Name _____ Date _____

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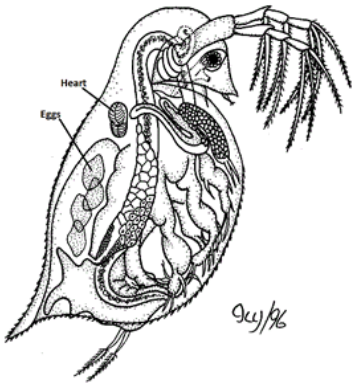
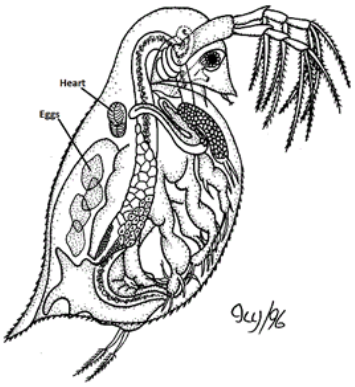


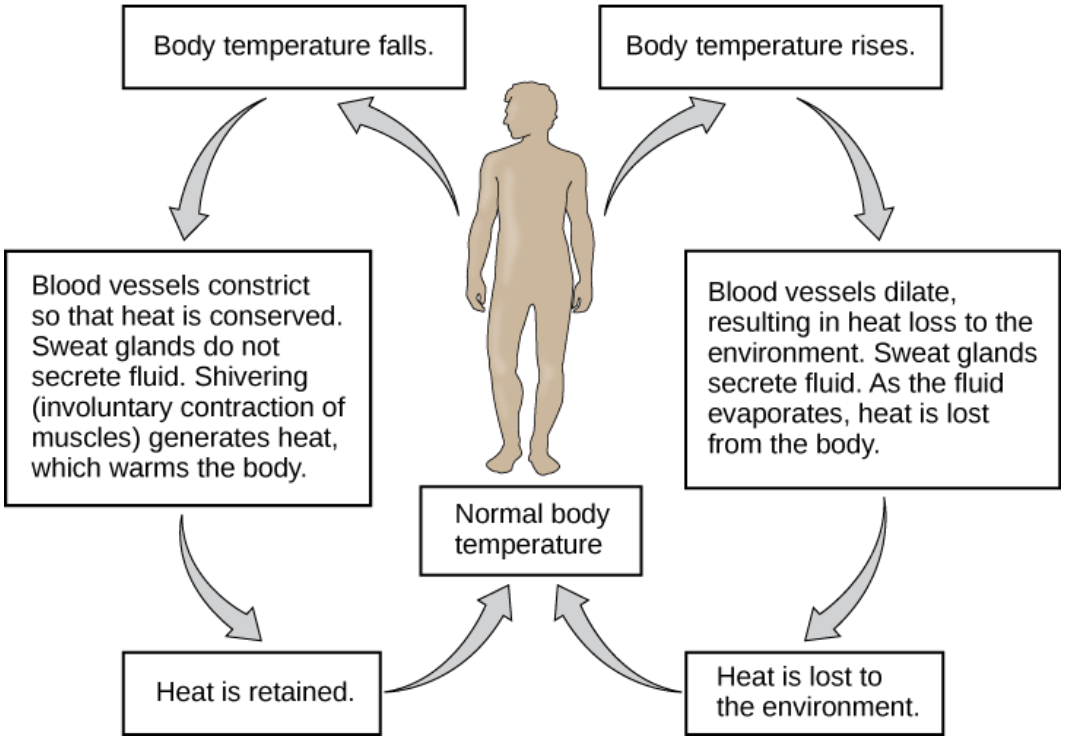

# The Effect of Temperature on Heart Rate in Daphnia




## Background Information

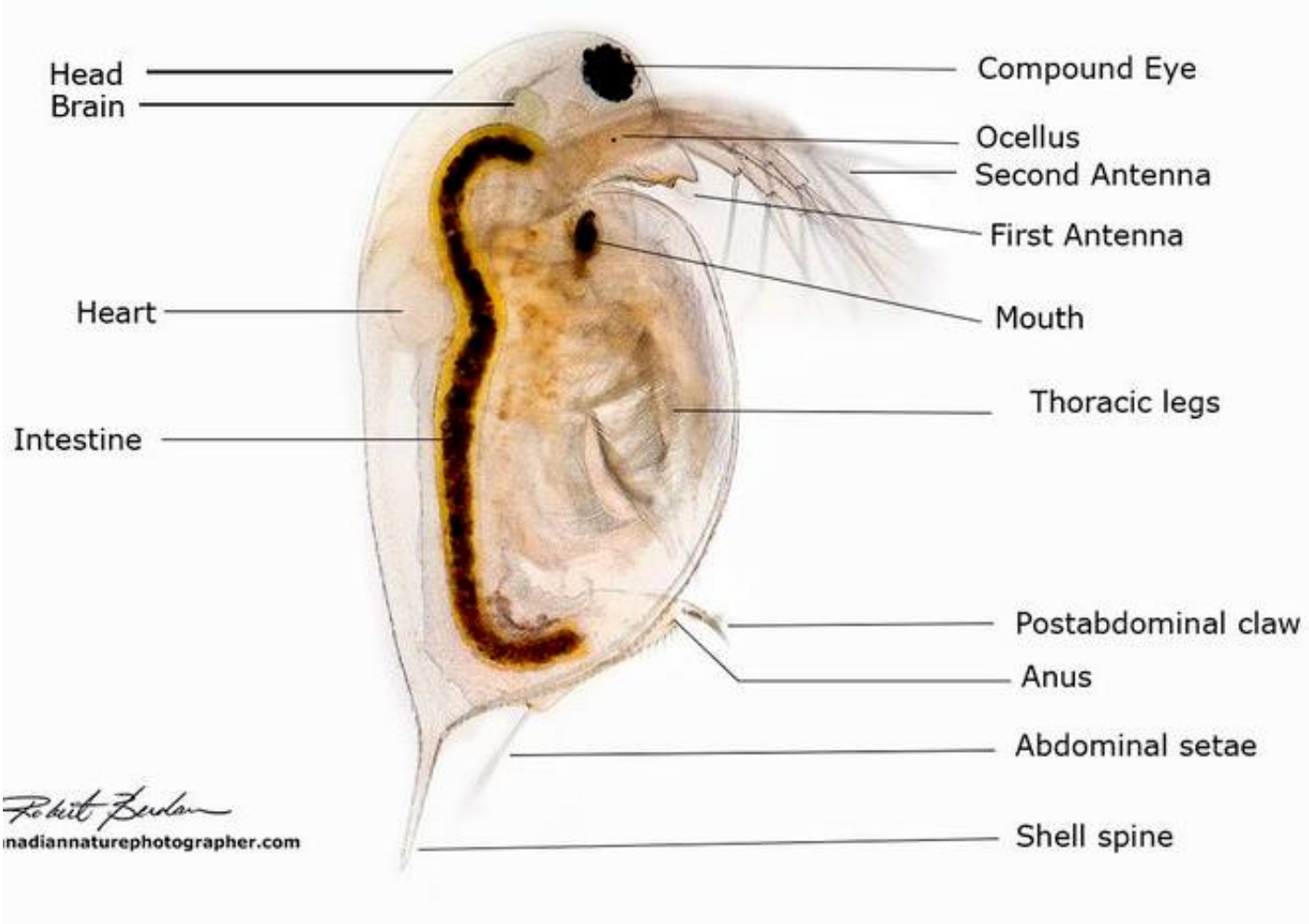
**Homeostasis** *is the maintenance of a stable internal environment*. One way organisms maintain homeostasis is by controlling their body temperature. **Thermoregulation** *is the maintenance of internal temperatures within a range that allows cells to function*. It may involve both physical and behavioral adaptations. For example, humans thermoregulate by sweating or shivering (*physiological***)** and snakes by basking on sunny rocks (*behavioral*).

**Figure 1. Thermoregulation in Humans**



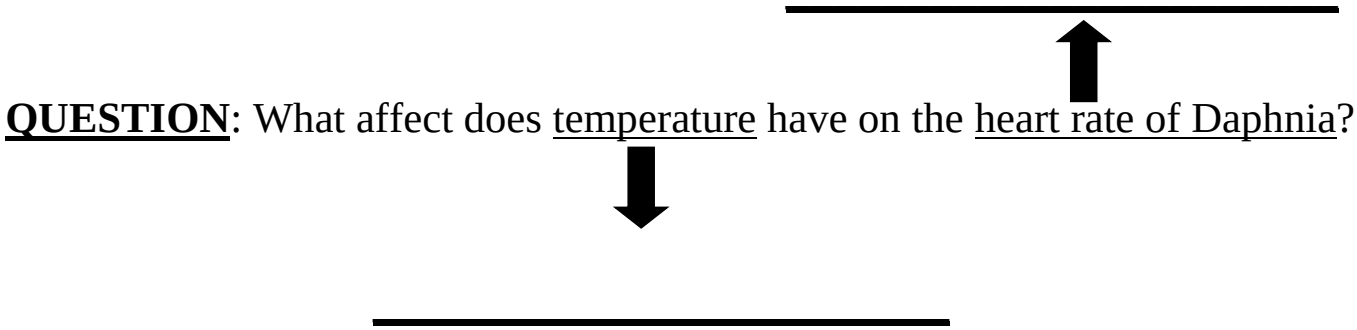

In this activity, we will be using a tiny **crustacean** called a *Daphnia* (*related to shrimp*) that has a clear outside skeleton (*carapace*) and *jointed legs*. Like other **arthropods** *(jointed appendages)*, its heart is on its back and clearly visible through its carapace which makes it an ideal organism to study heart rate. Check out the diagram on the next page to see more of the Daphnia's anatomy.

# Anatomy of the Daphnia



Discovering and explaining connections is one of the basic methods by which our knowledge of the world advances. ***It is what science is all about!*** Sometimes the connections are not what we expect or would predict, and sometimes we may have a hard time explaining them. Nevertheless, that is how science makes progress.

As previously stated in the Gum Lab, when scientist *make connections*, they are really looking at what impact the **<u>independent</u> <u>variable</u>** has on the **<u>dependent</u> <u>variable</u>** of an **experiment**. Being able to identify these variables is a skill we have been working on throughout the year.




**(1)** Based upon your prior knowledge, make a **hypothesis** as to how you **predict** a decrease in temperature will affect the heart rate of a Daphnia.

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## MATERIALS

*Daphnia* in culture liquid
A clean depression slide/coverslip
Transfer pipette
Compound microscope
cotton

## METHODS

**1.** Place a SMALL stand(s) of cotton in the center of your depression slide and using a clean pipette, carefully transfer a *Daphnia* and ONE drop of liquid onto a depression slide over the piece of cotton.
*(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.

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

**3.** Count the number of heart beats 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 heart beats in the data table below. Multiply the number by 6 to get the number of beats per minute.

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

**6.** When you have finished recording the heart rate in water at room temperature (the **CONTROL**), repeat the same procedure, however, this time you will place your Daphnia in the **refrigerator** for 1 minute to simulate a **COLD** environment.

**7.** Record the number of heart beats in the data table below. Multiply the number by 6 to get the number of beats per minute.

**8.** Take at least **three** separate heart rate measurements for each individual *Daphnia* in each environment and calculate the average of the three measurements.

### Table 1.

| | **Temperature** | | | |
|---|---|---|---|---|
| | **Room Temp. (control)** | | **Cold** | |
| **Trial** | 10 sec. | BPM (x6) | 10 sec. | BPM (x6) |
| **1** | | | | |
| **2** | | | | |
| **3** | | | | |
| **Average** | ----- | | ----- | |

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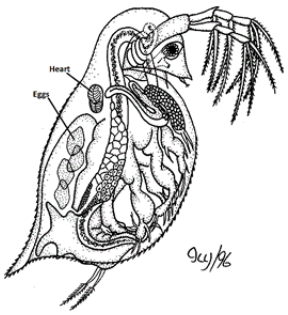
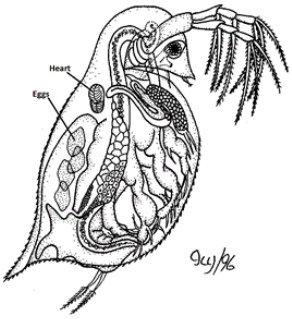



# The Effect of Temperature on Heart Rate in Daphnia




## Summary Sheet

**1.** Define homeostasis.

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**2.** Restate your hypothesis for this experiment.

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**3.** Identify the ***independent*** variable for this experiment.

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**4.** Identify the ***dependent*** variable for this experiment.

_____

**5.** Identify two controlled variables or CONSTANTS for this experiment.

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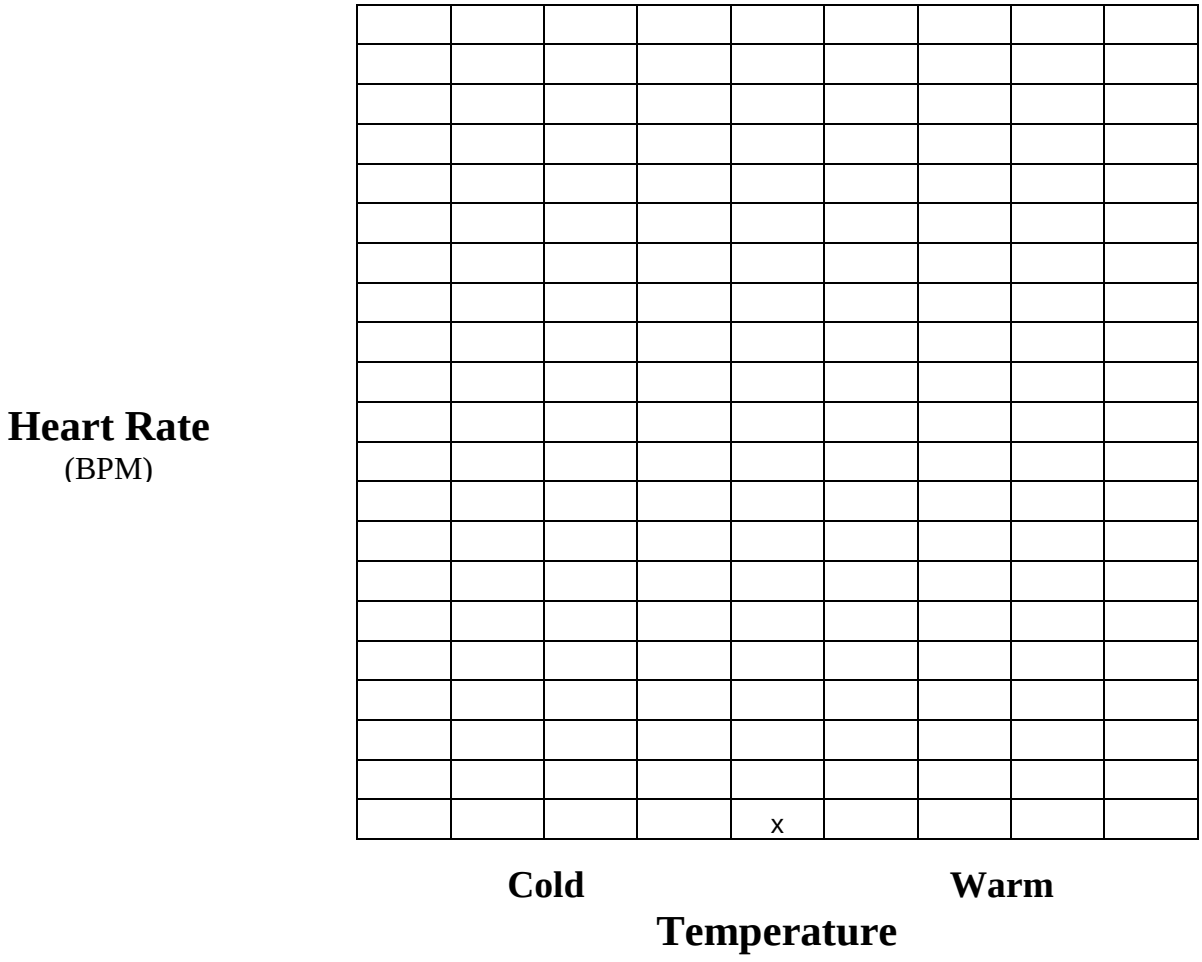
_____

**6.** Transfer the information from **Table 1** to the data table to the right.

| | Temperature | | | |
|---|---|---|---|---|
| | Room Temp. (control) | | Cold | |
| **Trial** | 10 sec. | BPM (x6) | 10 sec. | BPM (x6) |
| **Average Heart Rate** | ----- | | ----- | |

**7.** Using the information above, construct a bar graph in the grid below.

## Effects of Temperatures on the Heart Rate of Daphnia




**8.** What is the connection (*relationship*) between temperature and heart rate in Daphnia?

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