

**Investigative Lab 29**

## Breaking Down Fat Digestion

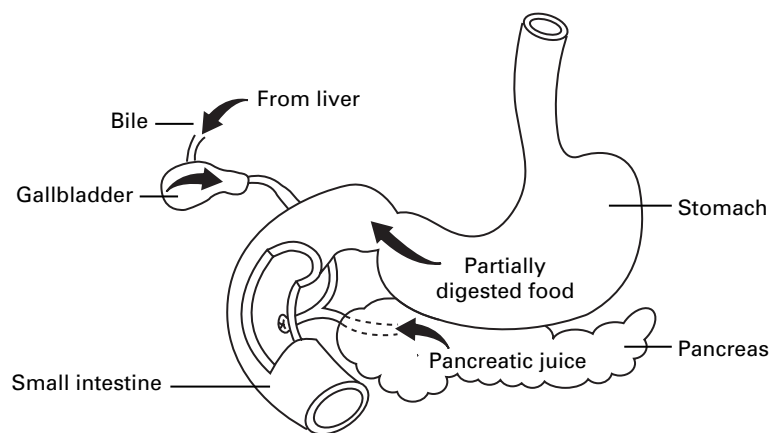
### *How Bile and Pancreatic Juice Affect Fat Digestion*

**Question** What are the roles of bile and pancreatic juice in fat digestion?

**Lab Overview** In this investigation you will determine the roles of bile and pancreatic juice in fat digestion. You will use whole milk as a source of fat, samples of bile and pancreatic juice, and the pH indicator phenol red.

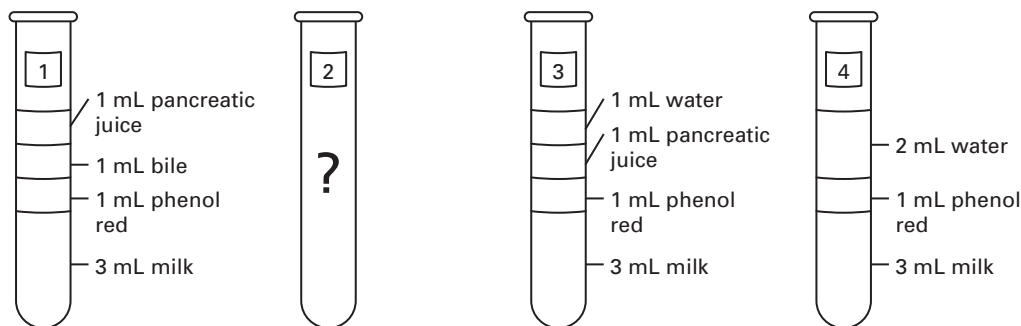
**Introduction** In the Prelab Activity you will examine part of the experimental design and complete the plan. Then, you will answer questions about how the design of the experiment will help you determine the effects of bile and pancreatic juice on fat digestion.

**Background** From the stomach, food enters the small intestine. Several chemicals that are secreted into the small intestine continue the chemical digestion of food there. Two of these chemicals, bile (made in the liver and secreted by the gallbladder) and pancreatic juice (made and secreted by the pancreas), play roles in the digestion of fat.



When fat molecules are digested, the result is molecules of glycerol and fatty acids. The presence of fatty acids can be detected with a pH indicator such as phenol red. In a basic solution, phenol red is hot pink, while in an acidic solution, it is orange. The faster a solution changes from basic to acidic, the faster the color change occurs. In this lab you'll use phenol red to determine when milk fat is broken down, and to compare how quickly it is broken down in different samples.

**Prelab Activity** You will use four test tubes in the investigation. Examine the set-up of test tubes 1, 3, and 4 below.



**Prelab Questions**

1. What should go in Tube 2? What is the purpose of this tube in the lab?

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2. How will you be able to tell if either bile or pancreatic juice breaks down fats? Explain.

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3. If both bile and pancreatic juice break down fats, how will you be able to tell if one is more effective than the other? Explain.

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4. How will you be able to tell if bile and pancreatic juice must *both* be present for fat to be broken down?

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5. Explain why Tube 3 contains 1 mL pancreatic juice and 1 mL water rather than 2 mL pancreatic juice.

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6. Predict what you think will happen in this experiment.

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### Materials

- 4 test tubes
- labeling tape
- pen or marker
- 4 plastic film squares, stoppers, or caps
- test-tube rack
- graduated transfer pipettes
- 12 mL whole milk solution
- 2 mL bile solution
- 2 mL pancreatic juice solution
- 4 mL water
- 4 mL phenol red solution
- stopwatch or clock with second hand

(NOTE: In the Prelab Activity you determined the contents of Tube 2. Check your answer with your teacher before proceeding with the investigation.)

### Procedure

1. Label the test tubes 1–4. Fill the test tubes with the volumes of different liquids listed in the Prelab Activity. Place the test tubes in the test-tube rack.
2. Tightly cover each tube with a plastic film square, stopper, or cap. Thoroughly mix the sample in each tube by inverting the tube (turning it upside down). After mixing, place each tube back in the test-tube rack. Record the start time and the initial color of each sample in Data Table 1 on the next page.

- When you observe a color change in a tube invert the tube again. Then, record the time and a description of the observed color in Data Table 1 below.

**Data Table 1**

Test Tube	Start time/ Initial color	Time/ Color	Time/ Color	Time/ Color	Time/ Color
1. Pancreatic juice and bile					
2. _____ _____					
3. Pancreatic juice and water					
4. Water only					

**Analysis and Conclusions**

- From the results of your experiment, what conclusions can you draw about the effect of bile on fat digestion?

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- From the results of your experiment, what conclusions can you draw about the effect of pancreatic juice on fat digestion?

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3. What was the purpose of Tube 4 in the experimental design?

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4. How might fat digestion be affected if the pancreas, liver, or gallbladder were not functioning properly? Explain your answer.

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**Extension**

The fat in butter is mostly saturated fat, while the fat in margarine is mostly monounsaturated or polyunsaturated fat. Design an experiment to determine if there is a difference in the rate of fat digestion between butter and margarine. **CAUTION:** *Always check with your teacher before carrying out any investigations.*

