



Chapter 14: Quick Activities

Medicinal Chemistry

Paper Wad Receptor Site

Most drugs work by binding to tiny nooks and crannies within our bodies, called *receptor sites*. The biological effect of the drug occurs only upon the binding of the drug to its receptor site. For this activity, the clay represents a drug, which has a receptor site found within a wadded-up paper ball.

PROCEDURE

1. Wad a sheet of paper into a ball.
2. Soften a teaspoon of craft clay by kneading it with your hands or by heating the clay in a microwave oven for a few seconds.
3. Press the softened clay into one of the nooks or crannies of the paper ball. Let the clay cool (in a freezer, if available) so that the clay retains the shape of that nook or cranny.

ANALYZE AND CONCLUDE

1. Once you pull your clay out of the paper, does the paper have to open up and flex to re-accept the clay? How well does the clay fit in other nooks and crannies?
2. If two drugs have the same biological effect, what might be true about their 3-dimensional shapes?
3. Some drug molecules have rigid structures that do not flex very easily. Others have a more relaxed structure that can contort into a variety of shapes. Which of these types of drug molecules might have a greater variety of biological effects? Which is likely to have a more specific biological effect?





Diffusion

Nerve impulses travel at speeds of up to 100 meters per second, but neurotransmitters travel across the synaptic cleft at a much slower 0.00001 meters per second. Why so slow? Once the neurotransmitters are released into the cleft there is no “magnet” that forces them quickly to the opposite side. Instead, they are prodded to the other side merely by the random bumping of jiggling molecules in the cleft—a process known as *diffusion*.

Recall from Chapter 2 that molecules slow down with decreasing temperature. The effect of temperature on diffusion can be readily seen by adding food coloring to water. Fill one glass with the ice-cold water, one with the warm water, and one with the hot water. Allow the glasses of water to stand for a couple of minutes so that the water is perfectly still. Add a drop of food coloring to each glass. The drop will sink to the bottom and then begin to diffuse. Observe how long it takes until the water is uniformly colored. Use your observations to suggest a reason why cold-blooded animals become sluggish at colder temperatures.

Old Medicines

Medicines are organic chemicals and they tend to deteriorate over time, especially when subjected to warm and moist conditions, such as might be found in a bathroom medicine closet. This is why medicines come with expiration dates. After such a date, although the medicine might look fine, much of it has chemically transformed into a variety of decomposition products. Not only will it be less effective, the some of the decomposition products might be harmful. Where might be an ideal place to store your medicines? Expired medicines are no longer so effective and they are often found by children. So please consider throwing away your expired medicines.





Author Responses to Quick Activities

Paper Wad Receptor Site

1. The paper wad has nooks and crannies of definite shape, but the wad is flexible and may need to open up a little to re-accept the clay. You should find that the shape of your clay is specific to only one receptor site on your paper wad. All these attributes are similar to biochemical receptor sites.
2. If two drug molecules have the same biological effect, then there's a good chance that they act at the same receptor site, which means then have similar structures.
3. The loose structure should be able to contort to fit into a greater number of receptor sites, which would make this drug molecule have a greater variety of biological effects. The drug with the rigid structure will likely have a more specific biological effect.

Diffusion

Because molecules slow down with decreasing temperature, the rate at which neurotransmitters are able to diffuse across the synaptic cleft decreases with temperature. This is one of the reasons cold-blooded animals become sluggish at colder temperatures. As neurotransmitters take longer to diffuse across the synaptic cleft, the rate

at which nerve signals can reach target muscles slows down.

When stuck outside in the cold without adequate clothing, you may find your extremities becoming numb and your muscles sluggish. This isn't just because of a decrease in the rate of diffusion in your synaptic clefts. Your body responds to cold by diverting blood from your extremities to your internal organs. The speed of neuron transmission, however, depends on blood supply. As the blood supply diminishes, neurons lose out on needed oxygen and nutrients and thus begin to shut down. The result is a numbing effect or loss of muscle control. An ice pack applied to an injury, such as a sprained ankle, puts this principle to good use. The same thing happens to your foot after you've been sitting on it for too long and it has "gone to sleep."

Old Medicines

The refrigerator or freezer is an ideal place to store your medicines, but only if the medicines are safely out of the reach of children.

