Muscle BioAmp Patchy

Upside Down Labs

Dec 16, 2025

CONTENTS

CHAPTER

ONE

MUSCLE BIOAMP PATCHY

v0.2

1.1 Overview

Muscle BioAmp Patchy is a wearable ElectroMyoGraphy or EMG sensor that snaps directly to gel electrodes and connects to your muscle like a patch. It comes with reverse polarity projection, power indicator, onboard snap connectors, and Upside Down Labs' powerful BioAmp sensing technology for precise muscle signal recording. This enables you to easily integrate this sensor in your EMG- based Human-Computer Interface (HCI) easily.

1.2 Features & Specifications

Operating Voltage	5 V
Input Impedance	10^12 ohm
Fixed Gain	x2420
Bandpass filter	72 – 720 Hz
Wearable	Yes
Compatible Hardware	Any development board with an ADC (Arduino UNO & Nano, Adafruit QtPy, STM32 Blue Pill, BeagleBone Black, Raspberry Pi Pico, to name just a few) or a standalone ADC of your choice
BioPotentials	EMG (Electromyography)
No. of channels	1
Electrodes	3 (Positive, Negative, and Reference)
Dimensions	4.7 x 1.4 cm
Open Source	Hardware + Software

1.3 Hardware

Images below shows a quick overview of the hardware design.

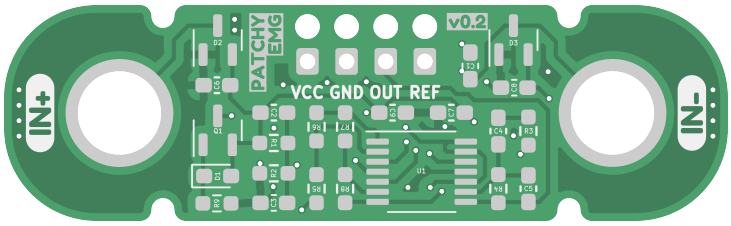


Fig. 1: PCB Front

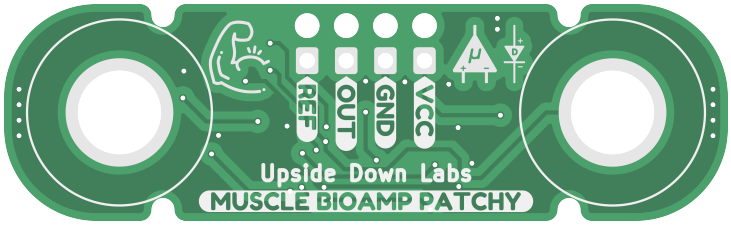


Fig. 2: PCB Back

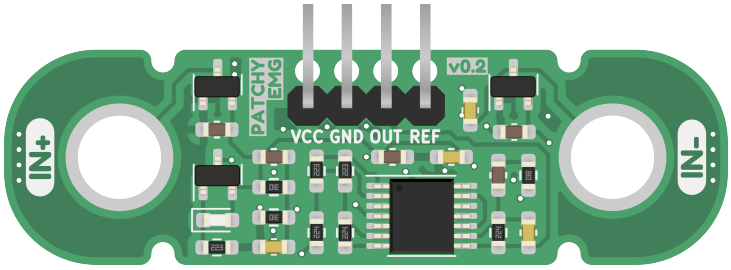
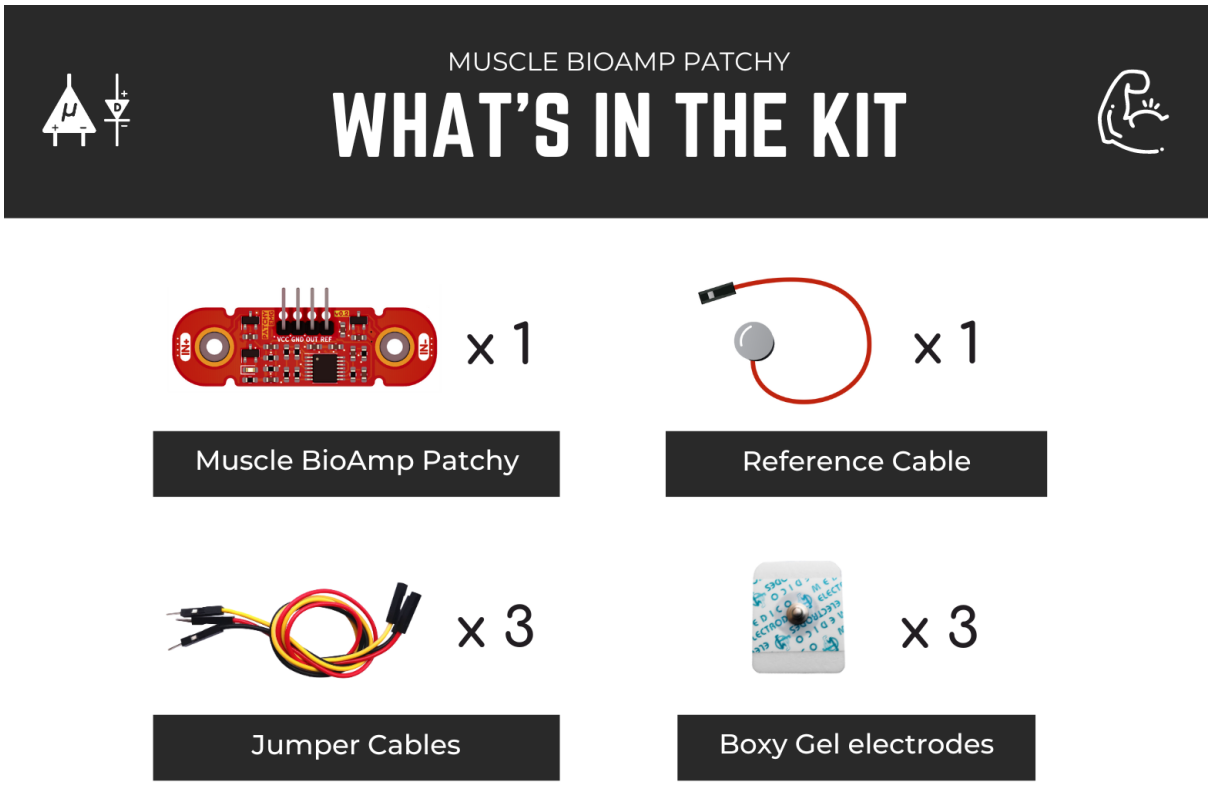


Fig. 3: Assembled PCB

1.4 Contents of the kit



**Each pack comes with a bunch of surprise goodies!!*

We have made a complete unboxing video of the kit. Please find the link below:

https://youtu.be/qRKU_HvapDE

1.5 Software requirements

Before you start using the kit, please download Arduino IDE v1.8.19 (legacy IDE). Using this you'll be able to upload the arduino sketches on your development board and visualise the data on your laptop.

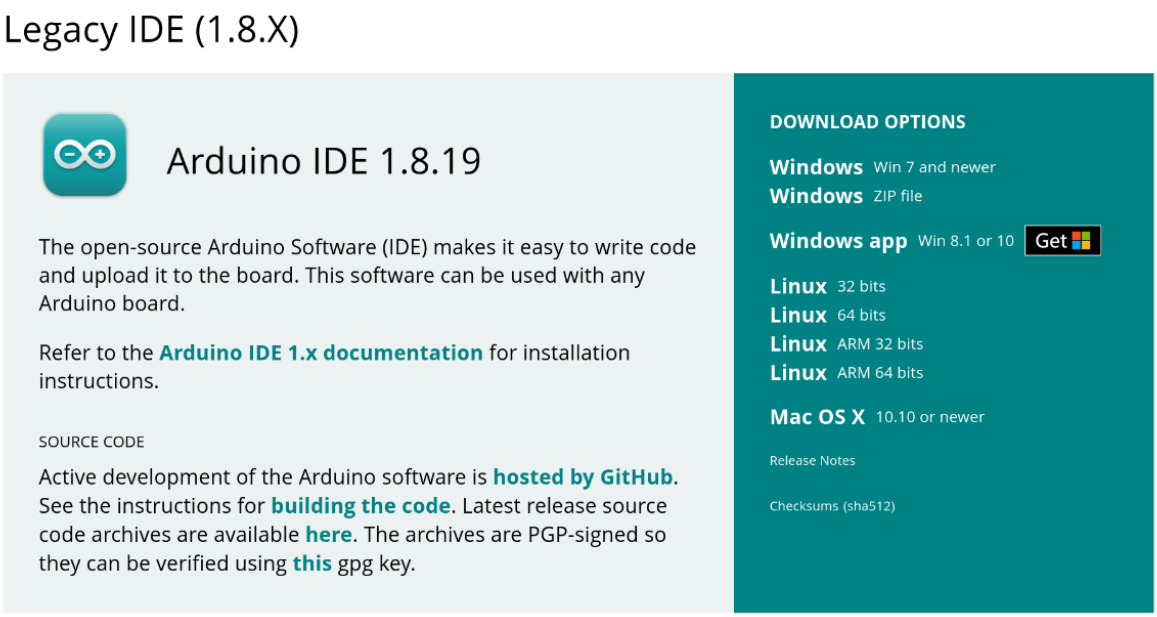


Fig. 4: Arduino IDE v1.8.19 (legacy IDE)

Visit Upside Down Labs Chords Web to visualize your biosignals directly in the browser.

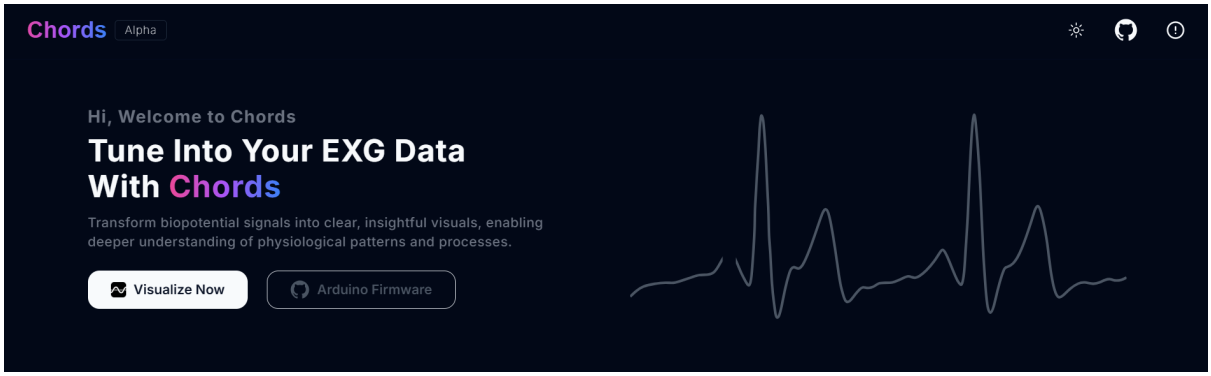


Fig. 5: Chords Web Landing Page

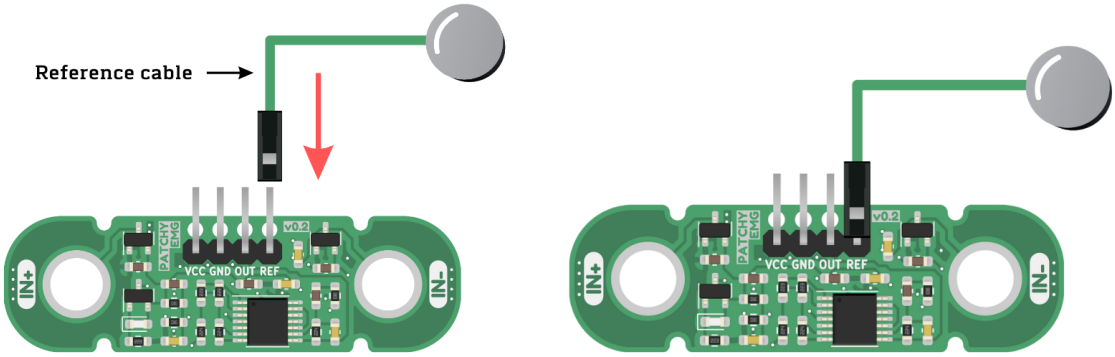
Getting started with Chords Web

https://youtu.be/IVIPnk9z75g

1.6 Using the kit

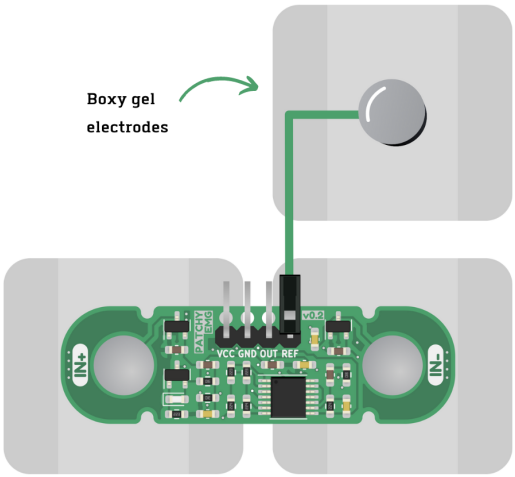
1.6.1 Step 1: Connect reference cable

Connect the reference cable to the Muscle BioAmp Patchy as shown in the diagram.



1.6.2 Step 2: Connecting sensor to gel electrodes

Snap the Muscle BioAmp Patchy on the gel electrodes (Don't peel the plastic backing from the electrodes at this moment).



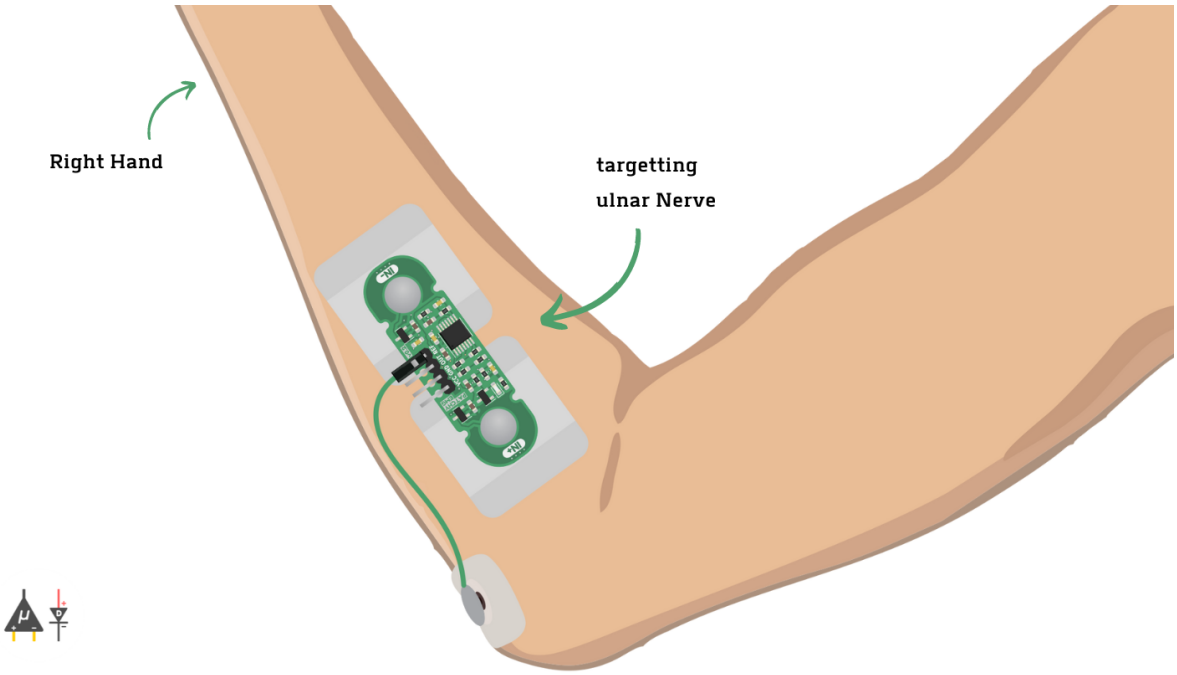
1.6.3 Step 3: Skin Preparation

Apply Nuprep Skin Preparation Gel on the skin surface where electrodes would be placed to remove dead skin cells and clean the skin from dirt. After rubbing the skin surface thoroughly, clean it with an alcohol wipe or a wet wipe.

For more information, please check out detailed step by step *Skin Preparation Guide*.

1.6.4 Step 4: Electrode Placements

Now peel off the plastic backing from the gel electrodes and place the Muscle BioAmp Patchy on the targeted muscle and the reference on the bony part of your elbow as shown in the diagram.



Note

In this demonstration we are recording EMG signals from the ulnar nerve, but you can record EMG from other areas as well (biceps, triceps, legs, jaw etc) as per your project requirements. Just make sure to place the IN+, IN- electrodes on the targeted muscle and REF on a bony part.

1.6.5 Step 5: Connect Arduino UNO R3

Connect `VCC` to `5V`, `GND` to `GND`, and `OUT` to `Analog pin A0` of your Arduino UNO via jumper cables provided by us. If you are connecting `OUT` to any other analog pin, then you will have to change the INPUT PIN in the arduino sketch accordingly.

Note

For demonstration purposes we are showing connections of the sensor with Arduino UNO R3 but you can use any other development board or a standalone ADC of your choice.

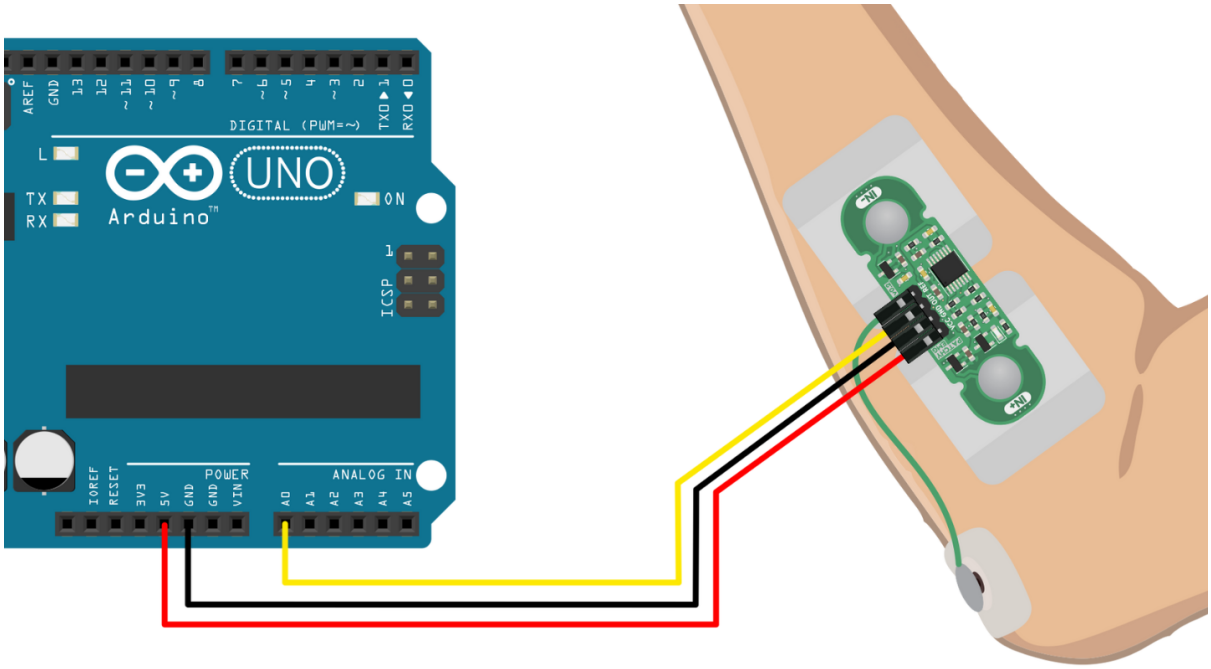


Fig. 6: Connections with Arduino UNO R3

1.6.6 Step 6: Upload the code

Connect your Arduino UNO to your laptop using the USB cable (Type A to Type B). Copy paste any one of the arduino sketches given below in Arduino IDE v1.8.19 that you downloaded earlier:

EMG Filter

EMG Envelope

Go to `tools` from the menu bar, select `board` option then select Arduino UNO. In the same menu, select the COM port on which your Arduino Uno is connected. To find out the right COM port, disconnect your board and reopen the menu. The entry that disappears should be the right COM port. Now upload the code, & open the serial plotter from the `tools` menu to visualize the EMG signals.

After opening the serial plotter make sure to select the baud rate to 115200.

Warning

Make sure your laptop is not connected to a charger and sit 5m away from any AC appliances for best signal acquisition.

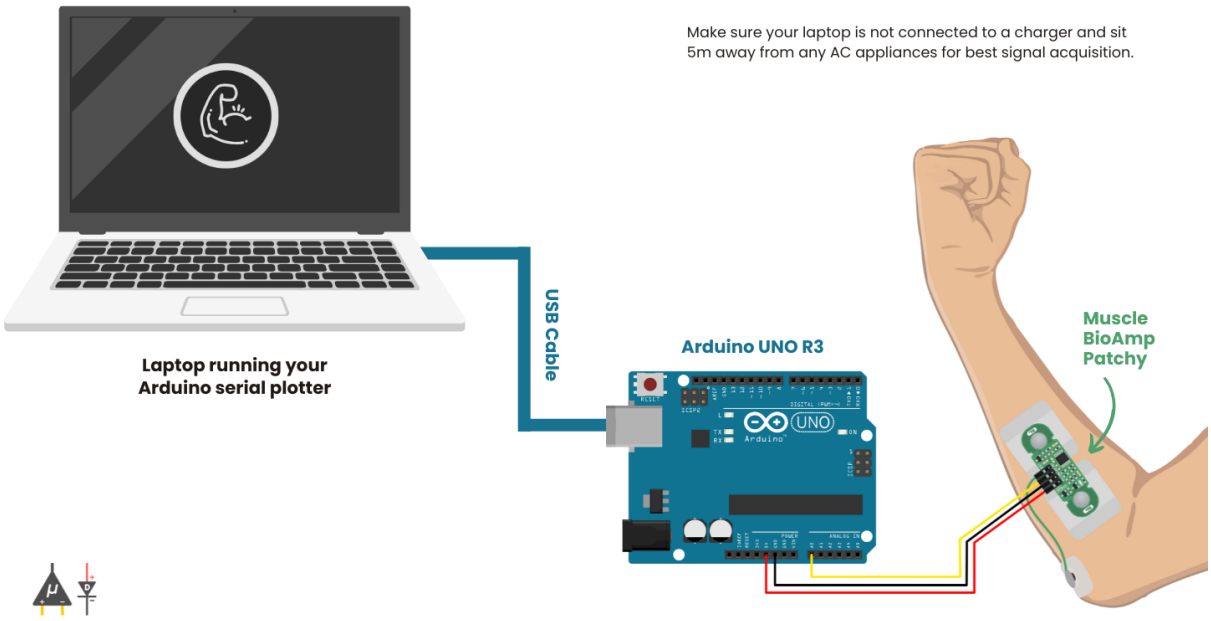
1.6.7 Step 7: Visualizing the EMG signals

For visualizing the EMG signals, use Chords Web for quick and hassle free real-time biosignal visualization right from your browser, without installing any software.

Now flex your arm to visualize the muscle signals in real-time on your laptop.

Video tutorial:

https://youtu.be/4dnCX3U7LS8



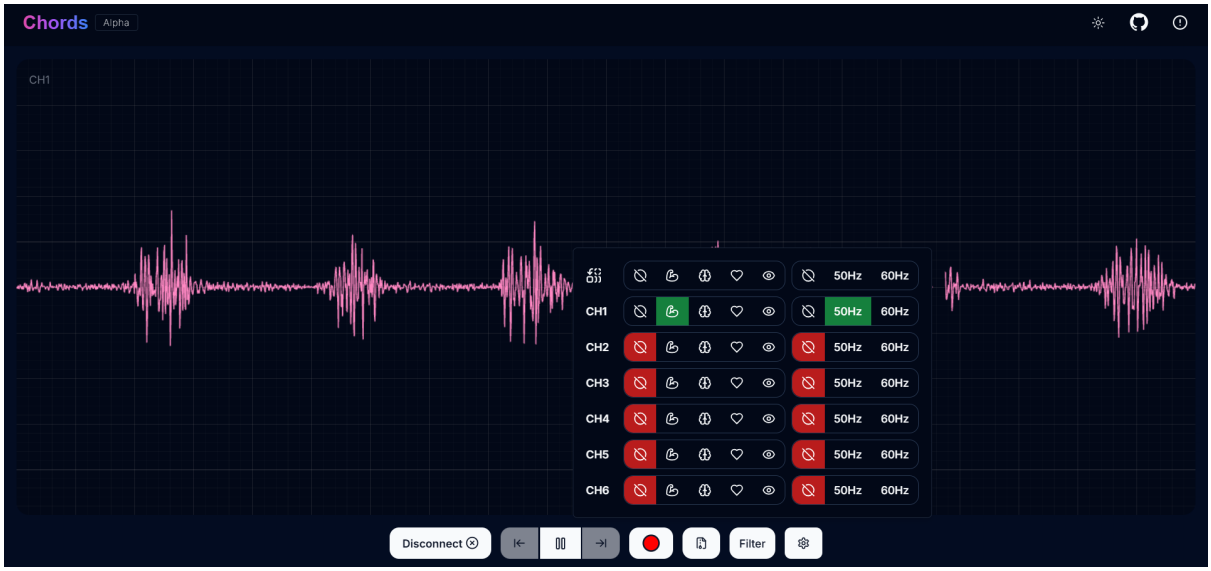


Fig. 7: Visualizing EMG signals on Chords Web

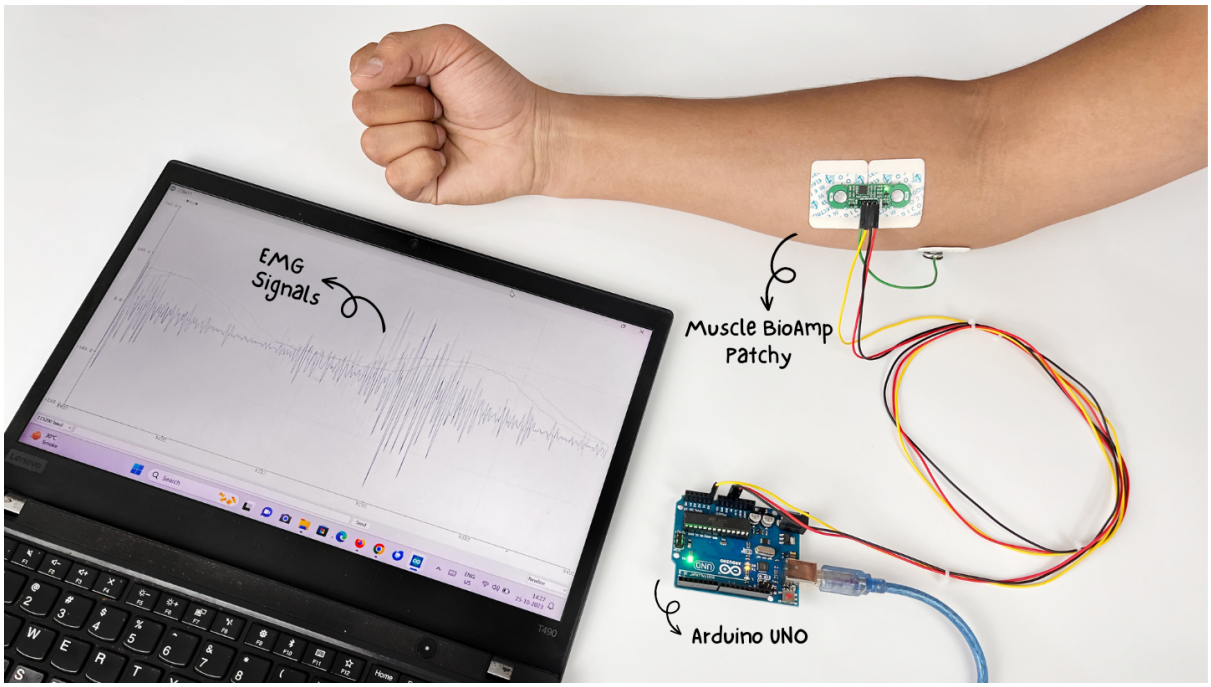


Fig. 8: Visualizing EMG signals on Arduino IDE v1.8.x

CHAPTER

TWO

SKIN PREPARATION GUIDE

2.1 Why skin preparation is important?

Proper skin preparation is crucial before recording any biopotential signal be it Electrocardiography (ECG), Electromyography (EMG), Electroencephalography (EEG), or Electrooculography (EOG).

- `Clean skin surface:` Removes dead skin cells, oils, & other substances that increases skin impedance.
- `Improve impedance:` Improves the conduction of electrical signals from the body to the recording equipment and minimizes impedance.
- `Electrode-skin contact:` Ensures optimal contact between the electrodes and the skin surface.
- `Signal quality:` Enhances the overall quality of recorded signals, providing clear & reliable data for analysis & improves the ability to capture subtle variations in biopotential signals.
- `Consistency in recordings:` Reduces variability in signal quality, making it easier to make any Human-Computer Interface (HCI), Brain-Computer Interface (BCI) project or a real-world application.
- `Long term adhesion:` Facilitates long-term adhesion & stable placement of electrodes to the skin during extended signal monitoring.

2.2 Kit Contents

Nuprep gel	Mildly abrasive, highly conductive gel that should be applied before placing the electrodes on the skin to improve signal quality & enhances the performance of monitoring electrodes.
Electrode Gel	Highly conductive gel that acts as a coupling agent between dry electrodes and the skin to aid the transmission of biopotential signals like ECG, EMG, EOG, or EEG.
Ten20 paste	Contains the right balance of adhesiveness and conductivity, enabling the dry electrodes to remain in place while allowing the transmittance of biopotential signals.
Alcohol Swabs/Wet wipes	Soft & non-woven pads that helps in cleaning the skin surface and does not leave any residue.
Cotton Swabs	Useful while applying nuprep gel or ten20 paste.

2.3 Steps to follow

You can follow the steps given below to do the skin preparation properly:

2.3.1 Step 1: Identify the targeted area

Identify the target area where the gel electrodes or BioAmp Bands will be placed for recording the biopotential signals.

2.3.2 Step 2: Apply NuPrep gel

Take a small amount of NuPrep gel using a cotton swab and apply it on your targeted area.

2.3.3 Step 3: Clean the skin surface

Use gentle, circular motions to rub the gel on the skin surface. This removes all the dead skin cells & improves conductivity.

Warning

Do not rub the gel for too long as it has abrasive properties and may cause skin redness and irritation.

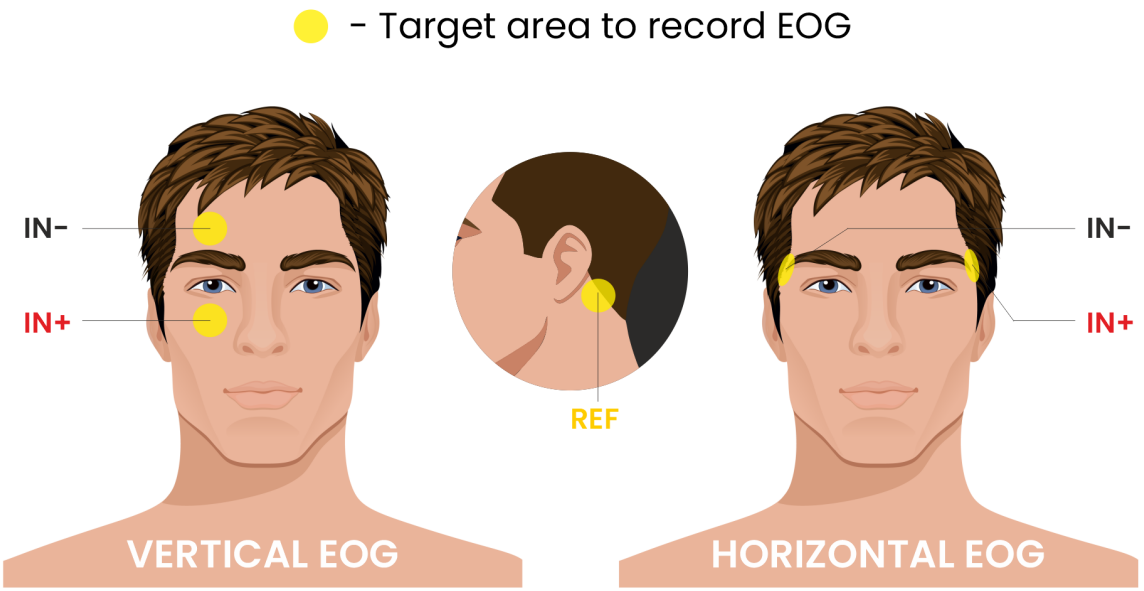


Fig. 1: Target area to record EOG

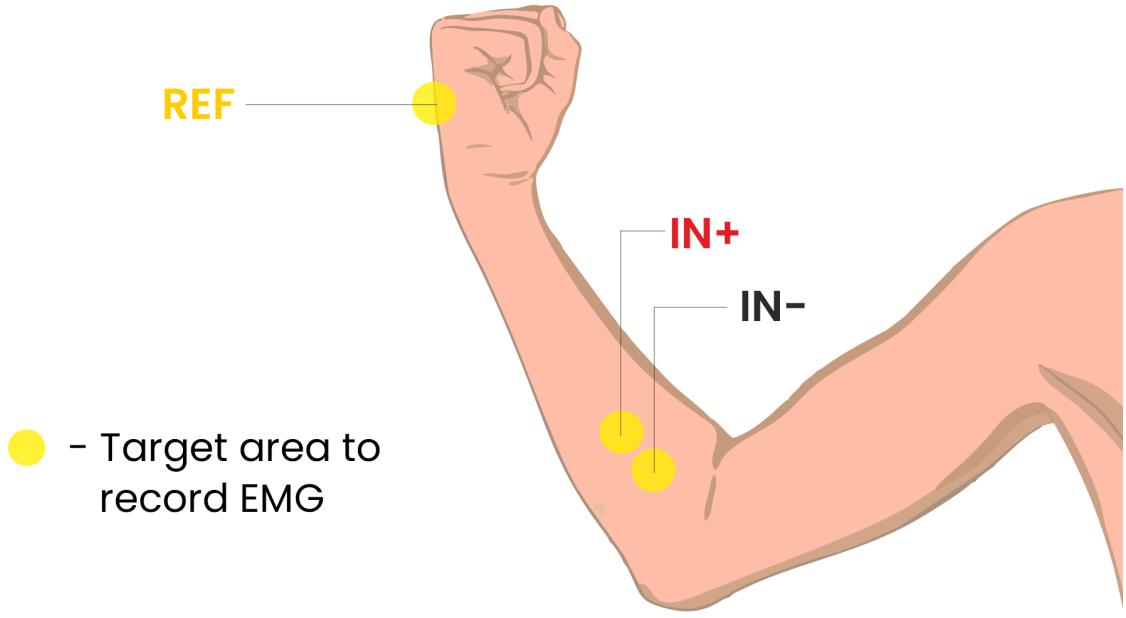


Fig. 2: Target area to record EMG

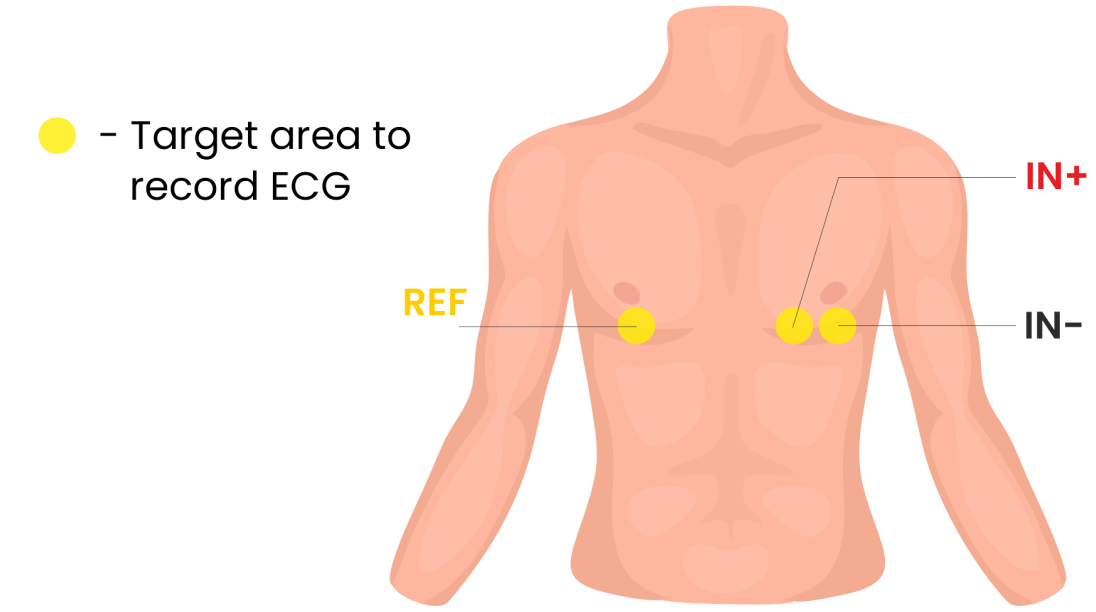


Fig. 3: Target area to record ECG

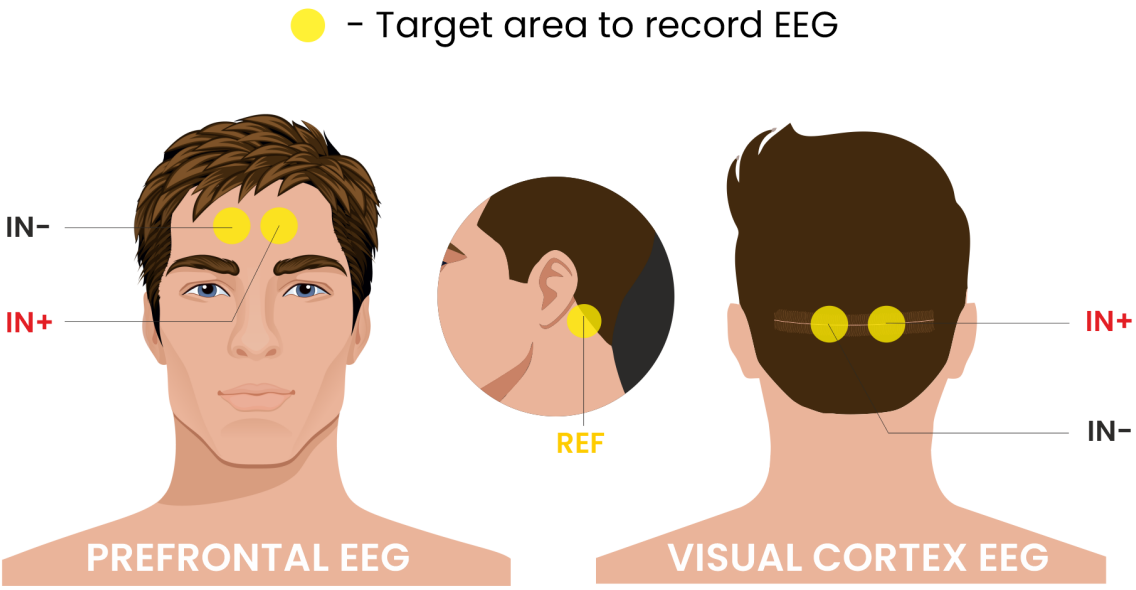
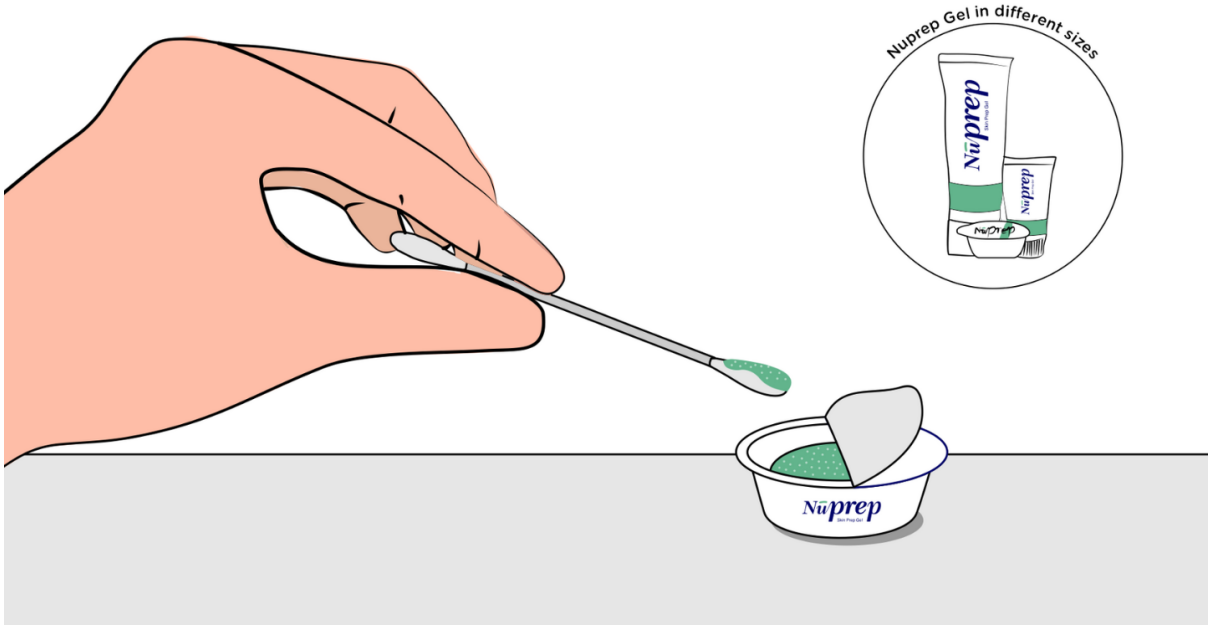


Fig. 4: Target area to record EEG



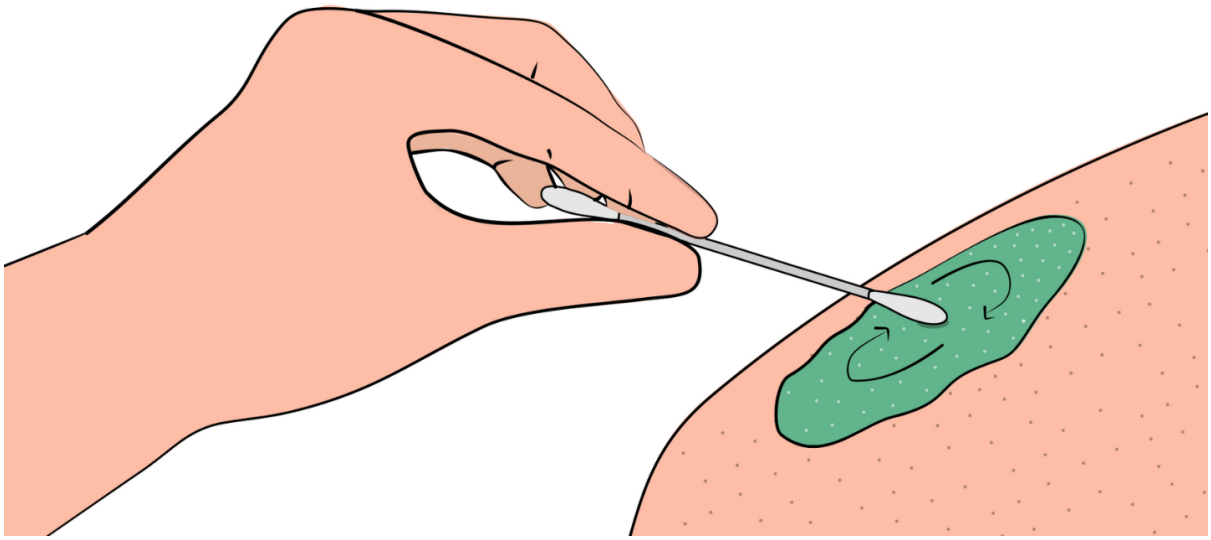


Fig. 5: Rub the gel gently using the cotton swab

2.3.4 Step 4: Wipe off the gel

Wipe away excess gel with alcohol swabs or wet wipes.

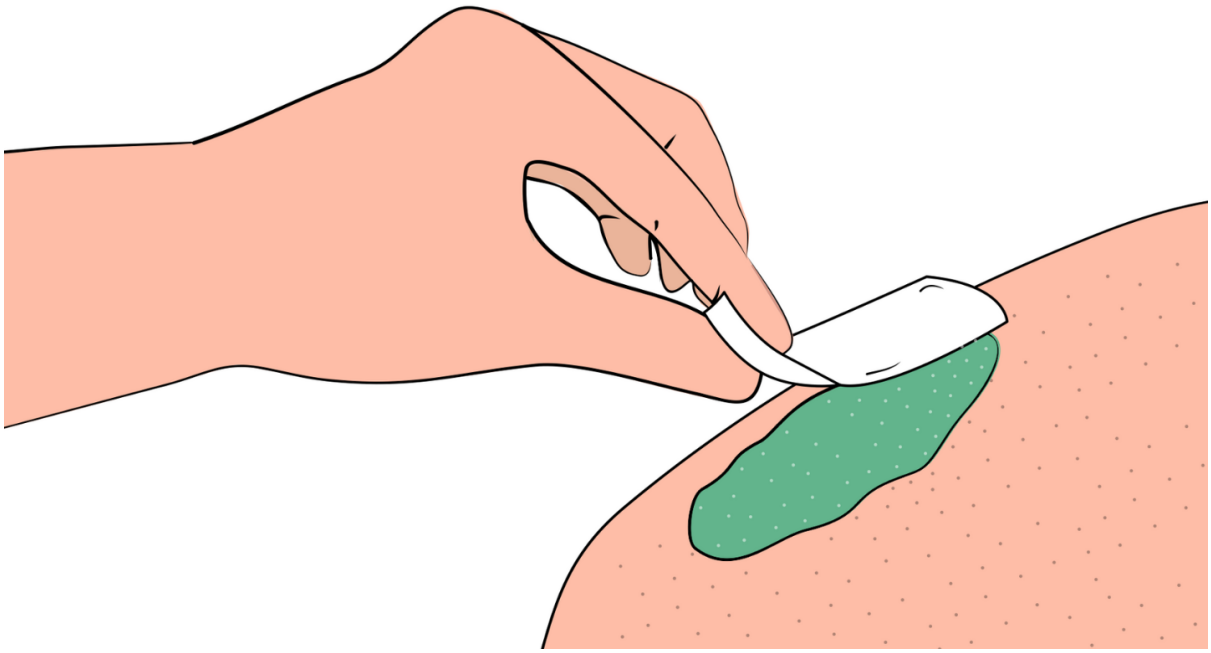


Fig. 6: Wipe away excess gel

Warning

- Using alcohol swabs can dry out the skin, so don't use them if your skin is already dry.
- Close your eyes while using the alcohol swabs for EOG recording else it may cause eye redness & irritation.

2.3.5 Step 5: Measuring the signals

Now you can either use gel electrodes or BioAmp bands for the signal recording.

Using gel electrodes

Connect the BioAmp cable to gel electrodes, peel the plastic backing from electrodes and place the IN+, IN-, REF cables according to your specific biopotential recording.

Note

While placing the gel electrodes on the skin, make sure to place the non-sticky tab of the electrode in the direction opposite to your hair growth. This allows you to remove the electrodes easily without pulling off much body hair.

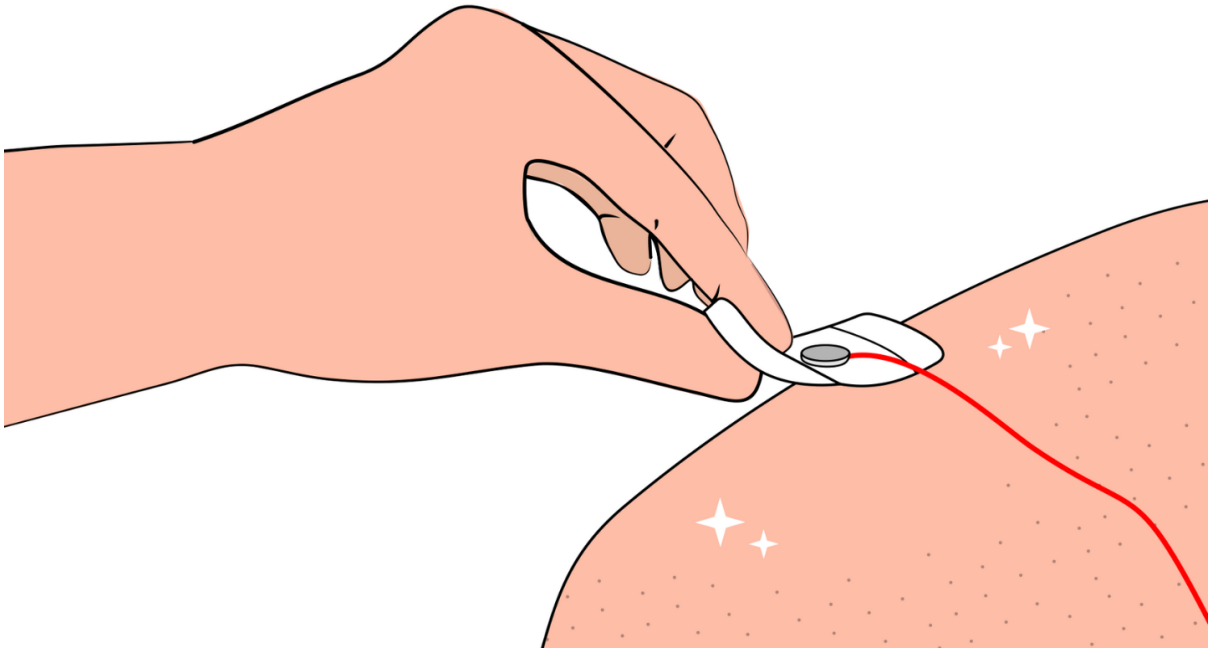


Fig. 7: Placing gel electrodes on skin surface

Using BioAmp bands

Connect the BioAmp cable to your BioAmp band. Now apply a small amount of `electrode gel` or `Ten20 conductive paste` on the dry electrodes between the skin and metallic part of BioAmp cable. This improves the signal conductivity, enhancing overall signal quality.

Note

The above graphics demonstrates the use of electrode gel/Ten20 paste with Muscle BioAmp Band. Similarly you can use Brain BioAmp Band and Heart BioAmp Band. Refer to using-bioamp-bands guide to assemble and use all the BioAmp Bands correctly.

Now you are all set! Make all the connections correctly and start recording your biopotential signals.

Warning

NuPrep gel, Ten20 paste and the alcohol swabs shouldn't be used if you have a history of skin allergies to lotions and cosmetics.

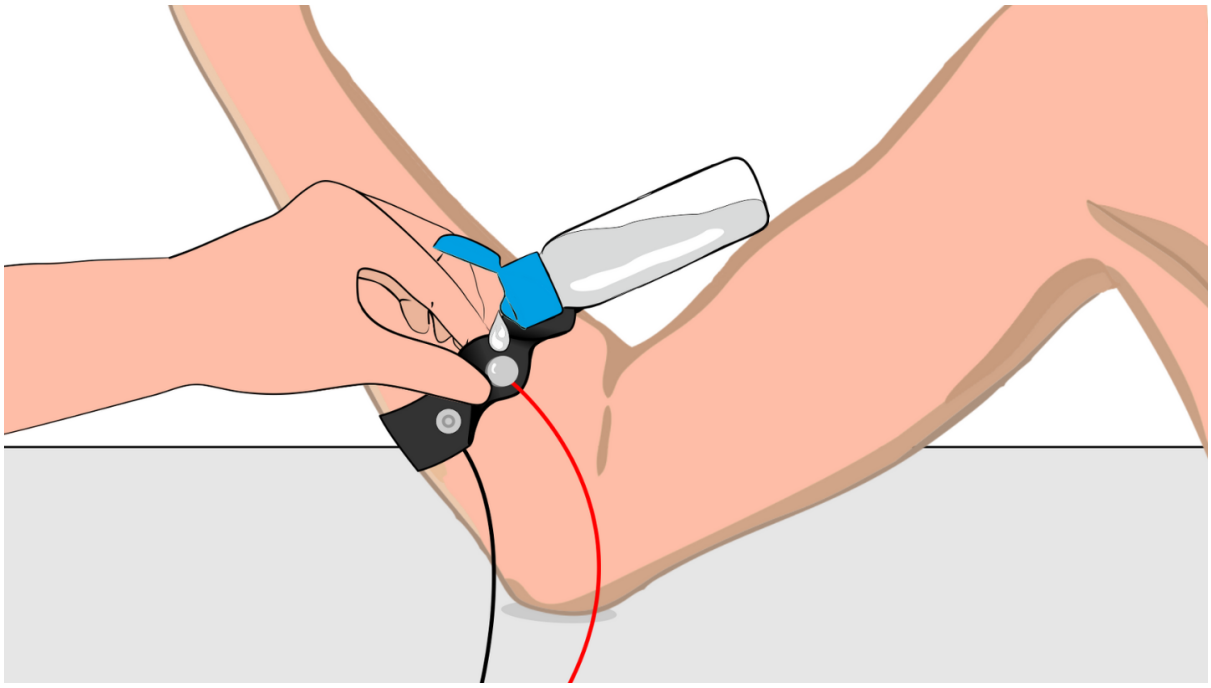


Fig. 8: Method 1: Using Electrode gel

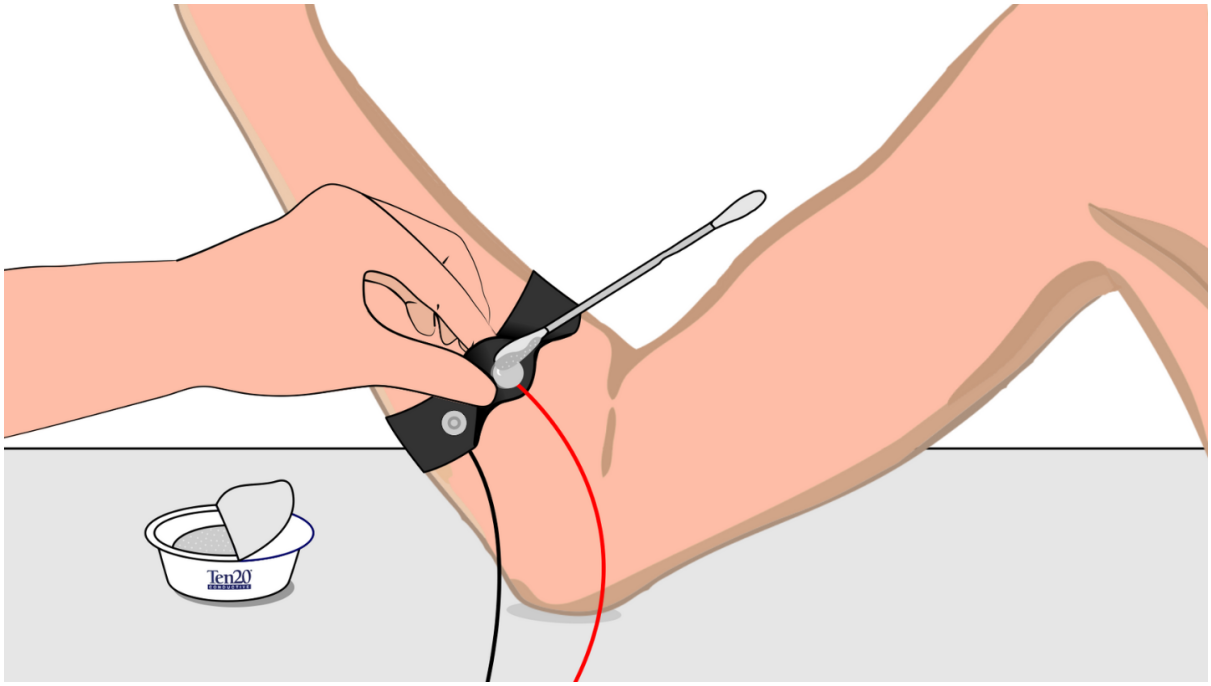


Fig. 9: Method 2: Using Ten20 paste