**Self-Designed Pepsin Enzyme Lab – Biology I Honor**

In this lab, you will be investigating factors that affect how quickly pepsin (an enzyme) digests its substrate (protein, found in foods like tofu). Pepsin is an enzyme found in your stomach, which is very acidic. Soaking a piece of tofu in the pepsin solution overnight will result in (at least) partial digestion of the piece of tofu. By massing the tofu before and after overnight exposure to pepsin, you will be able to detect/measure digestion of this tofu.

Along with a small group of fellow scientists, you will be investigating one of the following questions:

* How is the rate of an enzyme-catalyzed reaction affected by the surface area of the substrate?
* How is the rate of an enzyme-catalyzed reaction affected by the temperature of the reaction?
* How is the rate of an enzyme-catalyzed reaction affected by the concentration of the enzyme?

Although this lab is clearly designed to help you gain a better understanding of enzymes and factors that may affect the speed of an enzyme-catalyzed reaction, it is also about experimental design: including appropriate controls, collecting both qualitative and quantitative data, and representing your data graphically. With all of this in mind, your first step will be to plan your experimental design, based upon the research question that you choose. Use the provided lab planner.

1. In class - Choose one of the above research questions; sign up on the white board (space is limited).
2. In groups - Develop and record a corresponding hypothesis, and a rationale for that hypothesis. Your hypothesis and rationale must be based on prior knowledge on homeostasis and enzyme function.
3. Individually at home- Design control group(s) and experimental groups for your lab.
   * Review the list of available materials to help you with this section.
   * Focus on the negative control group when planning your experiment.
   * Come up with 3 experimental groups for your variable. Be specific when making your selection. (i.e. Do not say hot, specify hot as 100o C). Which of your experimental groups is most like a positive control?
   * Triplicate the experimental groups to increase sample size. (i.e. Three trials at each experimental group concentration.)
4. Individually at home- Write the “dirty dozen.” In the first column, brainstorm twelve factors that would affect your results regarding decomposition of the tofu. These factors are also known as confounding factors. (i.e. What variables will you need to keep consistent in the experiment.)
5. Individually at home- Write your procedure. Be sure to include your control and experimental groups. Make sure that the data gathered is both qualitative (observations) and quantitative (mass of tofu). This procedure must be fully written (number the steps) before you can begin the lab.
6. Individually at home- In the second column of your “dirty dozen” chart explain how your procedure minimizes or eliminates the variable identified in the first column. If your procedure doesn’t minimize or eliminate the variable, revise the procedure accordingly.
7. In groups – Share your hypothesis, experimental set up, rational, share your procedures and the “dirty dozen”. Discuss similarities and differences. Work as a group to come up with one common procedure. Meet with your teacher to get your procedure approved.

Available Materials to each group:

* + Pepsin (enzyme), dissolved in water (5% concentration)
  + Tofu (as a source of protein, pepsin’s substrate)
  + Electronic balances
  + Refrigerator (4°C)
  + Room Temperature (about 22oC)
  + Incubator (37°C = body temp.)
  + Hot Water bath (TBD temp.)
  + Rulers
  + Plastic knives
  + 50 mL Culture tubes w/ caps (limit 12 per group)
  + Distilled water

**Our group’s research question**:

**Hypothesis**:

**Rationale**:

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| --- | --- |
| **Experimental Groups (3 groups)** | **Negative Control Group** |

**DIRTY DOZEN (Control variables)**

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| **Variable** | **How will the Procedure Minimize or Eliminate the Variable** |
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**Procedure**:

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