



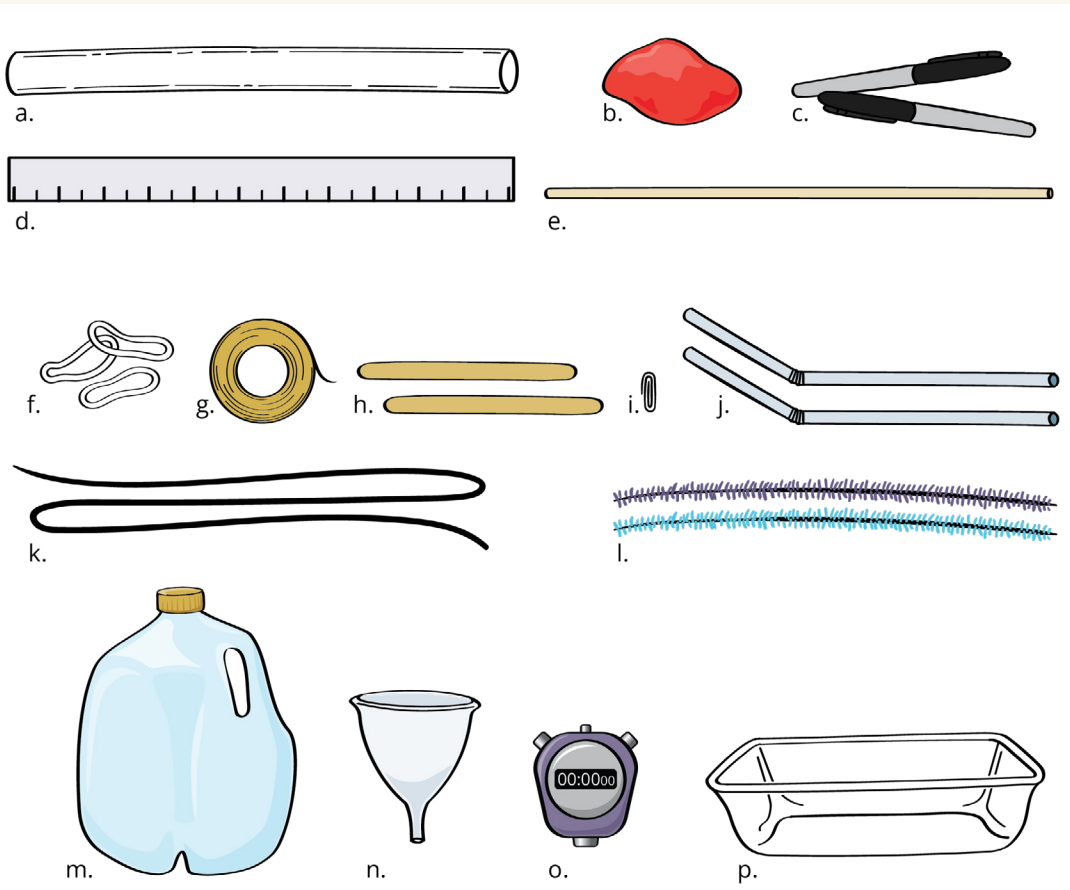
Blood clot removing catheter competition!

Total activity time: ~20 minutes.

A blood clot, also known as a thrombus, can interrupt blood flow to essential parts of your body. Surgery to remove a blood clot from a blood vessel is called a **thrombectomy**. The Centers for Disease Control and Prevention estimates that every year 100,000 Americans die of blood clots (source: <https://www.cdc.gov/ncbddd/dvt/infographic-impact.html>). During a thrombectomy, the doctor introduces special devices through tubes called catheters to break up or remove clots within a blood vessel. In this activity, you will design a new surgical device to remove a clot.

The Robotic Swarm Control Lab, at the University of Houston, is developing miniature robots to remove blood clots, with funding from the U.S. National Science Foundation. For a video overview, watch "[UH Engineers develop magnetically navigated robots to attack and remove blood clots.](#)"

Materials

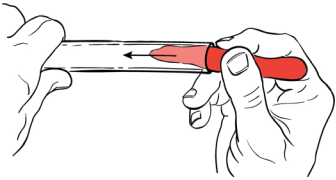


- a. One plastic tube, 12 inches long, 3/4-inch inner diameter
- b. Play-Doh™
- c. Two Sharpie markers (or wooden rods)
- d. Ruler
- e. Wooden rod, 12 inches long, 1/4-inch diameter
- f. Three rubber bands
- g. Three feet of masking tape
- h. Two popsicle sticks
- i. One paper clip
- j. Two drinking straws
- k. Three feet of string
- l. Two pipe cleaners
- m. One gallon of water
- n. One wide-tipped funnel
- o. One stopwatch (or cell phone timer)
- p. One tub, with capacity to hold at least 2 liters

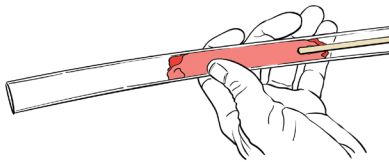


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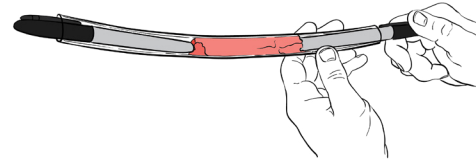
Preparation: Build a thrombectomy device



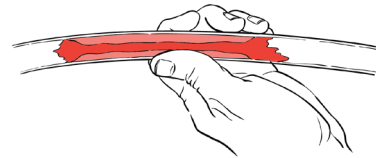
1. Take one plastic tube and push Play-Doh™ into the tube until the tube is about 4 inches full.
(Each tube requires approximately 0.8 oz. of Play-Doh™.)



3. Push the 1/4-inch wooden rod through the Play-Doh™ to make a channel through the clot.



2. Using the Sharpie markers (or wooden rods), push the Play-Doh™ into the approximate center of the tube.



4. Remove the wooden rod. Repeat for each tube. Bundle items "h" through "l" with rubber bands for each team.

The Experiment

The concept and rules of the engineering design challenge:

The tube represents an artery, the Play-Doh™ represents a partial-blockage blood clot. The goal of the design challenge is to use the provided materials to remove as much of the blood clot as possible in order to allow water (blood) to flow through the tube quickly.

Rules

Students cannot:

- Bend, squeeze, or otherwise change the shape of the tube.
- Shake or hit the tube to remove Play-Doh™.

Steps

1. Divide students into teams of five or fewer, and hand out supplies.
2. Give each team two minutes to discuss their plan for removing the blood clot (no touching the materials yet!).
3. Once their two-minute planning session has passed, give all students eight minutes to remove their blood clots.
4. After eight minutes, stop teams from working and begin testing.
5. Measure out two liters of water (one liter if it is necessary to minimize testing time).
6. Fit the funnel to one end of the first team's tube and have one person hold the tube and funnel over the plastic tub.
7. Start the timer and have one team member pour the water into the funnel. (The person pouring the water should keep

the funnel full but not overflowing).

8. Stop the timer when all the water has passed through the tube. Write the times on a whiteboard, display, or poster. (It takes 2 liters of water approximately 10 seconds to go through an empty tube, and 30 seconds through the unmodified clot.)
9. Discuss what you learned.

