**Soapy Enzymes**

**Subject area/course**: Science, Biology

**Grade level/band**: 11­–12

**STUDENT PROMPT SECTION**

1. **Task context**:

According to the California Energy Commission (ca.gov), the average family in the United States does about 400 loads of laundry every year. Recent reports from Europe estimate that the consumption of laundry detergents ranges from about 2.2 to 3.6 pounds of laundry detergent per person per year. Using a value of 3 pounds per person per year and applying that information to the current population of the United States (317,392,323 people in January 2014), it can be estimated that about 950 million pounds of detergents are consumed in the United Stated every year. Laundry detergent sales clearly are a big business with lots of consumer dollars at stake.

Imagine that you have just landed your first position at a consumer protection laboratory. A number of commercial detergents add enzymes, claiming that these enzymes improve the cleaning power of their products. Is this a valid claim or just marketing hype to capture the consumer dollar? Your mission will be to explore the effectiveness of enzymes in detergents.

1. **The task**:

Your task is to determine if laundry detergents (such as Tide Original) that contain enzymes or detergents that do not contain enzymes are more effective at removing bloodstains from clothes. You will work with your partner (or lab group) to design a laboratory investigation to explore this question. You will then need to write a brief individual report summarizing your findings to your boss (details given below). Before you begin designing your experiment, your teacher will provide you with a list of materials that are available for your use.

Before you make a hypothesis about the effectiveness of enzymes in detergents, it will be helpful to become familiar with the chemicals in detergents and their functions. Spend some time researching how the chemicals in detergents work using appropriate Internet sites, your course text, or chemistry texts that you have access to. Take detailed notes on your research, and keep track of the sources you use. Use your research notes to develop a hypothesis about whether or not you think detergents that contain enzymes are more effective at removing bloodstains than detergents that do not contain enzymes. Design and conduct an experiment to test your hypothesis, and keep detailed notes of your procedure and data. When designing your experiment, be sure to decide:

* What is your independent variable? (What do you want to test the effect of?)
* What is your dependent variable? What will you be measuring? What units will you use?
* What variables do you need to control and how will you control them?
* How many trials will you run?
* How will measure, record, and organize the data?

After your experiment, you will individually write a 3- to 4-page lab report. Your report should include:

* Demonstrate an understanding of how proteins, specifically enzymes, function in biotic systems.
* An introductory paragraph with your research question, background information about the structure and function of relevant biomolecules, and hypothesis based on your background information.
* A detailed step-by-step procedure for your experiment. It must be detailed enough so that another scientist could replicate your experiment exactly.
* A results section that provides your data in graphs and/or charts.
* A conclusion paragraph in which you analyze your data and determine whether your hypothesis should be supported or rejected. Directly refer to your experimental evidence when making a claim about the effectiveness of enzymes. Use your knowledge of biomolecules to explain and rationalize the outcome of your experiment.
* A Works Cited section in which you list any references you cite in your report. Use the reference format suggested by your teacher.

1. **Materials/resources:**

* A calculator
* Your text
* A computer to search for the active ingredients of the laundry detergents you have on hand to test
* Lab materials for your experiment to test your hypothesis, provided by your teacher

1. **Time requirements:**

This task will take approximately 1 week. Your instructor may choose to make changes to the task or adjustments to the timeline.