



Chapter 34 Project

Student's Digest

Project Goal + Timeline

The ability to digest food is essential to survival. The digestive system accomplishes this task through a complex multistep process that involves mechanical digestion, chemical digestion, and nutrient absorption. In this project, you will create a model of the digestive system that demonstrates these stages. You will also examine how modifications to a given stage may alter or disrupt digestion. This project should take between two and four hours to complete.

Directions

Part 1: Digestive System Model

In this part, you'll develop a model that emulates the steps in the digestion of a typical meal. You'll use crackers (such as saltines) and a drop of olive or vegetable oil to represent the combination of carbohydrates and fats that you might find in a meal. Follow the steps to construct your model. As you work, think about what each step represents and answer the corresponding question(s).

Place two crackers (such as saltines or graham crackers) and 1 teaspoon of olive oil in a small Ziplock bag. Add 2 to 3 tablespoons of water to mimic the presence of saliva. You may even include a small amount of your own saliva in the bag or a small portion of a digestive enzyme tablet containing amylase.

1. Why would the addition of actual human saliva be appropriate at this stage?
Gently press on the bag for a few minutes to crush the crackers and mix everything together.

2. What does this stage represent?
Add $\frac{1}{4}$ cup of vinegar to the bag. Then, fill a small bowl with hot water (not boiling, but hot) and place the bag in the bowl. Do not empty the contents of the bag into the bowl but rather allow the bag to soak. Allow this mixture to sit for 1 hour.

3. What does this stage represent? What are some imperfections of the model in emulating this stage?
After the hour incubation, note the appearance of the mixture. Add a few small drops of a detergent and/or a digestive enzyme supplement to the bag, then gently mix the contents.

4. Why should you add detergent? What part of digestion does this represent?
Place a coffee filter over the opening of a mug or small bowl. You can use a rubber band to secure the coffee filter, so it won't fall into the mug or bowl. Slowly pour the mixture from the bag into the coffee filter.

5. What does the filter represent?

6. What does the liquid that filters into the mug or bowl represent?

Carefully remove the filter and close it at the top, using the rubber band to tie the top of the coffee filter. Gently wring out any remaining liquid from the filter into the mug or bowl.

7. What does the material that remains inside the filter represent?

Part 2: Digestive System Modifications

Now that you've completed a full model of the digestive system, let's investigate how modifications to the process can alter how food is digested.

Consider each of the possible modifications to the digestive system model constructed in Part 1. Complete Table 1 by identifying the type of digestive system or disorder the modification might emulate. Then, make a prediction about the effect of that change on your model of digestion.

TABLE 1: Modifications of Digestive System Model

Modification	Demonstration of Digestive System or Disorder	Prediction of Effect of Modification on Digestion
Crackers are not crushed after being placed in the bag.		
Water is added to the bag in place of vinegar.		
Detergent is not added.		

Now, choose one of the changes from Table 1 and repeat the steps from Part 1 but with your modification.

1. Describe any differences you observed between the results of your modified model and the results of the model constructed in Part 1.
2. Do the differences you observed support your prediction for the effect of the modification?

Project Materials

- Project worksheet
- Pen or pencil
- At least 4 crackers (such as saltines or graham crackers)
- Olive oil
- Measuring cups (teaspoons, tablespoons, $\frac{1}{4}$ cups)
- Detergent (dish-washing soap)
- Vinegar
- Hot water
- 2 Ziplock bags
- 2 small bowls, or 1 bowl and 1 mug
- 2 coffee filters
- Rubber bands
- *Optional: Digestive enzyme tablets*

Student Checklist

- ☐ Construct the digestive system model
- ☐ Complete Part 1 questions
- ☐ Complete Table 1
- ☐ Construct a modified digestive system model
- ☐ Complete Part 2 questions