Purpose / Objective(s):
- Measure and correlate physiological life metrics including respiratory and heart rate under various conditions.

Hypothesis (ese):
- (1) An irregular heart rate, also known as an arrhythmia, impacts respiratory rates; specifically recovery rates.
- 2 students in my group of 4 (myself and one male) both have irregular heart rates. During this Lab I observed that we both had varied recovery rates vs. the other students.
- (2) A lower resting heart rate is a sign of better heart health, whereas a higher resting heart rate could indicate future potential heart health problem(s).

Materials / Subjects / Specimens:
- 4 Biology 105 students ranging in age from 30 to 48 were measured.
- 2 females and 2 males
- An arm blood pressure monitor was used to measure blood pressure.
- A stethoscope, an acoustic medical device for listening to sounds in a human, was used to measure blood pressure.

Methods / Tools / Instrumentation / Procedures:
- Standard class clock was used to measure heart and respiratory rate.
- An arm blood pressure monitor and stethoscope was used to measure blood pressure.
- A Standard table was used for students to lie in the supine position.
- Students used varied means to achieve and elevated heart rate including indoor jogging/walking, burpies, jumping jacks and pushups.
- Heart Rate, Blood Pressure and Respiratory Rate were measured in varied conditions:
  - Resting/Sitting
  - Standing
  - Supine
  - Elevated (after 5 minutes of physical exertion), then in 3 following increments (3, 6 and 10 minutes)
- Each student shared their age, BMI (from a previous lab) and their lifestyle as non active, semi active or active.
- See attached file: Bio_105_Cardi_Rate_Recovery_Lab_Assignment_4_KathyWhaley_100310.1doc

Results
- After careful review of all the data collected in lab there does appear to be a correlation between irregular heart rates and respiratory rates.
- The regular heart rate students showed a consistent pattern of recovery. (See Table 1)
- When isolating the 2 irregular heart rate students the findings show a varied/non consistent pattern of recovery. (See Table 2)
Common Lifestyle attributes of both irregular heart rate students include: Higher BMI, Ages between 35-40 and some activity.

Arrhythmias are disorders of the regular rhythmic beating of the heart. They’re common — about 2.2 million Americans are living with atrial fibrillation (one type of rhythm problem). Arrhythmias can occur in a healthy heart and be of minimal consequence. [10845]

Regarding Hypotheses (2) we observed that the female resting heart rates were lower than the male resting heart rates. (See Table 3)

There does seem to be a correlation between resting heart rates and heart health.

Women with the highest resting heart rate (more than 76 beats per minute) were significantly more likely to suffer a coronary event than women with the lowest resting heart rate (62 beats per minute or less). [2009/02/090203192429.htm]

Table #1 Group Respiratory Rates (Irregular & Regular)

<table>
<thead>
<tr>
<th>Respiratory Rate</th>
<th>Sitting</th>
<th>Standing</th>
<th>Supine</th>
<th>Peak</th>
<th>3 min recov</th>
<th>6 min recov</th>
<th>10 min recov</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irregular 1</td>
<td>40</td>
<td>35</td>
<td>30</td>
<td>25</td>
<td>20</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>Irregular 2</td>
<td>30</td>
<td>25</td>
<td>20</td>
<td>15</td>
<td>10</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Regular 1</td>
<td>10</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Regular 2</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Both Regular Students show a similar trend

Table #2 Group Respiratory Rates (Irregular)

<table>
<thead>
<tr>
<th>Respiratory Rate</th>
<th>Sitting</th>
<th>Standing</th>
<th>Supine</th>
<th>Peak</th>
<th>3 min recov</th>
<th>6 min recov</th>
<th>10 min recov</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irregular 1</td>
<td>40</td>
<td>35</td>
<td>30</td>
<td>25</td>
<td>20</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>Irregular 2</td>
<td>30</td>
<td>25</td>
<td>20</td>
<td>15</td>
<td>10</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Regular 1</td>
<td>10</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Regular 2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Table #3 Group Resting Heart Rates

**Analysis / Discussion:**
- The results that we observed as well as supporting documents do support my hypothesis. Although the research I conducted on the web did not provide a lot of research studies to support the direct correlation between irregular heart beats and varied respiratory rates.
- Results as well as supporting documents demonstrate that there are a lot of variables that affect heart health and that understanding the indicators or symptoms associated with heart health are important.
- **Symptoms of irregular heart rhythms (Cleveland Clinic see attached)** - An arrhythmia may be "silent" and not cause any symptoms. A doctor can detect an irregular heartbeat during an examination by taking your pulse, listening to your heart or by performing diagnostic tests. If symptoms occur, they may include:
  - Palpitations -- a feeling of skipped heart beats, fluttering, "flip-flops" or feeling that the heart is "running away"
  - Pounding in the chest
  - Dizziness or feeling light-headed
  - Shortness of breath
  - Chest discomfort
  - Weakness or fatigue (feeling very tired)

**Conclusions / Further Considerations:**
- Irregular heart rate, arrhythmia, are quite common in healthy individuals.
- I actually discovered that I had an irregular heart rate as a result of this exercise, as did the male student in my group.
- It would be interesting to take a pole of our student class to see what percentage as an irregular heart rate and compare that to the average population.
- While this group was much too small to understand the impact of age, BMI and irregular heart rates. I think that there may be a correlation as well.
- Since resting heart rate seems to be a good indicator of future heart health disease and is easy to monitor, the American Heart Association might consider launching a dynamic media campaign to educate the general public at an early age.
http://www.americanheart.org/presenter.jhtml?identifier=10845

**Arrhythmias are disorders of the regular rhythmic beating of the heart.** They're common — about 2.2 million Americans are living with atrial fibrillation (one type of rhythm problem). Arrhythmias can occur in a healthy heart and be of minimal consequence. They also may indicate a serious problem and lead to heart disease, stroke or sudden cardiac death. The goal of this site is to help the public and healthcare professionals learn more about arrhythmias, and ultimately reduce disability and death from heart disease and stroke. Do your part by learning the facts and taking the steps needed to understand and control arrhythmias.

http://www.sciencedaily.com/releases/2009/02/090203192429.htm

**Resting Heart Rate Can Predict Heart Attacks In Women**

*ScienceDaily (Feb. 5, 2009)* — A simple measurement of resting pulse predicts coronary events in women independently of physical activity and common risk factors, such as smoking and alcohol consumption, finds a study published on the British Medical Journal website. Previous studies have shown that resting heart rate predicts coronary events in men. But, for women, the relationship between heart rate and coronary events or stroke remains uncertain.

So researchers in the USA assessed resting heart rate in 129,135 postmenopausal women with no history of heart problems. Risk factors that might be expected to affect heart rate, such as high blood pressure, high cholesterol levels, smoking and alcohol intake were taken into account at the start of the study. The women were monitored for an average of 7.8 years, during which time all hospital stays and coronary events were recorded.

During the study period, 2,281 coronary events (heart attacks and coronary deaths) and 1,877 strokes occurred.

**Women with the highest resting heart rate (more than 76 beats per minute) were significantly more likely to suffer a coronary event than women with the lowest resting heart rate (62 beats per minute or less).** Further analysis showed that this association was independent of physical activity, did not differ between white and minority women, or those with or without diabetes, but was stronger in women 50-64 years of age than among women 65 years or older.

There was no such relationship between resting heart rate and stroke.

Resting heart rate is a simple, inexpensive measurement that independently predicts heart attacks and coronary deaths, but not stroke, in postmenopausal women, say the authors. Although the strength of this association is less than cigarette smoking or diabetes, it may be large enough to be clinically meaningful, they conclude.