

# LABORATORY

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## Student-Designed Experiment

# 1

### OBJECTIVE

- To design an experiment testing alterations in the activity of isolated chloroplasts
- To run the experiment and collect data
- To interpret the results of this experiment
- To assess the quality of the experimental design and propose revisions

### THEORY

Experimental design is a crucial part of scientific investigation. Data, or the conclusions one reaches from that data, are only as good as the design. Controls and variables must be carefully planned. Alternative explanations and results are predicted, considered, and discussed. The experiment must, by its design, answer the specific question being asked.

The Hill reaction was used previously to measure the capacity of spinach chloroplasts to gather the energy of light and transfer it to chemical energy. This same analysis will now be applied to study the effects of chemical or physical alterations on electron transport during photosynthesis. Chloroplasts will be isolated as before. All supplies and instrumentation used previously for the Hill reaction protocol will be available for this analysis. Any further or alternate materials or instrumentation necessary for this experiment must be specifically requested.

The experimental design must be **cleared with the instructor beforehand** to allow time for material preparation before the lab session. This will require research into the background of photosynthesis and chloroplast activity. Consider a hypothesis that some change either affects or does not affect chloroplast activity **for a specific reason** suggested by details of chloroplast function or scientific research.

### INTRODUCTION, MATERIALS, AND METHODS

These are to be designed by students in assigned pairs or groups, written up formally, and turned in 2 weeks prior to lab. They need to list specific materials and methods to allow preparation.

**Hints:**

1. Think about what a chloroplast does and how it accomplishes this. What might have a predictable effect on the chloroplast functioning? Is there any previous work suggesting an effect?
2. All tubes prepared during the experiment should have the same total volume (adjust with H<sub>2</sub>O as necessary) and be treated similarly, except for one variable in each tube. Include a blank tube with no added DCPIP.
3. Be sure to include all important controls. How are proper controls chosen?
4. Provide appropriate lighting and temperature during incubation, as chosen.

**RESULTS AND DISCUSSION**

1. Measure the absorbance of each tube at the chosen time intervals.
2. Present final data to clearly show the results and support the conclusion(s).
3. Discuss what was observed with relation to chloroplast function and the experimental conditions. How did the results support or disprove the hypothesis? What previous knowledge or research supported or led to this experiment?
4. How might this experiment be redesigned or repeated?

Note: While all procedure details and data are to be collected in your notes during lab, a formal, typewritten report is also required.