

**In-Class Lab (weeks 1-2):  
Heart Rate Determinants**

BI-102  
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(Modified by Dr. C. S. Tritt)  
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**The Assignment**

Your company wants to design a pacemaker that mimics the normal heart rate at all times. In the early stages of product design, you are asked to explore two questions: (1) Does resting heart rate depend on the individual?, and (2) Do daily activities affect resting heart rate?

You would like to address these questions by performing a scientific study. For the first question, determine one personal attribute that you think might affect resting heart rate. For the second, decide on some daily activity that you think might alter resting heart rate. You are asked to develop hypotheses regarding the effects of your variables on resting heart rate, design experiments to test your hypotheses, conduct the experiments, and analyze and present your results.

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**Step 1: Develop Hypotheses**

- Hypothesis 1 (attribute):
  
- Hypothesis 2 (activity):

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### The hypotheses need to be justified

- Your assignment for next lab:
  - Search for references linking these variable to heart rate
  - References can include websites
  - For next week, bring back a 1-2 sentence summary and the article or website
  - Try to find at least one reference for each hypothesis, but bring at least one reference total

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### Step 2: Experimental Design

- Variable Definitions for Hypothesis 1:
  - Dependent variable:
  
  - Independent variable:
  
  - Control variables:
  
  - Confounding variables:

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### Step 2: Experimental Design

- Variable Definitions for Hypothesis 2:
  - Dependent variable:
  
  - Independent variable:
  
  - Control variables:
  
  - Confounding variables:

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### Step 2: Experimental Design

- Plan for the *categorical variable* hypothesis
  - Treatment levels to be tested:
  
  - Number of measurements at each level (replicates):

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### Step 2: Experimental Design

- Plan for the *continuous variable* hypothesis
  - Anticipated range:
  
  - Total number of measurements to be made:

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### Hypothesis 1 Procedure

- Equipment:
  
- Steps:

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### Hypothesis 2 Procedure

- Equipment:
- Steps:

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### Data Collection

- Collect data in class
- Everyone writes down the data collected in class

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### Data Analysis

- Transcribe the data into Excel
- Perform statistical analysis
- Construct charts

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### Data Analysis Summary

- Hypothesis 1
  - Type of test used:
  - P-value:
  - Statement of conclusion:
  
- Hypothesis 2
  - Type of test used:
  - P-value:
  - Statement of conclusion:

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### Write the Report

- Save title and abstract for the end.
- The following slides contain information from the Grading Rubric previously used for this lab.
- Grade weights are approximate.

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### Introduction (8%)

- The importance of heart rate is discussed.
- The introduction provides some kind of rationale for each hypothesis.
- The introduction refers to material from at least one reference.
- The hypotheses are clearly stated at the end of the introduction.

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### Materials and Methods (5%)

- The report describes how the experiment was organized (the categories or levels for the independent variable, how many subjects, etc.).
- The report describes the selection criteria for the subjects (who they were).
- The report describes any variables that were controlled.
- The report describes how heart rates were measured (who did them, how it was timed, etc.).

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### Results (30%)

- The results section guides the reader through the results. For each result, text is followed by appropriate figures and/or tables.
- Figures and tables are embedded (ex. Cut and Pasted) into the document.
- Figures and tables have appropriate captions.
- Tables are created containing the raw data collected.
- The statistical tests are described (t-tests, linear regressions).
- Statistical results are provided using appropriate terms (p-values).
- Graphs present the data visually (bar graphs and/or regression graphs).
- Conclusions are stated such that they are consistent with the statistics.

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### Discussion (15%)

- The results are related to the hypotheses.
- The results are related to what was expected, based on the literature search or rationale for conducting the experiments (given in the intro).
- Sources of error in making measurements are discussed.
- Several confounding variables are discussed, as well as their potential impact on the experimental findings.

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### Conclusions (5%)

- Results are concisely and accurately summarized.
- For results that were found to be statistically significant, the limitations of the conclusions are discussed (does it apply to all humans, etc).
- Potential future work is discussed that might provide more insight into the question driving the hypothesis.

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### Abstract (10%)

- The abstract summarizes everything important regarding the experiment.
- The abstract is the appropriate length (one paragraph, approximately 10 sentences).
- The abstract clearly states the hypotheses and conclusions.

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### Other Grading Criteria

- References (4%)
  - Information is listed thoroughly for each reference.
  - These references are appropriately referred to in the body of the text where they are discussed.
- General Science (10%):
  - The experiments were designed well to specifically test the stated hypotheses.
  - One or more variable was controlled.
  - The statistical analysis was appropriate for each experiment.
- Writing (13%)
  - The report is written in a professional scientific tone, avoiding personal pronouns and writing in the past tense in the passive voice.
  - Grammar is good and typos are minimal.

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