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Assignment 1 – Experimental Design & Methods BES 108 W22

For this assignment, you will design an experiment based on a topic to be assigned by the lab instructor, and an objective of your choosing that falls under that topic. To do so, you will complete the following: [Total: 20 marks]

Topic Assigned: \_\_\_\_\_

**Question 1. Decide on what the objective/question for your experiment will be.**

**Objectives/questions can be written in many ways, but will typically be in the form of: “..how \_\_\_\_\_ impacts/influences/effects \_\_\_\_\_.”**

**Objective/ Question:** How does exposure to magnetic fields affect plant growth and development?

**Question 2. Develop a hypothesis for your experiment that directly addresses your objective/question; the hypothesis should be at the same level of detail as the objective.**

**Hypothesis:** Exposure to magnetism increases plant growth rate.

**Question 3. Justify/explain your hypothesis using existing knowledge from a primary, peer reviewed source using one point/sentence (paraphrased) from the source you choose. Include a proper in-text citation and full reference (CSE format).**

- According to Maffei (2014), plants that grow near the earth's north and south poles, where the earth's magnetic fields are strongest, show differences in growth and development compared to those that grow near the equator (Maffei, 2014).
- Exposure to magnetic fields increases/ fastens plant germination.
- Plants that are exposed to magnetism show improved health in their development and tend to grow faster, taller and bigger compared to those that are not exposed to magnetism.

## Reference

Maffei M. E. (2014). Magnetic field effects on plant growth, development, and evolution. *Frontiers in plant science*, 5, 445.

<https://doi.org/10.3389/fpls.2014.00445>.

Question 4: ***Based on your hypothesis and the design of your experiment, what is/are your prediction(s), or expected outcome(s)? Predictions are based on your hypothesis and specific to your experiment. (Do Q2 & Q5 before answering this). You can indicate your predictions in written form or visually (using a graph)***

- The first expected outcome is that plants grown within a magnetic field will show higher root and stem growth rates.
- Plants grown without exposure to magnetism will show a slower root and stem height growth rate.

***Question 5: Design an experiment to test your hypothesis. Indicating the following components:***

***a. Independent/Manipulated Variable: including what specific experimental groups or treatments will be established, and their conditions. [1 mark]***

The independent variable for this experiment is the magnetic field.

***b. Control Group(s): identify what 'treatment' group(s) will experience no manipulation as a reference point (if applicable, some experiments lack these). [1 mark]***

The control group for this experiment is plants left out to grow without magnetism.

***c. Dependent/ Responding Variable: including what specific parameter will be measured and how (using what tool). [1 mark]***

The dependent variable for this experiment is the plant's growth rate, and the specific parameters to be measured during the experiment are plant height and root length in a four-week period.

***d. Experimental Controls: the variables/conditions that will be kept constant across all groups. [1 mark]***

For the experimental control, the selected plant species will be divided into two and grown under the same conditions of sunlight, water, and warmth. However, half of the plants will be

exposed to a magnetic field, while the other half will be left out to grow without magnetic exposure.

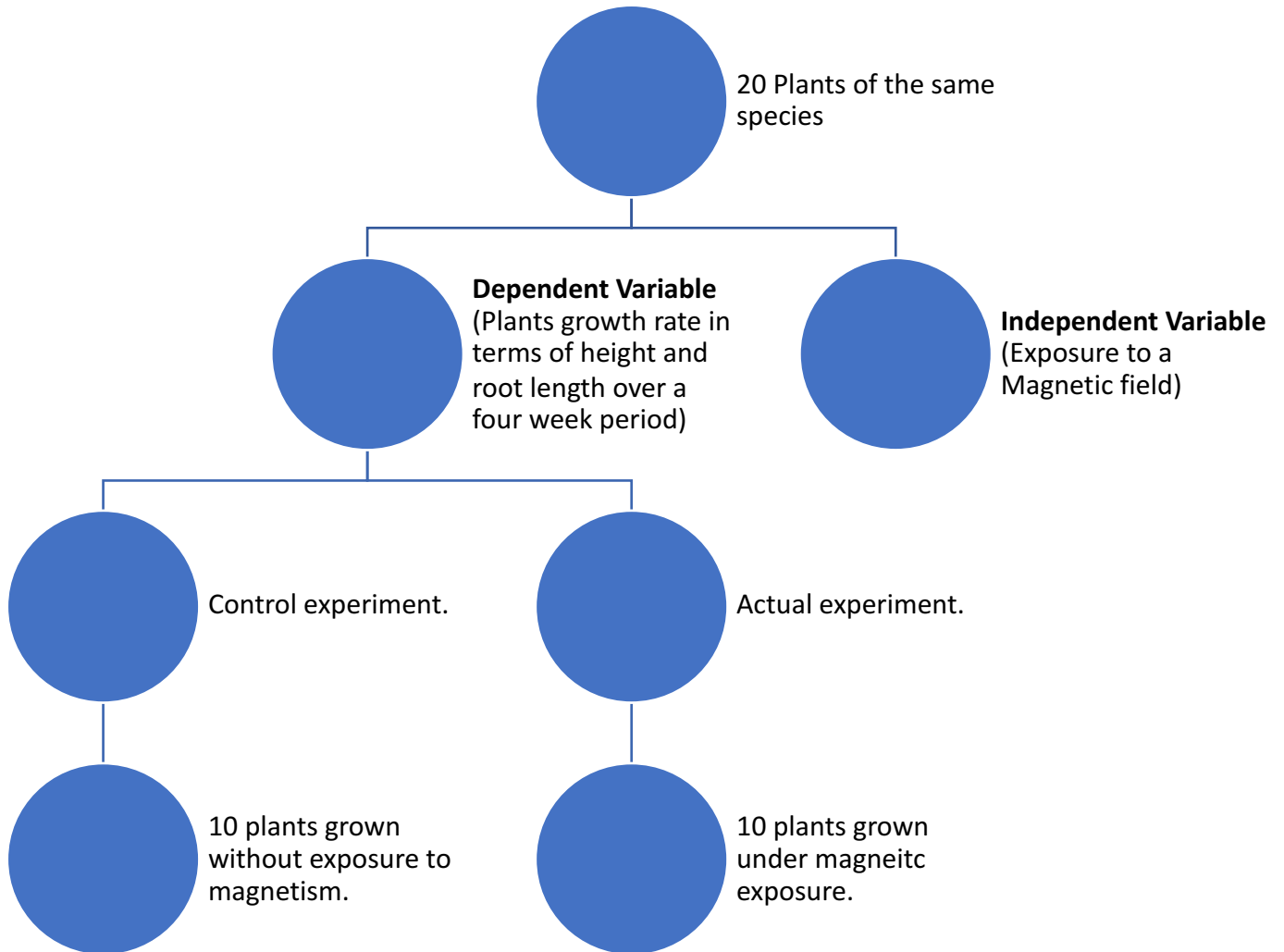
***e. Sample Size; an appropriate number of replicates/trials will you have in your experiment for each group. [0.5 mark]***

The sample size for this experiment will be a total of 20 plants of the same species, where 10 plants will be grown in an area exposed to a magnetic field while the other 10 will be left unexposed to magnetism.

***f. Data Analysis; how will the data collected be summarized and reported (ex. mean/average, total, percentage, etc.)?***

Data analysis will take the form of the average growth rate in terms of plant height and root length under four weeks.

Question 6. Create an illustrated flowchart, to show how your experiment would be carried out. All the components listed above should be shown in the flowchart using either a diagram or as brief but sufficiently descriptive points. This should take up approximate 8.5'x11' page and can be completed in the space below



**7. Write up the experimental procedure as if it were to be included in a methods section of a report. All the components from Question 5 should be mentioned (do not simply list the same points off). Information should be presented in well-structured sentences that form short paragraphs. Paragraphs can be organized using the following sub-headings. [5 marks]**

(1) Experimental Setup

- The materials needed are soil bags, soil, ruler, water, seeds, 10 magnets of 0.50 Tesla.
- Twenty seeds will be planted in soil bags, watered daily, and receive 8 hours of sunlight across the 4 weeks.
- Ten of the twenty seeds will be grown near magnets, while the remaining seeds will be grown far from the magnets.

(2) Data Collection

- After four weeks, each plant category's height and root length will be recorded.

(3) Data Analysis

- Each plant category's average root length and plant height will be calculated and later divided by four weeks to get the average root and stem growth rate per week.
- The data from each category will be compared to evaluate which plants recorded a higher growth rate.



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