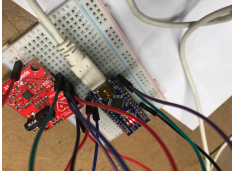


Conductive Gels for Electrocardiograms Log Book

Original Logbook -

<https://linen-bookcase-966.notion.site/Conductive-Gels-for-Electrocardiograms-Log-Book-81a151a6a2ca4ba5a479d751afbc622d?pvs=4>

<p>November 1, 2024</p>	<ul style="list-style-type: none">● came up with project idea of creating a heart rate monitor● mild research● came up with basic materials list and basic procedure <p>AD8232 Heart Rate Monitor Hookup Guide - SparkFun Learn</p> <p>Electrocardiogram</p> <p>Arduino Based ECG & Heartbeat Monitoring Healthcare System</p>
<p>November 7, 2023</p>	<ul style="list-style-type: none">● researched ECGs and how they work● looked at hookup guide and data sheet for arduino and chip AD8232 Heart Rate Monitor Hookup Guide - SparkFun Learn● researched serial pin names for connecting the chips● soldered pins onto arduino and connected to breadboard <p>Serial - Arduino Reference</p> <p>What do these pins mean? Where should I plug them in?</p>
<p>November 14, 2023</p>	<ul style="list-style-type: none">● researched serial pins and baud rate● fritzing the nano to the chip● testing on myself - it worked!!! <p>improvements:</p> <ul style="list-style-type: none">● find a way to decrease amount of time on x axis so the serial chart so it looks better 
<p>November 21, 2023</p>	<ul style="list-style-type: none">● played around with code● noticed there were now three inputs instead of one and too much variation in data<ul style="list-style-type: none">○ something wrong with the chip or the nano?○ data now coming very irregularly and is different than the

	<p>first time I tested the device</p>
<p>November 28, 2023</p>	<ul style="list-style-type: none"> ● realized I was running out of electrode pads and decided to make my own ● did research on the best materials for making conductive gels and found salt and gelatine fairly effective ● researched conductive gels and brand materials <ul style="list-style-type: none"> ○ decided to make conductive gels for the application of and ECG machine <p>Materials used to simulate physical properties of human skin</p> <p>What Can You Use Instead of Ultrasound Gel and Echo Gel? SONO Supplies</p> <p>[Making and Using Electrode, Conductive, and Electrical Gel](https://www.wikihow.com/Make-Electrical-Gel#:~:text=Add 1 tablespoon (17 grams,aloe gel much more easily.&text=Mix the aloe vera and salt together.))</p> <p>How to Make ECG Pads & Conductive Gel</p> <p>Electrically conductive gel composition</p>
<p>December 5, 2023</p>	<ul style="list-style-type: none"> ● realized I can't test the device safely or ethically on anyone besides myself ● researched TENS machine as an alternative for a heart beat ● researched conductivity of human skin <p>TENS (transcutaneous electrical nerve stimulation)</p> <p>Simple Electric Shock Device</p> <p>Teardown: Inside the Neurometrix Quell TENS device</p>
<p>December 10, 2023</p>	<ul style="list-style-type: none"> ● mild research on effects of surface electrode pads ● filled out basic project info and ethics due care
<p>December 11, 2023</p>	<p>Bought materials</p> <ul style="list-style-type: none"> ● "Knox" unflavoured gelatine (3X) ● Table Salt

- rubber gloves

December 20, 2023

- weighed masses of components of the experiment
- 5 versions of the gel
 - Version A: approx. equal amounts of gelatine and salt, double amount of water
 - Version B: approx. half amount of salt and water in comparison to gelatine
 - Version C: approx. equal amounts of gelatine and salt, half amount of water
 - Version D: approx. half amount of salt, equal amounts of water and gelatine

Version	Mass of Gelatine (+/- 0.01g)	Mass of Salt (+/- 0.01g)
A	8.22	7.96
B	8.42	4.19
C	3.93	3.78
D	5.42	3.17

Mass of plastic bag - 0.95g
 Paper package 0.68
 Gelatine Package 8.07

January 1, 2024

- creating gels
 - mixed each version and made the conductive gels and put them into silicone molds for testing
- storing in fridge

Mass of Gelatine, Salt, and Water for Various Versions of Conductive Gelatine Solutions

Version	Mass of Gelatine (+/- 0.01g)	Mass of Salt (+/- 0.01g)	Volume of Water (+/- 0.125mL)	Color
A	8.22	7.96	8	Blue
B	8.42	4.19	8	Yellow

	<p>C 3.93 3.78 8 Colourless</p> <p>D 5.42 3.17 10 Red</p>
January 4, 2024	<ul style="list-style-type: none"> researched conductive slime experiments drew diagram how I want to hook up the LED light <p>DIY Conductive Slime: Electric slime for colorful projects - Rosie Research</p>
January 5, 2024	<ul style="list-style-type: none"> noticed the gels were starting to shrink (probably because of the salt) and become really hard and inflexible Decided to re-do the gels and add water according the package directions (more water)
January 8, 2024	<ul style="list-style-type: none"> 16.43g of salt 8.2g of gelatine 100mL of water Used a syringe to put into molds
January 9, 2024	<ul style="list-style-type: none"> used gel from yesterday and tested its resistance with a multimeter gels started out separate and combined after sitting in backpack <ul style="list-style-type: none"> caused by heat or too much water added to solution? Tested heart rate monitor - still getting a lot of noise from chip <ul style="list-style-type: none"> tried to isolate the problem and discovered that the noise probably isn't coming from the jack connection but from the board itself tried to use a capacitor to get rid of noise - did not change anything on graph
January 10, 2024	<ul style="list-style-type: none"> measured more gelatine and salt to attempt to make the gels again <p>Version Gelatine (g) Salt (g)</p> <p>A 2.95 3.14</p>

	<table> <tr> <td>B</td> <td>4.10</td> <td>2.30</td> </tr> <tr> <td>C</td> <td>3.25</td> <td>6.38</td> </tr> <tr> <td>D</td> <td>5.53</td> <td>16.02</td> </tr> <tr> <td>E</td> <td>3.36</td> <td>0</td> </tr> </table>	B	4.10	2.30	C	3.25	6.38	D	5.53	16.02	E	3.36	0
B	4.10	2.30											
C	3.25	6.38											
D	5.53	16.02											
E	3.36	0											
January 15, 2024	<ul style="list-style-type: none"> ● still problems with noise ● researched ways to get rid of noise ● looking into programming a filter but nothing would give me real time data 												
January 30, 2024	<ul style="list-style-type: none"> ● used tester gel from before to light up a lightbulb ● LED bulb lit up at about 0.1 amps and 3.3V - resistance was calculated to be 0.41 ohms ● noticed rust forming on the legs of the LED bulb and hissing and spitting from the gels ● potential redox reaction between the metal from the legs? <ul style="list-style-type: none"> ○ gel may be storing a small amount of current from the multimeter and creating a battery! ○ put copper and lead solder inside gel to see if I can measure a voltage 												
January 31, 2024	<ul style="list-style-type: none"> ● created version a gels from measured out masses from January ● red color 												
February 1, 2024	<ul style="list-style-type: none"> ● Created version B gels 												
February 2, 2024	<ul style="list-style-type: none"> ● Created version c gels 												
February 3, 2024	<ul style="list-style-type: none"> ● tested resistance of gels ● noticed variation so measured the value after waiting one minute ● not a whole lot of variation between the gels :(so project might be a bust <p>https://docs.google.com/document/d/1kcxZme44zEOy1F0gKEcw_37P7vnZR1b7IVjIj9BIElg/edit?usp=share_link</p> <ul style="list-style-type: none"> ● version D gel did not form right (water may have been to hot) and it was just water the next day 												

	<ul style="list-style-type: none">• Does salt affect jello? <p>https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2141103/pdf/215.pdf</p>
February 15, 2024	<ul style="list-style-type: none">• Did write up
Mar 10, 2024	<ul style="list-style-type: none">• Mixed 1000mL of water and 3 packets (approx 45g) of gelatine and approx 15g of salt to create the simulated gelatine arm• Put in box and let cool in freezer and then moved outside
Mar 11, 2024	<ul style="list-style-type: none">• FINAL TESTING DAY!!!• Tested the gelatine from yesterday with the arduino device - getting no random electrical impulses which is good• Program working how its supposed to and the graph turns blue when i disconnect the leads• Hooked up the TENS machine I GOT A WAVEFORM<ul style="list-style-type: none">○ Waveform doesn't change that much when i increase the frequency of the electrical stimulation from TENS○ Bpm matches frequency of TENS display - YAYY