

# Sensing Your Friends Getting Eaten is Stressful, Having a Parasite Makes it Worse!

### **Research Questions**

> How do parasites influence how animals react to real world stressors?

# Background

- $\succ$  All animals face a barrage of daily stressors in their lives
- Parasites can cause a range of physiological changes in animals, yet few prior studies have looked at the combination of parasitism and stress in animals
- $\succ$  Daphnia are microscopic plankton that can have ecto-parasite-like organisms attached to their surface (epibionts)
- $\succ$  Vorticella is an single-celled ectoparasite that siphons food from the water column through the beating motion of the cilia.

### Sampling Methods

# Methods

- > We collected *Daphnia ambigua* from a local pond and housed them in our lab...
- In total, we conducted trials with 142 Daphnia ambigua. Some were naturally colonized with vorticella (see picture).
- > 21 of those Daphnia served as a control and were not exposed to a stressor.

### **Experimental Procedure**

- > Individual Daphnia ambigua were positioned in the middle of a petri dish on their side and held in place with vaseline.
- $\succ$  The Daphnia had free range of movement with appendages but couldn't move from that spot.
- $\succ$  Allowed to acclimate for one hour.
- $\succ$  During the acclimation period, 5-second videos of their heart beating were taken every 10 minutes.
- $\succ$  Prior to this, we prepared a solution of a "stressor" which was 5 macerated Daphnia in 0.1 ml of water (simulating a predation event).
- > At the 60 minute mark, 0.05 ml of water with the crushed Daphnia were added to the petri dishes with focal Daphnia.
- $\succ$  For the next two hours, 5 second videos of the heart rate were taken every 5 minutes.
- $\succ$  Videos were then reviewed and the heart rate collected

Helen Gloege<sup>1</sup>, Andrew K Davis<sup>2</sup> <sup>1</sup>Mount Holyoke College, South Hadley, MA; <sup>2</sup>Odum School of Ecology, University of Georgia

### Host and Parasite Images

Daphnia ambigua without vorticella



Daphnia ambigua with vorticella Results



Time (min)

**Figure 1:** Average heart rates of daphnia before and after exposure to a stressor (black dotted line), and with different levels of epibiont loads.





### Figure 1



Figure 2

Figure 1: petri dish with daphnia on a microscope stage Figure 2: daphnia with vorticella and babies

- reaction in Daphnia.
- during the period of measurement
- $\succ$  Our Interpretation:
  - Daphnia
  - daphnia
- described

- pathotens.

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## Discussion

 $\succ$  The presence or absence of ectoparasites appears to greatly influence the magnitude of physiological stress

> Daphnia without vorticella appeared to have no discernable reaction to the same stressor

 $\succ$  When there were 20 or more vorticella, the heart rate increased at 60 minutes and continued to increase

 Since the vorticella have cilia that beat the water around them, this churns and mixed up the water around the Daphnia, thereby drawing in the

surrounding water (and chemical cues) to the

• Without the churning of the water, the daphnia fail to sense their friends being eaten (the macerated

 $\succ$  The epibiont-induced effect has not previously been

 $\succ$  This could be interpreted as a novel sensory enhancement interaction, whereby daphnia with vorticella are better ables to sense their environment (via enhanced water flow around them)

# **Future Research Directions**

 $\succ$  Future research should determine if similar results will be observed if the daphnia are infected with other parasites, or

 $\succ$  It would be interesting to evaluate other species of daphnia to determine if they have similar reactions.

# Acknowledgements