

Project Heart

Activities for the Classroom

EXPERIMENT

THE BIG SQUEEZE: A CAPILLARY'S STORY

Introduction

The circulatory system is the route by which the cells in your body get the oxygen and nutrients they need. Blood is actually a tissue made up of three types of cells: platelets, red blood cells, and white blood cells. It is the job of the red blood cells to carry oxygen.

Blood is carried through the body using a system of blood vessels. If all the vessels of this network in your body were laid end to end, they would extend for about 60,000 miles (more than 96,500 kilometers), which is far enough to circle the Earth more than twice!

The smallest blood vessels in the body are called capillaries. Capillaries transport blood from small arteries (called arterioles) to small veins (called venules). Capillaries are so small that red blood cells have to move in a single file line to get through them. Using a few materials, you will be able to see how red blood cells (bath beads) travel through the capillaries (funnel spout).

Materials

1. Bath beads (can be found at most bath/beauty stores and pharmacies)
2. 2 glass jars
3. 5 cups water
4. 1 cup wheat flour
5. 1/4 cup sugar
6. Funnel (spout should be smaller than bath bead, approximately 19 mm in diameter)
7. Pot
8. Spoon
9. Stove
10. Petroleum jelly

Preparation

1. In a pot, add 1 cup wheat flour and 1/4 cup sugar. Stir together with spoon.
2. With an adult's help, heat pot on stove set to low heat.
3. Slowly add 5 cups of water to the pot. Use the spoon to get out all of the lumps.
4. Cook the mixture until it becomes thick and clear.
5. Remove mixture from stove and let cool to room temperature. You have now created capillary paste!

Directions

1. Place the funnel over the first glass jar with the spout facing down.
2. Try to push one bath bead through the funnel and into the empty jar. Notice that the bath bead (red blood cell) is too large to move through the tiny capillary (funnel spout).
3. Cover another bath bead with petroleum jelly. Try to push the coated bath bead through the funnel. Even though it's slippery, it doesn't get through.
4. Add one cup of capillary paste to the second glass jar. Soak a bath bead in the paste for 20 minutes.
5. Remove the bead and observe the shape. It should look similar to an intact jelly-filled donut. This is what a normal red blood cell looks like, a flexible biconcave disc.
6. Try to push the biconcave bath bead into the funnel. It should fit. This is how a large red blood cell is able to squeeze through a small capillary.

Deep Exploration

1. Think about why the biconcave bath bead was able to squeeze through the funnel. Because the bead became stretchy, the surface area of the bead increased while keeping the liquid securely inside. Having a larger surface area not only increases mobility, it also allows red blood cells to come into contact with and carry more oxygen. This makes it a great oxygen transporter.
2. How could a partial blood vessel blockage, such as plaque build up, affect the way blood and red blood cells travel through the body? What would happen if a vessel was completely blocked?
3. One health condition called sickle cell anemia causes a person's red blood cells to be a crescent moon shape instead of a biconcave (jelly donut) shape. How do you think this sickle cell shape affects the red blood cells' ability to travel and collect oxygen?