

Hypotheses and Experiments Worksheet
BIOL 01104 Spring 2020, Dr. Spielman

I. Hypotheses: For each hypothesis below, determine...

- Is it directional or nondirectional?
 - If *directional*:
 - What would the nondirectional version be?
 - What is the hypothesis for the other direction?
 - If *nondirectional*:
 - What is one directional version of the hypothesis?
- What is its corresponding null hypothesis?

1. The presence of calcium increases the activity of neurons.

2. Lower temperatures cause goosebumps on skin.

3. Iron availability determines the size of algal blooms.

4. More complex organisms have larger-than-average genomes.

5. Exposure to sunlight affects the length a plant will grow.

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II. Experiments: On the following pages are two experimental scenarios. Each scenario contains an alternative hypothesis and a description of the experiment performed. For each scenario, determine the following:

- The null hypothesis.
- The independent and dependent ("response") variables.
- Any confounding factors you can think of.
- Experimental validity based on: a) Presence of a control group(s); b) Presence of replication, c) Presence of randomization.
- Suggest at least one way the experiment could be improved, *considering one of the principles of experimental design*.

1. Hypothesis: Thyroxin (a thyroid hormone) release triggers amphibian metamorphosis.

Researchers collect 100 tadpoles. They randomly place fifty tadpoles into a tank with just water, and they place the other fifty tadpoles into a tank with thyroxin. After four days, they count how many tadpoles have undergone metamorphosis in each tank.

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2. Hypothesis: Acetylcholine stimulates muscle contraction.

Researchers prepare fifty identical replicate cell cultures of muscle fibers. They randomly divide these cultures into five groups with 10 dishes each. Three of the groups are treated with an acetylcholine solution of a different concentration. The fourth group receives a treatment of the solvent without acetylcholine, and the fifth group receives no treatment. They record whether the muscle fibers in each petri dish contract over a subsequent 10 minute period. They also record the amount of time that the muscle fibers in petri dish contract for.