
Bioengineering

Bioinformatics

- Combines Computer Science and Biology
- Data analysis on living organisms' data such as DNA

Biotechnology

- Combines Chemistry and Biology
- Deals with genetic engineering such as developing insect resistant crops (GMOs)

Biomechanics

- Combines Mechanics and Biology
- Deals with understanding the physical motion and forces associated with our bodies movement, involves kinesiology

Biomimetics

- Use different biological systems to inspire synthetic products that humans can use.
- Ex: The bur fruit inspired Velcro

Biomedical Devices

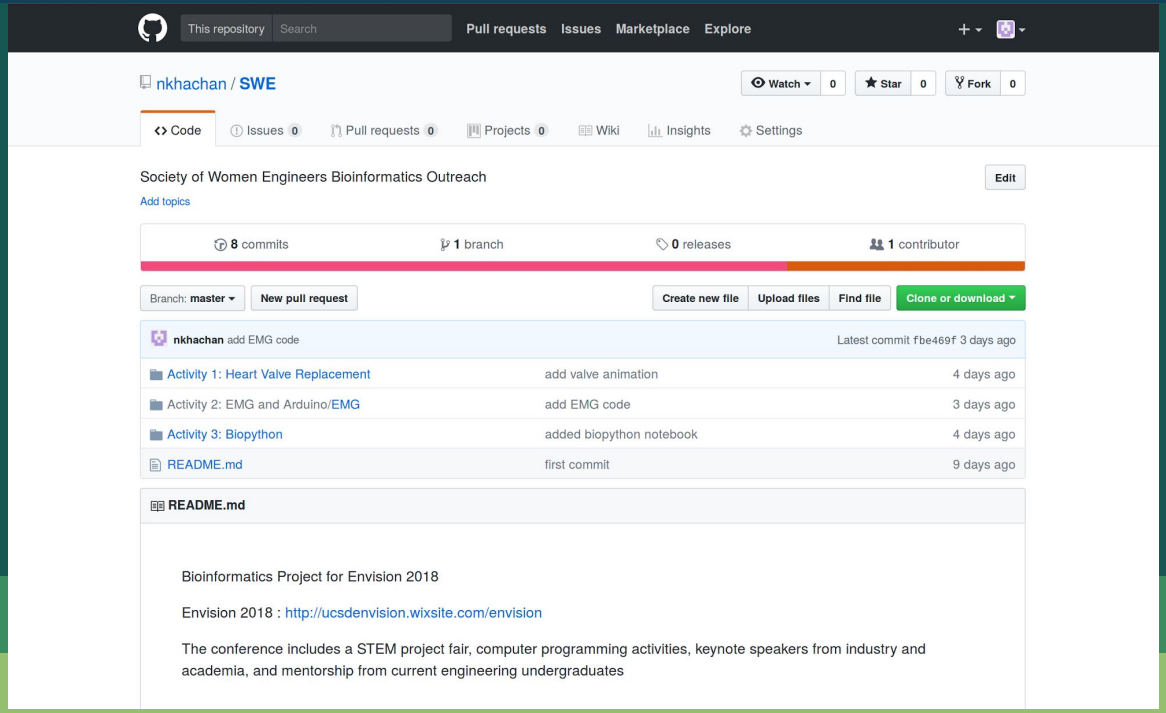
- Combines Engineering with Biology
- Create machines used to measure our biological responses used for health-care purposes

Starting Up

Go to the following link:

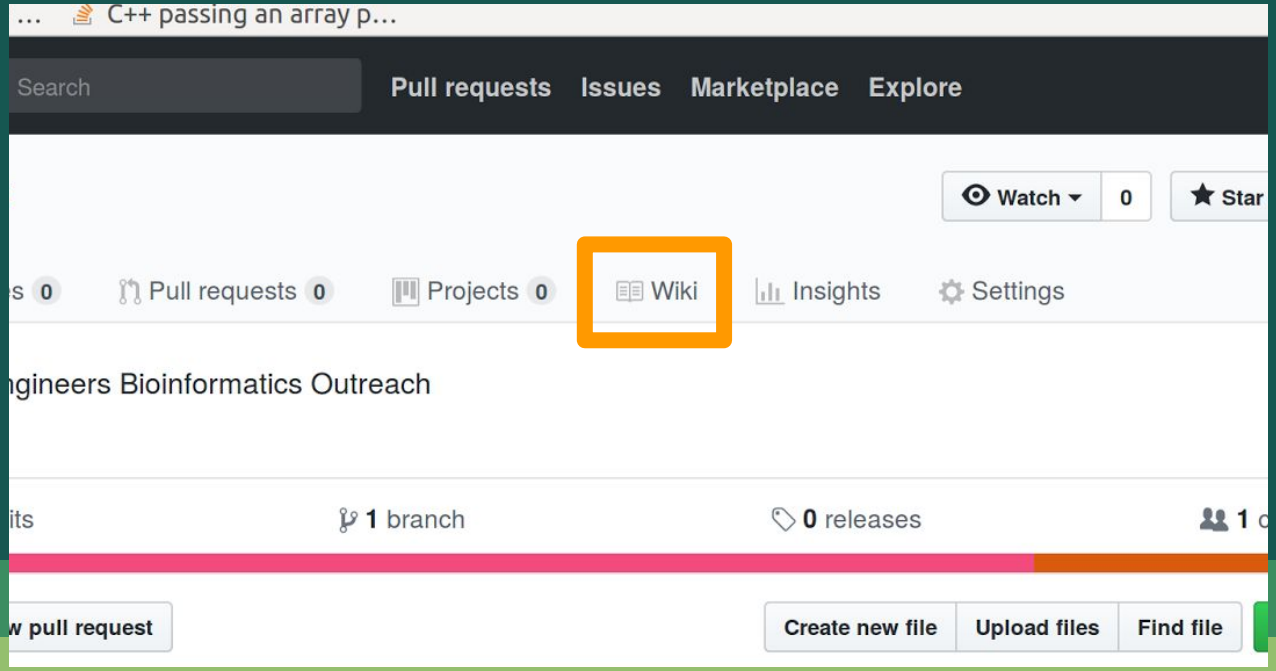
www.github.com/nkhachan/SWE

Starting Up



Please download all the files by clicking on the green button and download it as a .zip file.

Starting Up



Click on Wiki to access all the information for this workshop

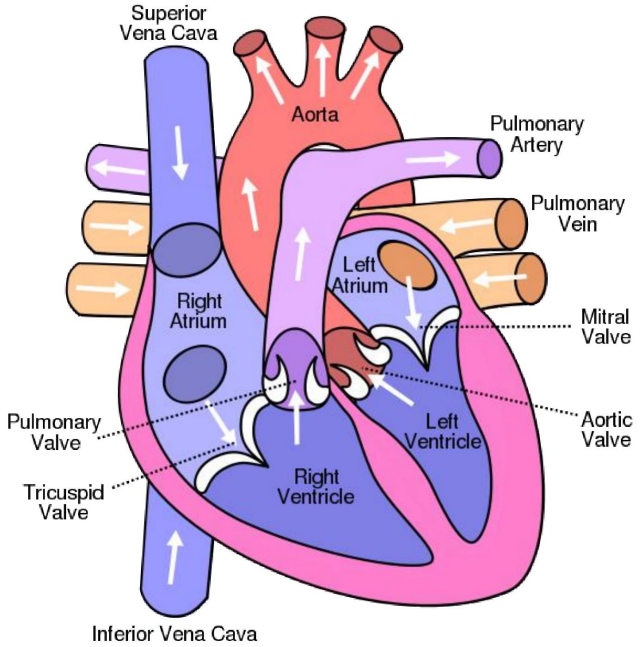
1

Heart Valve Replacement

The Heart

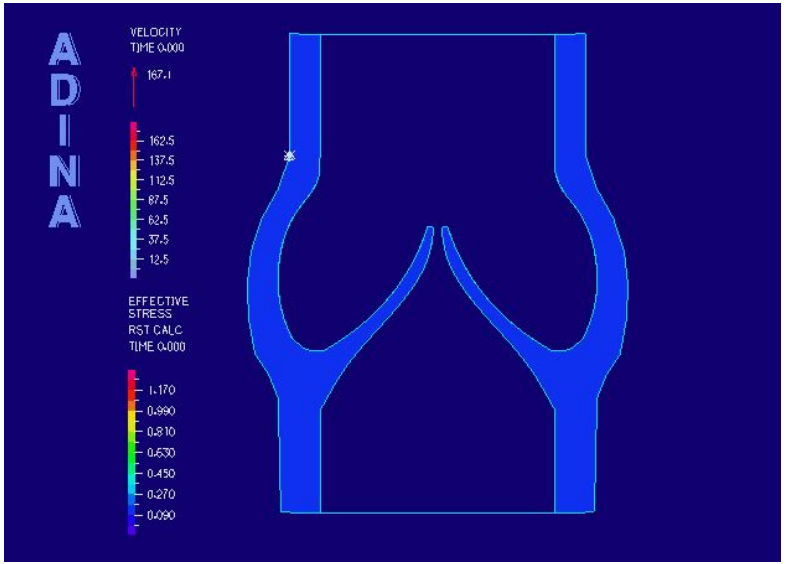
The heart contains 4 major valves:

- Aortic Valve
- Pulmonary Valve
- Mitral Valve
- Tricuspid Valve



Valves

- Our valves only allow blood flow in one direction
- When this is compromised, it can cause Valve Prolapse, which causes the heart to work too hard and results in fatigue and difficulty breathing



Artificial Valves

Pure artificial valves : They are made of wire and metal. These type of valves will often cause blood clots and as a result require patients to take blood thinners.

Animal tissue valves : These are made from real animal tissue and don't have the clotting problems that artificial valves have. On the other hand, they are short term and will degrade after about 10 years, and need to be replaced.

Ross Procedure : Allows using material from a healthy valve to replace the broken valve.

The Activity

Now we are going to try to build "valves". Our "heart" is going to be a cardboard box, and the "blood cells" are marbles.

You will have 15 minutes to build you valves.

2

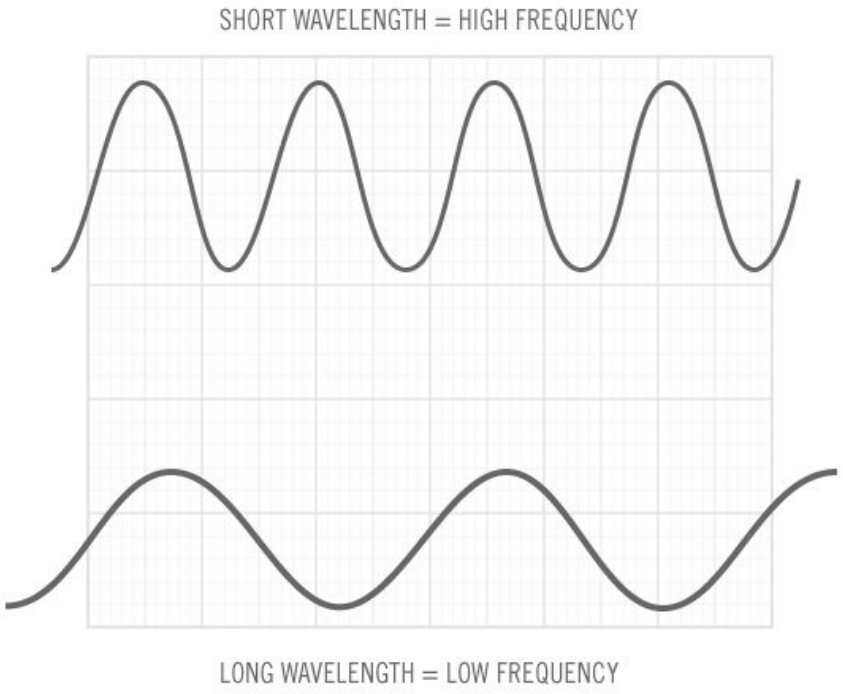
EMG with Arduino

Electromyography (EMG)

- **EMG**, or Electromyography which is used to monitor the electrical activity in your muscles using electrodes
- **Surface EMG** : This detects signals from the surface via electrodes that are stuck to your skin. We will be using this type of EMG
- **Intramuscular EMG** : This detects signals using needle(s) inserted into the muscle.

Filtering

- The signals that EMGs work with are incredibly small, and as a result they are susceptible to a great deal of noise
- **High Pass Filters** : Filters out low frequencies, and keeps high frequencies
- **Low Pass Filters** : Filters out high frequencies, and keeps low frequencies



3

Bioinformatics with Python

DNA

- All of our DNA and all living organisms' DNA comprises of long strings of combinations of 4 basic simple molecules that are referred to as nucleotides.
- 4 Nucleotides
  - Adenine
  - Guanine
  - Thymine
  - Cytosine