
EMG - Muscle
EOG - Eye
Sodium Potassium Ion channels

Action potential generation!
How to design hardware for Biopotential signal Amplification?
Requirements of a BioAmp

- High input impedance.
- High CMRR (>100dB).
- Low output impedance.
- Flexible Gain control.
- Target protection.
- Low power consumption.
Instrumentation Amplifiers
2 opAmp Design
3 opAmp Design
Why do we need affordable BioAmp hardware?

I believe Biology with technology is the next big revolution. To make sure everybody gets the equal opportunity to make a change, we need a supply of affordable development tools!
01

Research-grade Neuroscience hardware.

02

Affordable AFE for prosthetics control.
Digital telepathy

In the future there will be a way to automate responses based on pre-written keywords and through machine learning.

Presentations are communication tools that can be used as demonstrations, lectures, speeches, reports, and more. It is mostly presented before an audience.
Butter Robot

A real mesh of living neurons trained to pass butter with sensory inputs like vision, orientation, and motor control.

This idea is not my own, I stole it from Rick from "Rick & Morty".

https://rickandmorty.fandom.com/wiki/Butter_Robot
Thank you