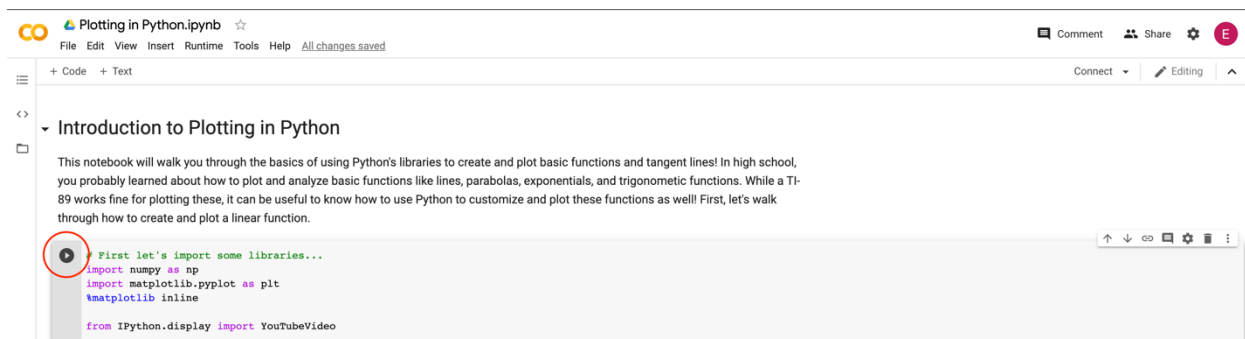Name: Date: Class:

What is an EMG? Jupyter Notebook Activity Answer Key

Directions
Open the file **WhatIsAnEMG_NOTEBOOK.ipynb** in Google Colaboratory by selecting "File->Open Notebook" (NOTE: You will need a Google Account to use Google Colaboratory.) Read each cell (block) of text and run each cell of code by clicking the play button on the left side of the block as indicated by the red circle in the figure below.   **Important note**: The data you will examine in this worksheet is actual EMG data collected for research. This data will not perfectly resemble the waves we saw in the slides—there is noise in the data, making it harder to read. When you complete this notebook and worksheet, keep this in mind! As you read, watch, and run each cell, answer the following questions. This is a graded assignment.

1. ***EMG Background.*** Watch the video on "EMG" by Mayfield Brain and Spine that is linked in the notebook.

    a. What does an EMG measure?
    Electrical activity of the muscles

    b. What are the two types of neurons in the body? Briefly describe each. (HINT: Go to the *1:30* timestamp in the video.)
    Sensory neurons: give information about touch, texture, temperature, pain, etc. from the body to the brain; input neurons
    Motor neurons: send information to the muscles about how to move, how much to move, where to move to, etc.; output neurons

c. Describe how the EMG changes when the patient bends their wrist. Does this result in more or less activity in the EMG? (HINT: Go to the *10:00* timestamp in the video.)

Bending the wrist results in more activity in the EMG—the data starts to get very noisy and the peaks increase in magnitude.

2. ***Examining your first EMG data.*** Run the first code block. When you are prompted to open a file, select **EMG_Example1.csv**. Then, run the remaining two code blocks to view the plot.

a. Move the *Zoom horizontal* slider all the way to the right and move the *X position* slider so that the x range in the plot is about [14.0,15.0]. Compared with other segments of the plot, does this segment have more electrical activity or less electrical activity? How do you know? (HINT: Think about the peak magnitude/height.)

This segment has less electrical activity than the rest of the plot because it has little to no spikes/activity compared to other segments.

b. Move the *X position* slider until you find a portion with a mix of low and high muscular activity (NOTE: it won't be perfect, just find a pattern that looks similar). Sketch the wave segment below and label the values on the x-axis.

Any answer is acceptable, as long as the student completes both the sketch and axis labels.

3. ***Examining more EMG data.*** Now, re-run the first code block. When you are prompted to open a file, select **EMG_Example2.csv**. Then, run the remaining two code blocks to view the plot.

   a. Adjust the X position and Zoom Horizontal sliders until the x range in the plot is about [1.0, 4.0] Which half of this segment involves **greater** activation of the muscle being measured? How do you know? (HINT: Think about the peak magnitude/height.)
   The second/latter half of this segment involves greater activation of the muscle being measured because the spikes are greater in magnitude (they're taller).

   b. Move the *X position* slider until you find a portion with a mix of low and high muscular activity (NOTE: it won't be perfect, just find a pattern that looks similar). Sketch the wave segment below and label the values on the x-axis.
   Any answer is acceptable, as long as the student completes both the sketch and axis labels.