

How Do Drugs Affect the Heart Rate of Daphnia?

Purpose

In this lab, you will compare the effect of stimulants and depressants on the heart rate of a water flea.

When you have finished this lab, you will be able to: *predict the effects of various drugs and of alcohol on our own heart rate.*

Materials

Light microscope	sleeping pill
Depression slide	pipettes
Culture of <i>Daphnia magna</i>	aspirin
Tobacco extract	nasal spray
Tea/coffee	diet pill
Alcohol	timer

Pre-Lab

The water flea, *Daphnia magna*, is a tiny animal with a transparent shell that lives in ponds and streams. Its legs and antennae have special parts that help it swim and dive.

Water fleas are food for many species of predators in lakes and streams, including small fish and hydra. Their quick darting movements help them avoid these predators.

In this lab you will use *Daphnia* to test the effects of various chemicals on heartbeat. Even though water fleas have a quite different cardiovascular system from our own, many chemical affect our hearts much the same way as they affect those in *Daphnia*.

Figure 1 shows parts of the circulatory system of *Daphnia*. Water fleas have a heart but only a few blood vessels into a special chamber serving all of the water flea's organs. The heart pumps materials into and out of this chamber. In contrast, the human heart pumps blood through progressively smaller and smaller blood vessels directly to different organs in the body. How rapidly the heart pumps will depend on the demands of the organs for oxygen in the blood.



Daphnia with eggs

Increase or decrease in heart rate may be affected by chemicals called hormones and by the nervous system, both of which act directly on the heart. Many substances that enter our blood from the outside world can affect the heart rate. In this lab you will study substances that either speed up

the heart rate (*stimulants*) or slow it down (*depressants*). Some substances have such an effect on the function of our cardiovascular system that a large dose of them could stop the heart altogether.

Safety Precautions

- Keep fingers away from your mouth and eyes while working with drug samples
- Wash your hands before you leave the lab

Method

1. Use an eyedropper to obtain a water flea from the stock culture.
2. Squeeze the contents of the dropper into the well of a depression slide. Use the dropper to remove most of the culture water from the well.
3. Mount the slide on the microscope stage.
4. Use the scanning objective lens to locate the water flea. (If the water flea is not stationary in the well, remove more culture water by using a piece of paper towel.)
5. Find the following on the water flea:
 - Head (anterior) and tail (posterior) ends of the organism
 - Upper (dorsal) and lower (ventral) halves of the organism
 - A pulsing midway between the anterior and posterior ends and close to the dorsal surface. (This is the beating of the water flea's tiny heart).
6. Count the number of times in one minute the heart of your water flea is beating. Record the normal heart rate in the first column of the data table.
7. Obtain a substance listed in the data table.
 - Using an eyedropper, place two drops of this substance into the well of the slide with the water flea. **Be careful not to cross contaminate the substances!**
 - After 10 seconds, count the number of heartbeats for one minute.
 - Record this after drug heart rate in the data table.
 - Wash the water flea and well contents down the drain.
 - Rinse and dry your slide.
8. Repeat steps 6 – 7 with fresh water fleas and different substances from the lab counter as many times as directed by your teacher.

