Name: **Date:** **Class:**

Day 2: Interface and Experiment Design Worksheet Answer Key

Group Members: _____

Project Overview

Over the next few days, you will be completing an exciting project at the intersection of technology and neuroscience. You will design and build a brain-machine interface that translates movement between your own muscles and a robot. By the end of this project, you will be able to control a robot's movements based on muscle signals from your own body.

Designing Your Interface

Your goal is to create a brain-machine interface that translates electromyography (EMG) signals from a person's arm to movements in a robot. The following components will be provided to your group:

- laptop (Qty: 1)
- micro:bit V2 starter kit (Qty: 2)
- micro:bit compatible robot kit (Qty: 1)
- MyoWare 2.0 muscle sensor (Qty: 1)
- MyoWare electrodes (as many as needed)

Your teacher may optionally provide you with the following:

- Red Dot electrodes (Qty: 3)
- MyoWare 2.0 cable shield (Qty: 1)
- 3.5mm jack electrode pads sensor cable (Qty: 1)

You will have to research the components to figure out how they should be connected. Think about the following three parts of the system:

- Muscle to micro:bit connection
- EMG data collection and processing
- Micro:bit to robot connection

Use this worksheet to plan your interface and experiment design. You may need to do research through outside sources to plan appropriately. Potential sources of information include the following:

- MyoWare muscle sensor product page
- Micro:bit start guide and resources
- Cutebot micro:bit robot wiki
- Introduction to EMG video

Name: **Date:** **Class:**

Part 1: Muscle to Micro:bit Connection

How will you connect the micro:bit to your muscles to gather EMG data? Where on your arm will you place the electrodes? For what movements will you collect data, and how will this affect the placement of the electrodes?

Answers will vary. A good plan should include information on how the muscle sensor will be set up, how it will be connected to the micro:bit (i.e., which wires on the muscle sensor will connect to which ports on the micro:bit), and how it will be attached to the test subject's arm (i.e., with the electrodes). Students should discuss where they will place the electrodes, citing the locations of the muscles they would like to test. They should support their plan with references.

Part 2: EMG Data Collection and Processing

What data do you need to collect? Which arm movements will you experiment with? How will you process the data in order to translate EMG signals to robot movements? Which arm movements should correspond to which robot movements?

Answers will vary. They should discuss the data they will collect for each movement. They should begin to discuss ideas for processing the EMG data, even though you will help them finalize this part. They should also discuss what arm movements they will translate to each robot movements; for example, they may decide that clenching a fist should make the robot move forward, opening their palm should make the robot stop, twisting their arm to the side should make the robot turn, etc. The plan does not have to be completely viable. For example, they may try to translate certain delicate finger movements, which the EMG sensor may not be able to pick up. That is okay at this stage, as they will revise their design later on.

Part 3: Micro:bit to Robot Connection

How will you connect the second micro:bit to your robot? How will you send signals from the first micro:bit (the muscle connection) to the second micro:bit (the robot connection) in real time?

Answers will vary. They should discuss how they will build the robot, taking guidance from the company's wiki page. They should also discuss how they will send information between the two micro:bits, which likely will involve radio signals.