The purpose of this study is to compare the charge delivery and impedance values of different electrode materials.

**INTRODUCTION**
- The recent innovation of carbon nanofibers (CNFs) could potentially increase charge delivery while decreasing resistance in electrodes. Stainless steel is the common material used in electrodes due to its ability to deliver a strong and clear signal.
- Charge - amount of current delivered across an electrode
- Impedance – resistance of a current when a voltage is applied
- For stimulation experiments, the ideal electrode delivers a high charge
- For recording experiments, the ideal electrode has a low impedance (high sensitivity)

**METHODOLOGY**
1. Set up buffer solution to test the electrode in (PBS/De-Ionized H2O)
2. Connect the two working electrode clips and the two reference electrode clips
3. Place testing electrode in buffer solution and attach it to working electrode clips
4. Run cyclic voltammetry cycles and EIS using Gamry EIS300
5. Integrate CV graphs using EChem Analyst Software to obtain a charge value
6. Obtain impedance values from the EIS graphs at 1kHz (pre-determined)

**RESULTS**

**DISCUSSION**
- The curvature of the lines in Figures 1, 5 indicate that steel and CNFs are durable, reliable materials that aren’t easily oxidized/reduced. Copper on the other hand, is easily oxidized based on its linearity.
- Overlaying Figures 1, 3, 5 indicates that in comparison to copper’s high charge, the charge capacity of both steel and CNF is nearly negligible. Overlaying Figures 2, 4, 6 leads one to believe that steel has the lowest impedance.
- Steel wires diameter: 0.25mm
- Cu wires diameter: 0.25mm (T1), and 0.65mm (T2,3)
- CNFs diameter: 20-40nm (T1-3)
- Therefore, if the same sized wires for steel, copper, and CNFs were available, one would see that CNFs have the lowest impedance value of the three.

**LIMITATIONS:**
- Copper shouldn’t be used in biological experiments because it corrodes easily, increasing its toxicity.
- While running CV for copper, it was difficult setting a proper parameter for the cycles (seen in Figure 3). Therefore, charge values cannot be entirely relied upon.
- Not having access to same sized wires for each of the materials hindered consistency

**CONCLUSION**
CNFs appear to be the most reliable material to use in charge delivery in electrodes for stimulation as well as in recording electrodes.

**ACKNOWLEDGEMENTS**
This study could not have been conducted without the help of numerous individuals. Alireza Akhavian for showing me how to make electrodes. Hamid Charkhar for explaining the theory behind CV and EIS. Jemika Kastee for training me in the use of the Gamry Potentiostat. Your efforts made it possible to reach these conclusions.

**TABLES**