LABORATORY 11 – CARDIOVASCULAR MEASUREMENTS

Purpose:

The purpose of Cardiovascular measurements are to be able to collect data among individuals by using devices such as the EKG, anaeroid, mercurial and an electronic sphygmomanometer. The said devices are just a few of many that can help determine ones physical fitness. The experiments completed below were able to help us as a class to collect data on our health and fitness though watching the action potential on the EKG/ECG screen.

Procedure:

11-A: Determination of blood pressure

1. Wrap the pressure cuff of the sphygmomanometer snugly around the upper left arm of your lab partner. Your lab partner should assume a relaxed, sitting or supine position.

2. Place the stethoscope securely over the brachial artery. Close the pressure valve and begin pumping up the rubber ball.

3. You will begin to hear the arterial pulse as you pass the diastolic pressure. Continue pumping until the pulse is not heard, approximately 10 mmHg above your partner's normal systolic pressure. The brachial artery is now totally occluded.

4. Slowly open the pressure valve and listen for the pulse sounds to reappear as the pressure drops. These are known as Korotkoff sounds.

5. The first sound heard signals the systolic BP. Record this value from the scale.

6. The sound will become louder as the pressure drops until it finally starts to become muffled. Record the pressure at which the sound vanishes. This signals the diastolic BP. Record your blood pressure as systole/diastole

7. Alternate with your lab partner and repeat these procedures.

8. Next, measure the BP of each of you immediately upon standing. (NOTE: be sure to have your cuff inflated prior to standing, so that you can begin to release pressure immediately upon standing.)

9. Lastly, measure the BP three minutes after standing. Record these values for your use and on the chalkboard.

10. Discuss the orthostatic response in terms of the receptors used and the effects of postural change. Include any limitations to obtaining reliable results. Calculate the mean and standard error of mean (SEM) for these values

11-B: Demonstration of a measure of physical fitness

1. Select three students who exercise regularly and three students who do not. Each student will take his/her resting pulse rate for one minute and record this value.

2. Each student will then run the track twice at a fast but comfortable pace.

3. Immediately upon returning to the laboratory, each student will record his/her pulse after exercise.

4. Each student will take his/her pulse at one minute intervals until the resting pulse is reestablished. (NOTE: The best method to employ is to take the pulse rate for 15 seconds and multiply by 4.)

5. These results will be recorded on the chalkboard for discussion. Is there a difference between the exercisers and the non-exercisers? Which student(s) do you consider to be in better physical condition? Why?

6. Determine the target heart rate range for each student (if the ages are available) and for yourself. The target heart rate range determines the heart rate that should be maintained for 20-30 minutes, at least 3 times per week for cardiovascular fitness. To determine your target heart rate range do the following calculations for the Karvonen formula (only use numbers rounded off to whole numbers):

a. 220 – your age = maximum heart rate (max HR)

b. Max HR – resting HR = HR reserve
(to find your resting heart rate, take your pulse before getting out of bed each morning for three days and then take the average)

c. target heart rate range =
(HR reserve x 60%) + resting HR = low target heart rate
(HR reserve x 80%) + resting HR = high target heart rate

Example: 20 year old with a resting heart rate of 65 beats per minute

220 – 20 = 200 (max HR)
200 – 65 = 135 (HR reserve)
(135 x 60%) + 65 = 81 + 65 =146
(135 x 80%) + 65 = 108 + 65 = 173

This student's target heart rate range would be 146 – 173 beats per minute.

7. Include your calculations for your target heart rate in the results section of your report.

8. Evaluate the class results in terms of target heart rate and level of fitness for each individual.

11-C: Demonstration of the diving response

Using the IWX/214 unit, a laptop and the EEG cables to conduct test.
Apply the black (-1) electrode to the scrubbed area on the right wrist. Repeat Steps 5 and 6 for the inside of the left ankle and the inside of the right ankle, so that the following Lead II is arranged:

- the black (-1) lead is attached to the right wrist,
- the red (+1) lead is connected to the left ankle,
- the green (C or ground) lead is connected to the right ankle.

1. Take resting heart rate

2. Fill a large tub with ice cold water.

3. Select one student volunteer and hook him/her up to the computer.

4. Recordings will then be taken with the student holding his/her breath for at least 20 seconds, hopefully for 30 seconds.

5. The experiment will be repeated with the student holding his/her breath and placing his/her head into a bucket of ice cold water.

6. Include copies of the results in your lab report.

7. Evaluate the two sets of data in terms of the bradycardia and vasoconstriction. What are the adaptive advantages of these reflexes?

Results:

11-A: Determination of blood pressure

Relaxed Sitting Position	5 Minute Later Test (Sitting)
122/80	120/70

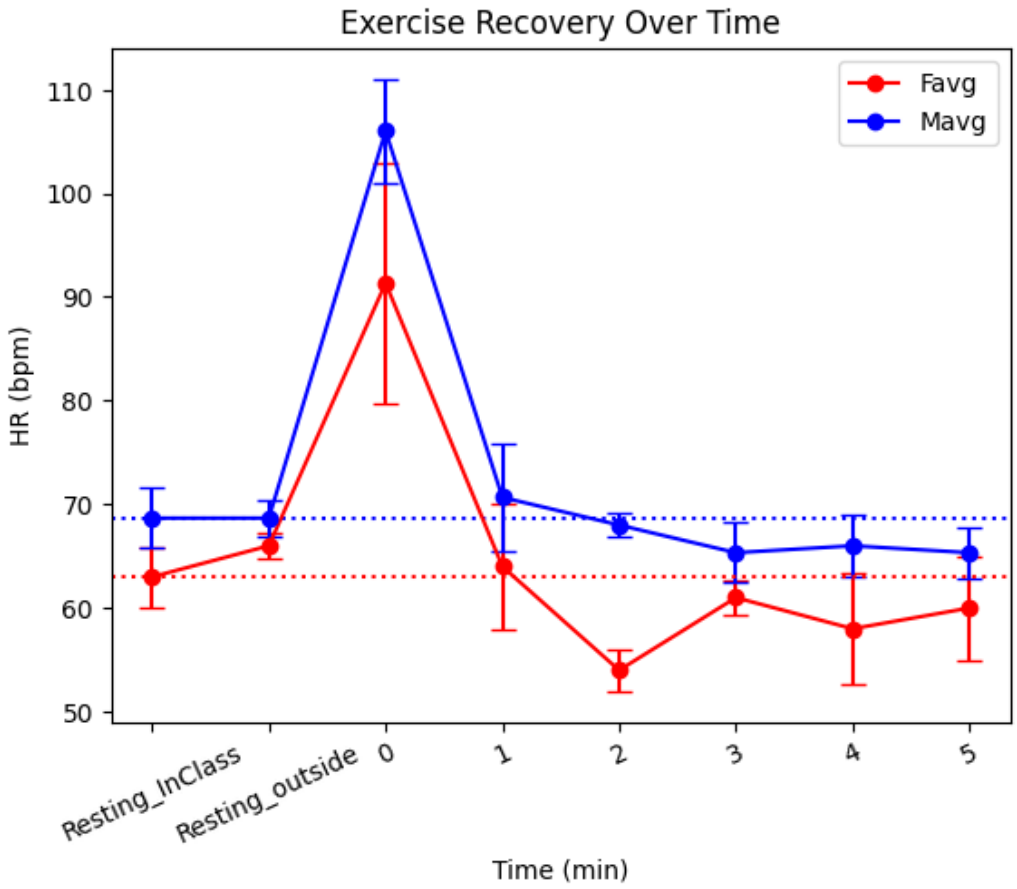
Relaxed Standing Position	5 Minute Later Test (Standing)
121/81	98/79

Ultimately, both standing and sitting after the initial test; resulted in lower blood pressure.

11-B Demonstration of a measure of Physical Fitness

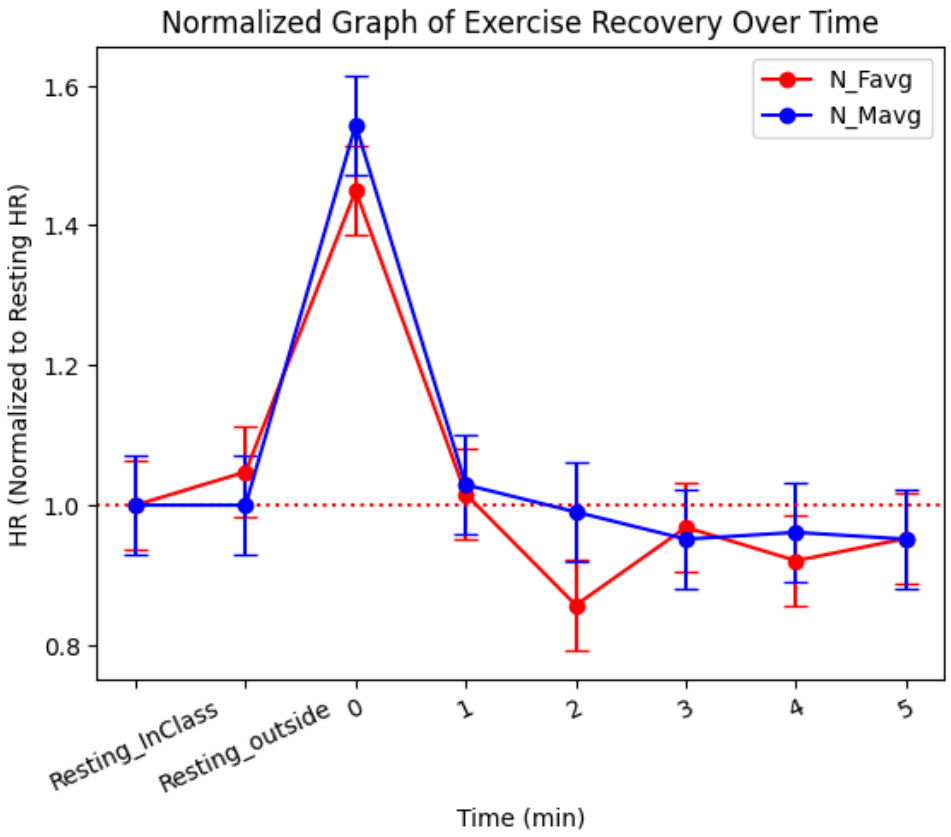
Set average resting HR

- **Text(0.5, 1.0, 'Exercise Recovery Over Time')**



Plot the normalized data

- **Text(0.5, 1.0, 'Normalized Graph of Exercise Recovery Over Time')**



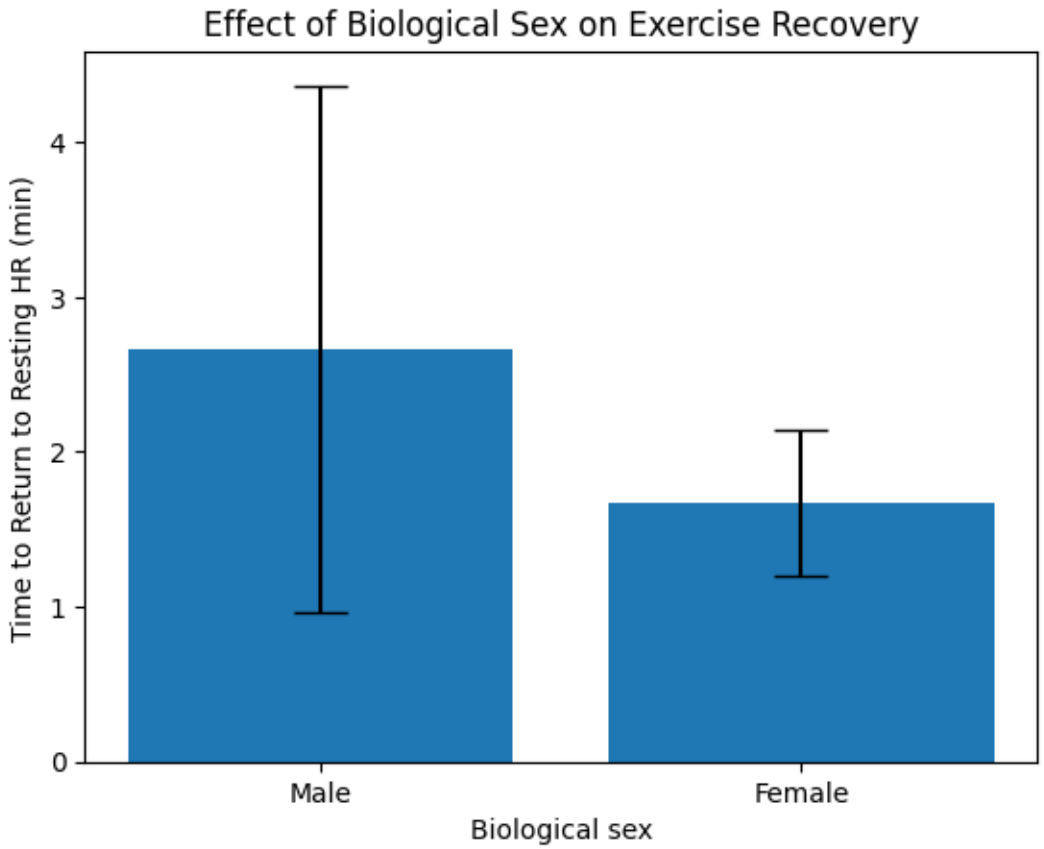
Resting Heartrate for each individual tested

- `F1_resting = 58`
- `F2_resting = 68`
- `F3_resting = 63`
- `M1_resting = 64`
- `M2_resting = 74`
- `M3_resting = 68`

The values for each individual's time to return to resting after exercise (male and female)

- Time to reach ~resting HR (set to: 64) for the male 1 was: 5 minutes
- Time to reach ~resting HR (set to: 74) for the male 2 was: 2 minutes
- Time to reach ~resting HR (set to: 68) for the male 3 was: 1 minutes
- Time to reach ~resting HR (set to: 58) for the female 1 was: 2 minutes
- Time to reach ~resting HR (set to: 68) for the female 2 was: 1 minutes
- Time to reach ~resting HR (set to: 63) for the female 3 was: 2 minutes

Calculate the mean and standard error of mean (SEM) for these values and Plotting the graph

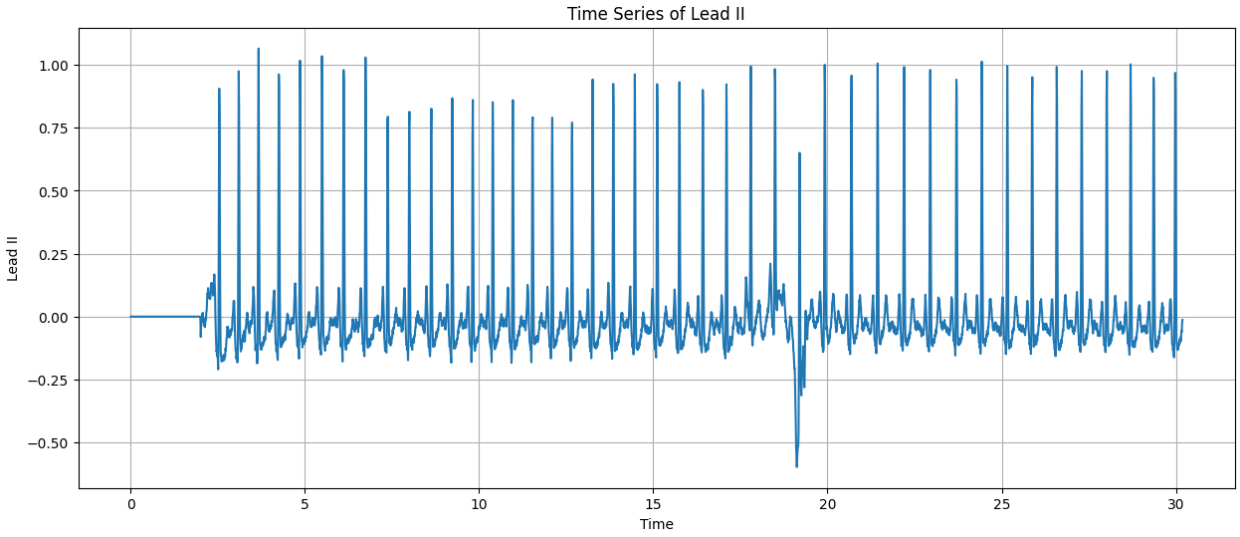


Test to determine significance ***(Note: pvalue of less than 0.05 is considered significant)***

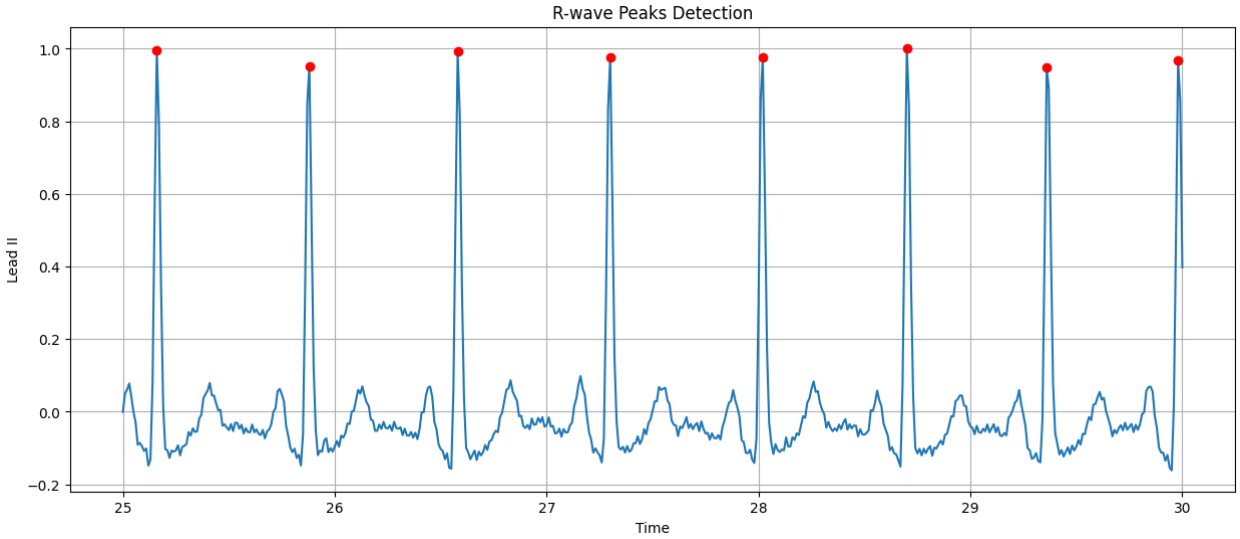
- Statistic = 0.8017837257372731
- Pvalue = 0.46760475460939743, df=4.0

<u>11-C: Demonstration of the diving response</u>

<u>Visualize control data (holding breath without submmersion)</u> **<u>Subject #1</u>**



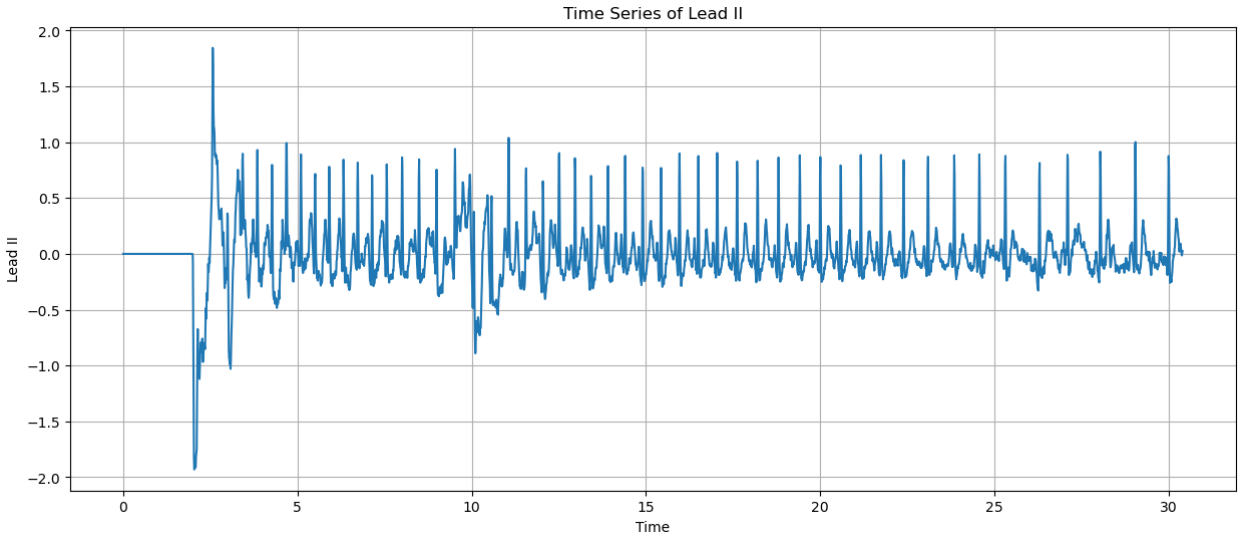
Detect R waves in the window between 25 and 30 seconds



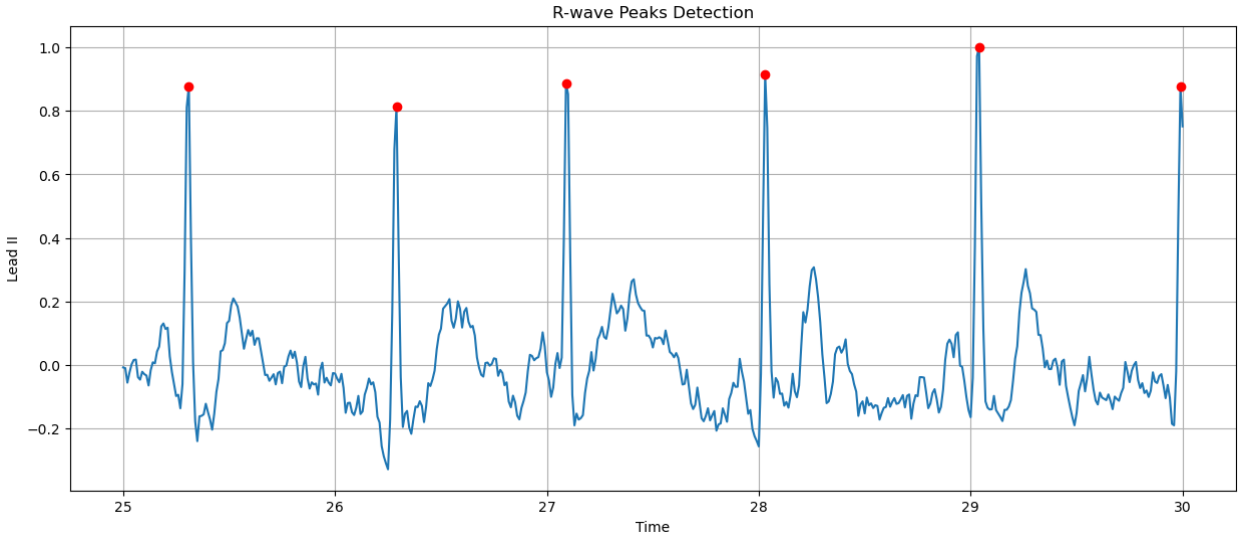
Calculate the HR at the window between 25 and 30 seconds

Average RR interval in the window: 0.69 seconds
Heart rate in the window: 87.14 BPM

Visualize the data from face submerged in icy water



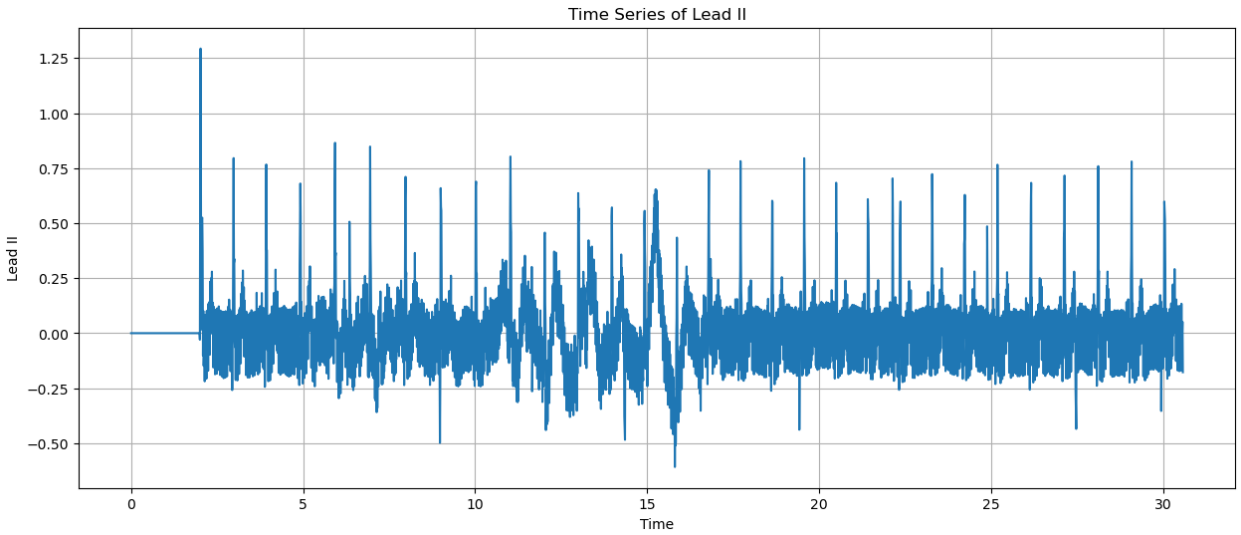
Detect R waves in the window between 25 and 30 seconds



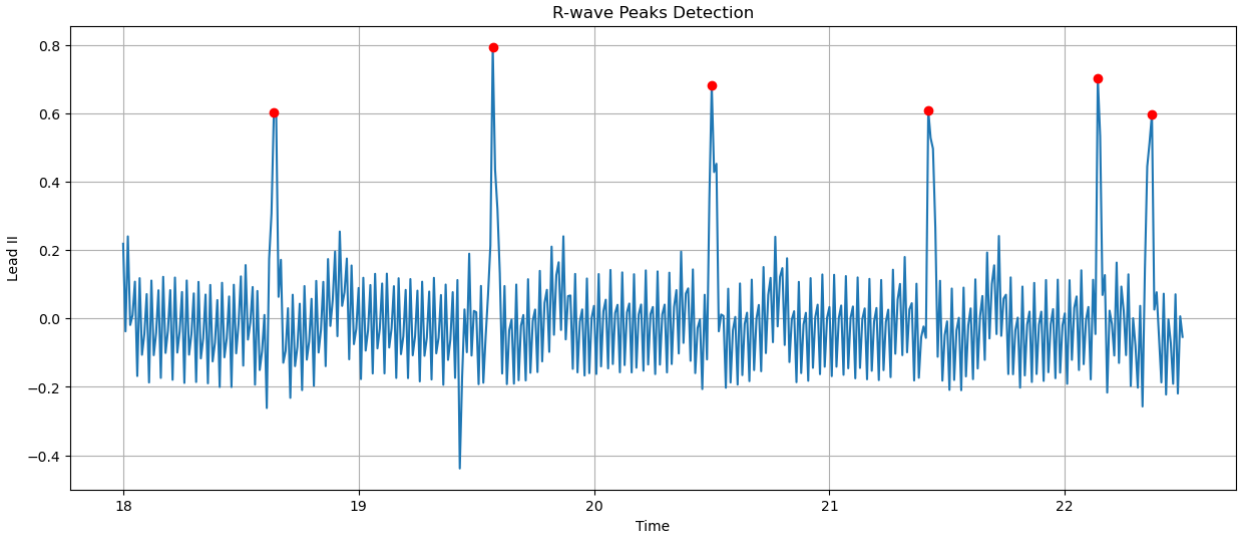
Calculate the HR at the window between 25 and 30 seconds

Average RR interval in the window: 0.94 seconds
Heart rate in the window: 64.10 BPM

Visualize control data (holding breath without submmersion) **Subject #2**



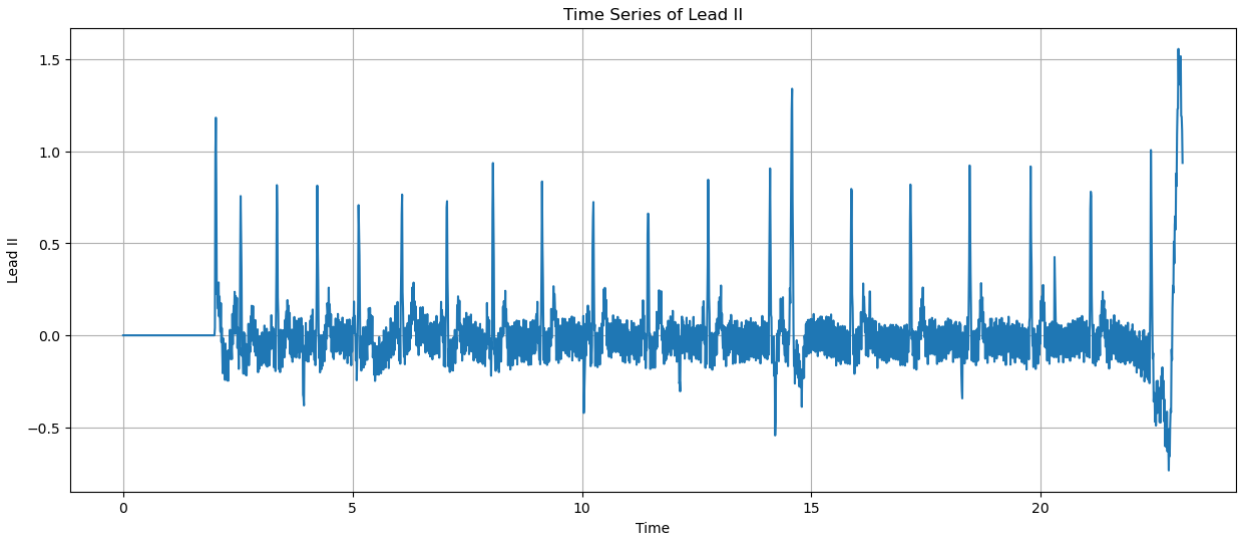
Detect R waves in the window between 18 and 22.5 seconds



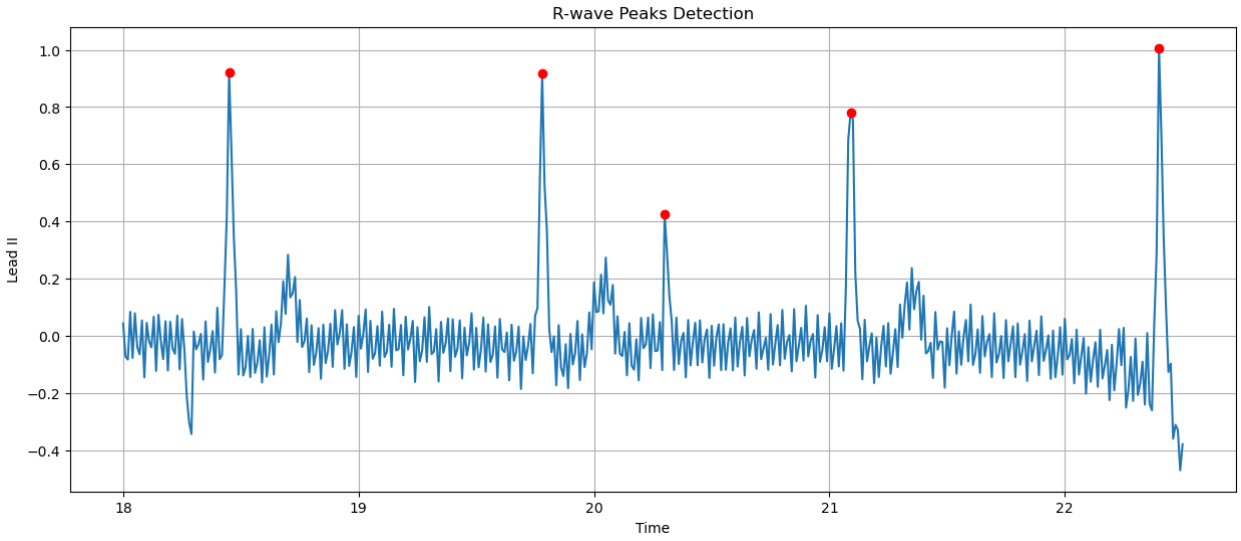
Calculate the HR at the window between 18 and 22.5 seconds

Average RR interval in the window: 0.75 seconds
Heart rate in the window: 80.43 BPM

Visualize the data from face submerged in icy water



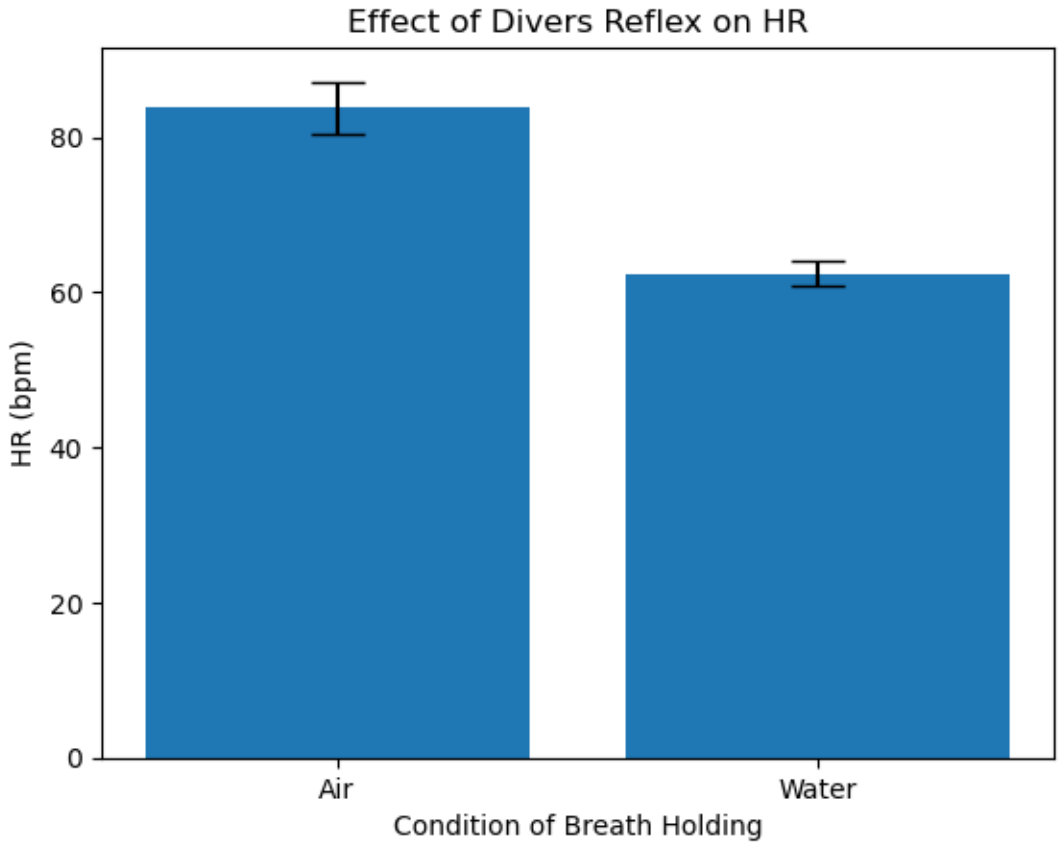
Detect R waves in the window between 18 and 22.5 seconds



Calculate the HR at the window between 18 and 22.5 seconds

Average RR interval in the window: 0.99 seconds
Heart rate in the window: 60.76 BPM

Combine the data together.



Perform a test to determine significance (note: pvalue of less than 0.05 is considered significant)

Ttest_indResult(statistic=5.697742121089294
pvalue=0.02944918860107101)

Discussion:

The blood pressure experiment was simplistic, but I had not used a pressure cuff and the stethoscope for about nine years, but once I started the activity, it came back to remember what to listen for. As for measuring physical fitness, several classmates volunteered to take their pulse at one-minute intervals and then analyze the data.

Conclusion:

I would do all of these experiments again! I may do the diver experiment again for my independent project; I wonder if different times of the day 'dive' would affect the data.