Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Daphnia Heart Rate Lab**

**INTRODUCTION:**

A *Daphnia* is a tiny crustacean (related to shrimp) that has a clear outside skeleton (**exoskeleton**) and jointed legs. Like other arthropods, its **heart** is on its back. The most obvious structure is the **eye**. The **brain** is the light-colored organ lying above the eye. Two pairs of **antennae** protrude from the head. These are used for locomotion and to sense the environment. Inside the exoskeleton are 5 pairs of **legs**. Comb-like **gills** are attached to some of the legs. When the legs kick forward, they bring a stream of water across the gills and wash bits of food up to the **mouth**, which lies just beneath the beak. From the mouth, the **esophagus** runs up into the head and then down into the body, where it widens into the **stomach** which connects to the **intestine**. In females, a large **brood chamber** is located behind the heart. Usually, it will contain eggs, but occasionally a fortunate student will find it filled with baby *Daphnia*. Draw and label a picture of the *Daphnia* below using our microscope drawing guidelines.

The environment challenges each living thing to respond. It includes the air, the water, heat and light, and the chemicals which enter our bodies. Because *Daphnia* are **ectotherms** (cold-blooded), their body temperature changes with the surrounding environment. Since chemical reactions are speeded up in warmer temps, what would you predict the effect of temperature changes would be on their rate of metabolism (and heart rate)?

I PREDICT THAT the Daphnia’s heart rate will \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_in warm water and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in cold water.

In any investigation, predictions are stated in an “IF………….………………, THEN……..” format. Restate your prediction above, using this format:

IF \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, THEN \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Chemicals which enter their bodies can also change their heart rate by interfering with the chemicals that nerves use to transmit signals. Chemicals that speed up heart rate are known as **stimulants**, whereas chemicals that slow down the heart rate are known as **depressants**.

**MATERIALS:**

*Daphnia* in culture liquid

Transfer pipette (dropper)

A clean **depression slide** – Sketch a depression slide here:

Compound microscope

A container for “used” Daphnia = INTENSIVE CARE

Ethanol, nicotine, and caffeine

**PROCEDURE:**

**\*Keep the light for your microscope OFF as much as possible to avoid overheating your *Daphnia*!**

What is the total magnification you are using ? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What stimulant or depressant will you use on your *Daphnia*? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

In the space below, write your hypothesis about how this will affect the heart rate of your Daphnia. Be sure to write your hypothesis in the “If………..………. , then……….” format.

1. Using a clean pipette, carefully transfer a *Daphnia* and ONE drop of liquid onto a slide. Keep the drop

small so that the *Daphnia* can’t swim out of your field of view.

2. Place the slide under the microscope and focus on the *Daphnia* so that you can see the beating heart.

**REMEMBER: its heart is on its back!**

3. Count the number of heartbeats that occur in 10 seconds. Have your lab partner time 10 seconds for

you as you count heartbeats. You want to make your measurements quickly, so that the Daphnia

does not become stressed in the small volume of water.

4. Record the number of heartbeats in the data table. Multiply the number by 6 to get the number of

beats per minute.

5. Take at least three separate heart rate measurements for your Daphnia and calculate the average of the

three measurements. REMEMBER: If the three numbers are NOT within 10% of each other, repeat your trials!

6. When you have finished recording the heart rate in water (the CONTROL solution), add ONE DROP

of your chosen stimulant or depressant to the slide. TURN THE LIGHT OFF AND WAIT 30

SECONDS.

7. Turn the light back on and count the number of heartbeats for 10 seconds again, repeating at least 3

times. Multiply each count by 6 to get the heart rate per minute. Record in the data table.

8. Rinse the Daphnia into the “Intensive Care” container for recovery.

**OBSERVATIONS:**

**DATA TABLE**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Trial | Control: water |  | Variable: |  |
|  | 10 seconds | BPM = rate at 10 seconds x 6 | 10 seconds | BPM = rate at 10 seconds x 6 |
| Trial 1 |  |  |  |  |
| Trial 2 |  |  |  |  |
| Trial 3 |  |  |  |  |
| Average |  |  |  |  |

**CONCLUSIONS:**

1. Did you use a stimulant or a depressant? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. Did your experiment prove your **hypothesis** correct? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. Which of the 2 *Daphnia* was your **control**? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4. In your experimental trial, what was the **independent** variable? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

5. What was your **dependent** variable? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

6. What were some of the **constants** (things that you kept the same) between your control

trial in just water and your experimental trial?

7. Perhaps your trials turned out just as you expected. For those classmates whose didn’t, what

could have been some possible **sources of error** (reasons things didn’t work out) ?