

2.1: MODELING HEMOPHILIA

It's time to make a

rock by rock 

Modeling Hemophila



Introduction

Your challenge is to develop models of different blood samples to help people better understand hemophilia. Part of having empathy for someone is understanding life in their shoes. Now, we're going to learn a bit more about hemophilia and what happens to the body when a person is impacted by it.

Now, we'll help you think through the steps to model what happens in the blood when people with and without hemophilia get a small cut.

First, you'll review some background information to learn what happens in the body when people with and without hemophilia get a cut. Then, you'll test different mixtures to see what happens when they interact and how these interactions can help you model different types of blood.

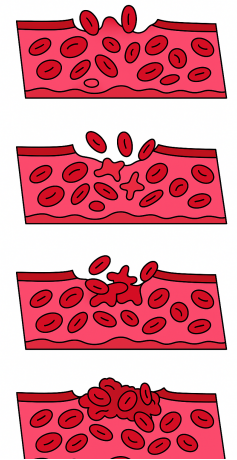
Finally, you will use what you have learned to design and test model blood samples of people with and without hemophilia.

PART 1: Background Information

When you get a cut, your body works fast to stop the bleeding. Here's what happens:

1. **The injury sends a signal.** When a blood vessel is hurt, it sends out a chemical signal to let the body know there's damage.
2. **Platelets rush in to plug the hole.** Tiny cells in your blood called platelets stick to the cut and to each other. They make a quick patch to stop some of the bleeding.
3. **Clotting factors make the patch stronger.** Special proteins in your blood called clotting factors help build a strong net over the platelets. This net keeps the bleeding from starting again.
4. **The clot stays until the cut heals.** The clot stays in place while your body fixes the blood vessel. Then the clot goes away when it's no longer needed.

People with hemophilia don't have enough of the clotting factors. That means their platelets can make a small patch, but the net doesn't form, so the bleeding doesn't stop easily. Hemophilia can be mild, or it can be more severe. People with mild hemophilia have more clotting factors in their blood than people with severe hemophilia, so their blood may clot more normally. People with mild hemophilia may only experience ongoing bleeding after a major injury or surgery, while people with severe hemophilia can experience ongoing bleeding for minor injuries.



PART 2: Testing Mixtures for Model Blood Samples

Now you will test some different substances to gather ideas about modeling the blood of people with and without hemophilia. You will make 4 different model blood samples and make observations of each model blood sample. Then you will add vinegar to each sample. Vinegar represents the chemical signal that lets the body know there's a cut. After you add the vinegar, you will make additional observations of each model blood sample. Later, you will use your observations to develop models to educate people about how hemophilia works. You will need the following materials for the rest of this investigation.

Materials:

- 1 tablespoon measuring spoon
- Milk (whole or lowfat)
- Water
- Cornstarch
- Vinegar
- 9 paper or plastic cups (~4 oz size or larger)
- 9 plastic spoons or stir sticks
- Fine mesh strainer (you can use coffee filters if you don't have a strainer)
- Sink or bowl (to catch the liquid after pouring it through the strainer)
- Paper towels

Procedure:

1. Using the information in the data table below, measure the substances for Model Blood Sample 1 into a clean cup. (An "x" means that substance is not used in the model blood sample.)
2. Stir the model blood sample and closely observe the appearance and thickness of the mixture. Use the spoon or stirring stick to take a closer look at the liquid and gather information about the thickness of the mixture.
3. Record your observations in the data table.
4. Add 2 tablespoons of vinegar and stir the mixture.
5. Wait 1-2 minutes.
6. Stir the mixture again, and then pour the mixture through the mesh strainer into a bowl or sink. This represents blood flowing through a cut.
7. Record your observations in the data table.
8. Repeat Steps 1-7 for the remaining model blood samples.



Data Table:

Model Blood Sample	Water	Milk	Cornstarch	Observations of model blood sample BEFORE adding vinegar	Observations of model blood sample AFTER adding vinegar
1	2 tbsp	x	x		
2	2 tbsp	x	1 tbsp		
3	x	2 tbsp	x		
4	x	2 tbsp	1 tbsp		
5	1 tbsp	1 tbsp	x		
6	1 tbsp	1 tbsp	1 tbsp		

PART 3: Plan Your Model Blood Samples

Now that you've explored how the different substances interact, it's time to plan three models to represent the following:

- A. No Hemophilia (blood with a typical amount of clotting factor)
- B. Mild Hemophilia (blood with some clotting factor)
- C. Hemophilia (blood with almost no clotting factor)

Use your knowledge from Parts 1 and 2 to design each model. You may choose from the combinations you tested in Part 2, or you may use different ones

In the table below, fill in the amount of each substance you plan to use for each model. (If you do not need a particular substance for a model, draw an "x" in the box.) Then explain why you chose each combination of substances for your models.

Model Blood Sample	Water	Milk	Cornstarch	Why did you choose this combination of substances and these amounts of each substance?
A. No Hemophilia <i>(blood with a typical amount of clotting factor)</i>				
B. Mild Hemophilia <i>(blood with some clotting factor)</i>				
C. Severe Hemophilia <i>(blood with almost no clotting factor)</i>				

PART 4: Test Your Model Blood Samples

Use the following procedure to test your models.

Procedure:

1. Measure out the substances needed to make Model A (No Hemophilia). Put these substances into a clean cup.
2. Add 2 tablespoons of vinegar and stir the mixture.
3. Wait 1-2 minutes.
4. Stir the mixture again, and then pour the mixture through the mesh strainer. This represents blood flowing through a cut. Look for the following as you pour:
 - Does all of the model's blood flow through the strainer quickly, or does the flow of model's blood slow/stop?
 - If the flow of blood stops, is there a lot of liquid left in the strainer or just a little?
5. Record your observations in the data table.
6. Repeat Steps 1-5 for the remaining model blood samples.

Model	What do you observe?	Was this model successful? Why or why not?
A. No Hemophilia <i>(blood with a typical amount of clotting factor)</i>		
B. Mild Hemophilia <i>(blood with some clotting factor)</i>		
C. Severe Hemophilia <i>(blood with almost no clotting factor)</i>		

Investigation Reflection

1. Your challenge was to develop models of different blood samples to help people better understand hemophilia. On a scale of 1 - 5 (where a 5 is extremely successful), how successful do you think you were with this challenge? Explain your rating.
2. All models have limitations (things that are missing or oversimplified). What are some limitations of your model for blood samples?
3. How do you think DNA is related to blood clotting and hemophilia? Why do you think this?