Rate of Diffusion and Surface Area to Volume Ratio

Materials

250-mL beaker	block of agar-phenolphthalein
clock or watch	100 mL of dilute sodium hydroxide solution
metric ruler	plastic spoon
scalpel	safety goggles
paper towels	lab apron

Procedure

1. From the large class block of agar, use a scalpel to cut three cubes that measure 1 cm, 2 cm, and 3 cm on a side.
CAUTION: Use extreme care when using the scalpel. Cut in a direction that is away from yourself.

4. Place the cubes in the beaker. Pour enough sodium hydroxide solution into the beaker to cover the cubes. Record the time.
CAUTION: Dilute sodium hydroxide is irritating to skin and eyes; it could damage clothing. Wear safety goggles and laboratory coat or apron. Wash off spills and splashes with plenty of water.

5. Turn the blocks frequently with the plastic spoon for the next ten minutes.
6. Calculate the surface area, volume, and surface-to- volume ratio for each cube. Record these values in a table.
7. After waiting 10 minutes, use the plastic spoon to remove the cubes from the beaker. Place the cubes on a paper towel.
CAUTION: Do not handle the cubes with your fingers.

8. Use a scalpel to slice the first cube in half. Observe the cut surfaces. Measure the depth to which the sodium hydroxide has diffused. Record your results in a table. Rinse the scalpel and ruler before continuing.
9. Repeat step 7 with the other two cubes.
10. Discard your agar cubes and sodium hydroxide as directed.

Questions

1. Explain the effect sodium hydroxide had on the cubes.
2. Which cube has the largest surface-to-volume ratio? The smallest?
3. Compare the depth of diffusion in the three cubes.
4. Based on this experiment, make a statement about cell size and the efficiency of diffusion.
5. Based on your statement in Question 4, what can you say about why cells are so small?