

## Biology

# The effect of alcohol and caffeine on the heart rate of the water flea, *Daphnia pulex*

### Background

The small heart of the water flea, *Daphnia*, is easily visible under low magnification using a standard light microscope. The heart rate (which can be up to 300 beats per minute) can be monitored and counted in different conditions – for example changing water temperature, or changing the type and concentration of chemicals added to the water. The procedure provides an interesting technique for investigating the effects of different chemicals on a metabolic process in animals.

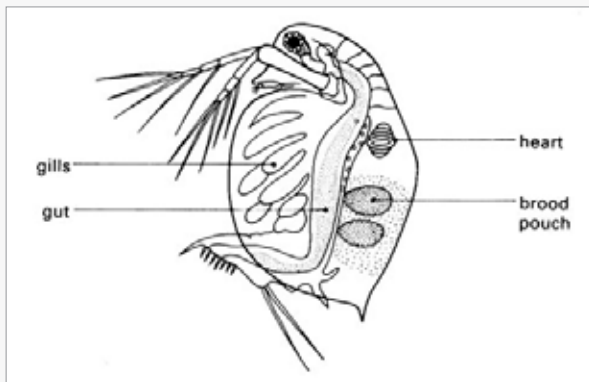
Live cultures of *Daphnia* can be purchased from various suppliers, including pet shops and local aquarists. Some scientific suppliers sell viable dried *Daphnia* eggs and culture kits

### You will need...

- ✓ 3 *Daphnia*
- ✓ 3 microscope slides (concavity slides are ideal)
- ✓ 3 plastic pipettes
- ✓ 1% caffeine solution
- ✓ 1% alcohol

### Follow these steps

1. Add one *Daphnia* to each of the solutions (water, ethanol, caffeine) using a plastic pipette and set a timer for 5 minutes



2. Transfer each of the *Daphnia* onto a glass slide using a plastic pipette. Narrow tips can be cut off at a 45° angle to avoid damaging the insects
3. Remove most of the liquid from the slide using a pipette but leave the *Daphnia* in a small drop.
4. Using a stopwatch, count the number of heart beats in 20 seconds. The heart-beat of *Daphnia* is very rapid, so count the beats by making dots on a piece of paper in the shape of a letter S. Count the dots and convert the heart rate to number of beats per minute. Record the results in a table.
5. Repeat for each of the 3 individual *Daphnia*.

### So what happened?

Alcohol causes a decrease in heart rate whereas caffeine causes an increase in the heart rate of *Daphnia*.

### What next?

The effect of different concentrations of alcohol or caffeine can be investigated (e.g. 1% to 10% alcohol), so that graphs of increase in heart rate against concentration of substance may be plotted. The effect of different temperatures on heart rate may also be investigated. A useful video guides to experimenting with *Daphnia* in the school laboratory can be found online.