

Effects of parasites and predators on heart rates of *Daphnia laevis* using an innovative electronic stethoscope

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INTRODUCTION

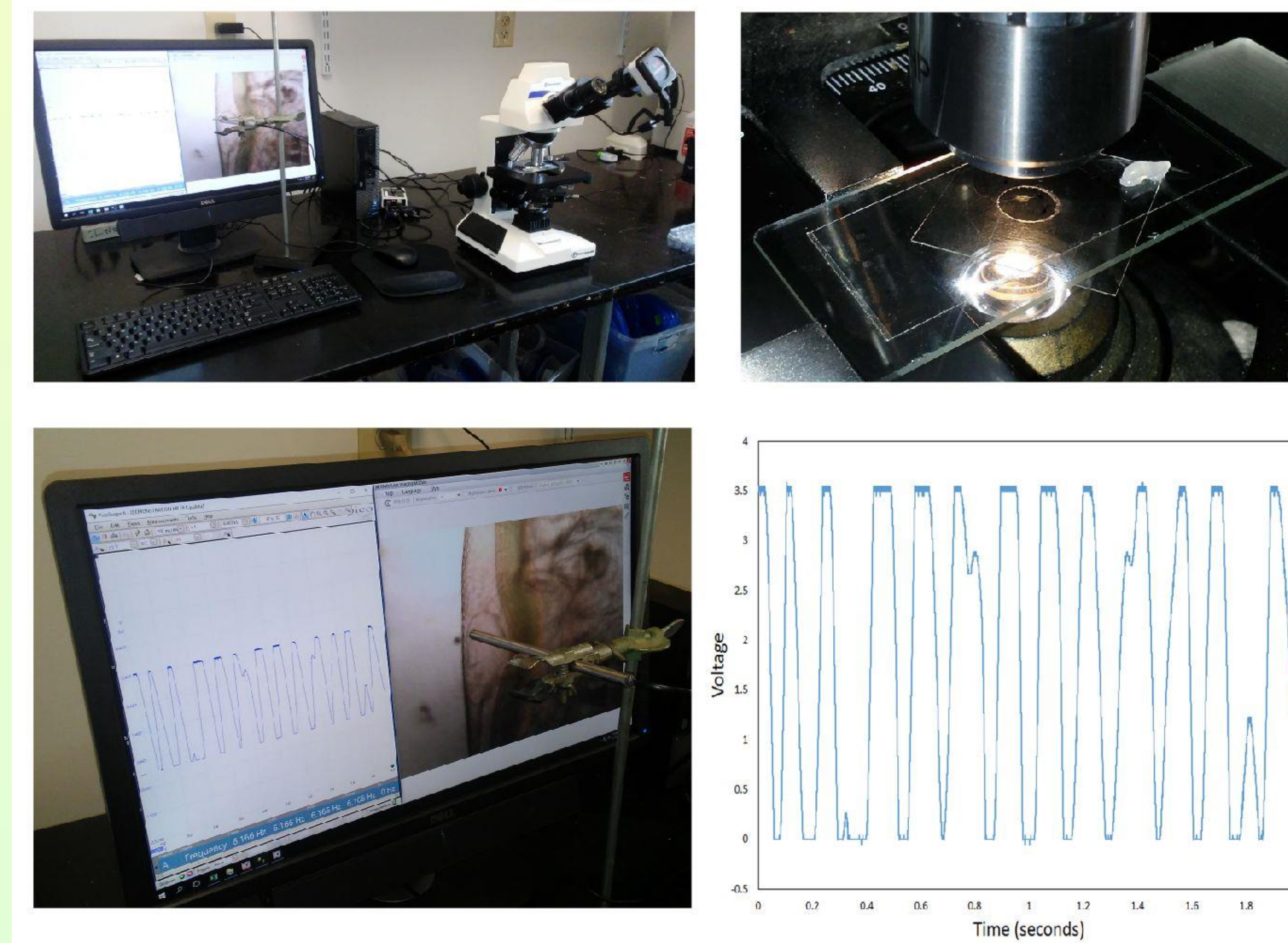
Daphnia are a model organism often used in investigations of chemical toxicity and as a system for ecology and evolution. We developed a novel apparatus for monitoring changes in Daphnia heart rates in real-time, with no need for manual assessments and without harming the animals. We used this approach to investigate how heart rate changes in response to stress with naturally-occurring parasites (epibionts) and a Daphnia predator (glassworms). We observed a difference in heart rate by time of day, suggesting a diurnal effect on the *Daphnia laevis*.

BACKGROUND

- » Daphnia are crustaceans, also commonly called water fleas, that can be found in fresh water environments.
- » Daphnia sp. are frequently parasitized by organisms called epibionts, which attach to the surface of daphnia and weigh them down.
- » The glassworm is one of the most important predators of Daphnia
- » The glassworm tend to prefer different types of zooplankton when they are in early larval stages.

METHODS

- » *D. laevis* and glassworms were found in a local pond near the University of Georgia.
- » Daphnia were individually placed under microscope on a special slide with a cover slip that held them in place.
- » A light-sensing electronic probe was aimed at the beating heart on monitor, converted pulses to digital signal, which was displayed in real-time.
- » Heart rates were measured for 5 minutes, recording every 20 seconds
- » 78 Daphnia were control (no treatment), 69, were exposed to a predator overnight.



A.

B.

Figure 1 A. Photos of the setup, including benchtop, daphnia under microscope, electronic probe and on-screen display B. Diagram of the procedure that the observer realize for each treatment.

RESULTS

- » Average HR across all 147 daphnia was 5.9Hz, or 354 beats/min
- » For comparison, reported HR of *D. magna* and *D. pulex* (measured manually) are usually between 250 and 450 beats/min

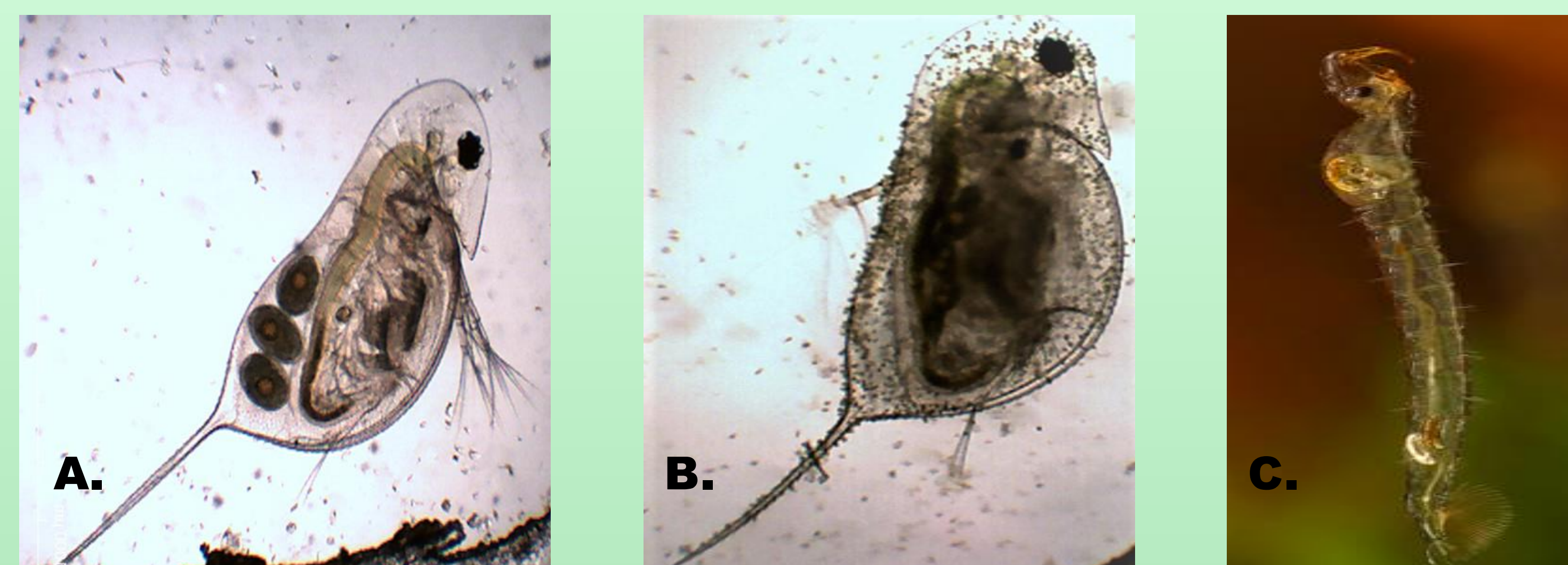


Figure 2. Representation of the organism used in this research A. Daphnia free of epibiont B. Daphnia with epibiont C. Glassworm

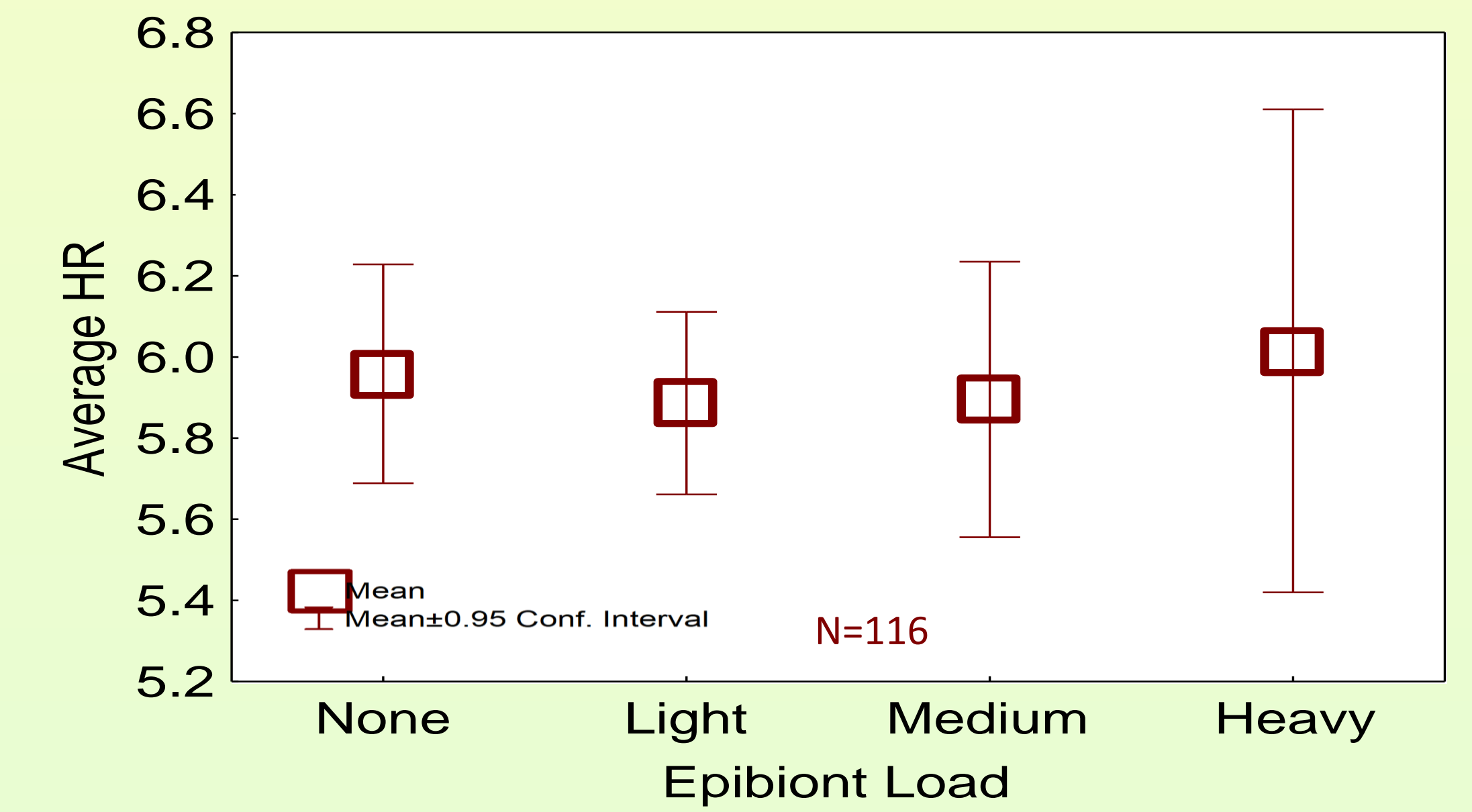


Figure 3. Average Heart Rate of Daphnia with different level of epibiont load. There was no statistical difference in HR between daphnia affected by ectoparasites.

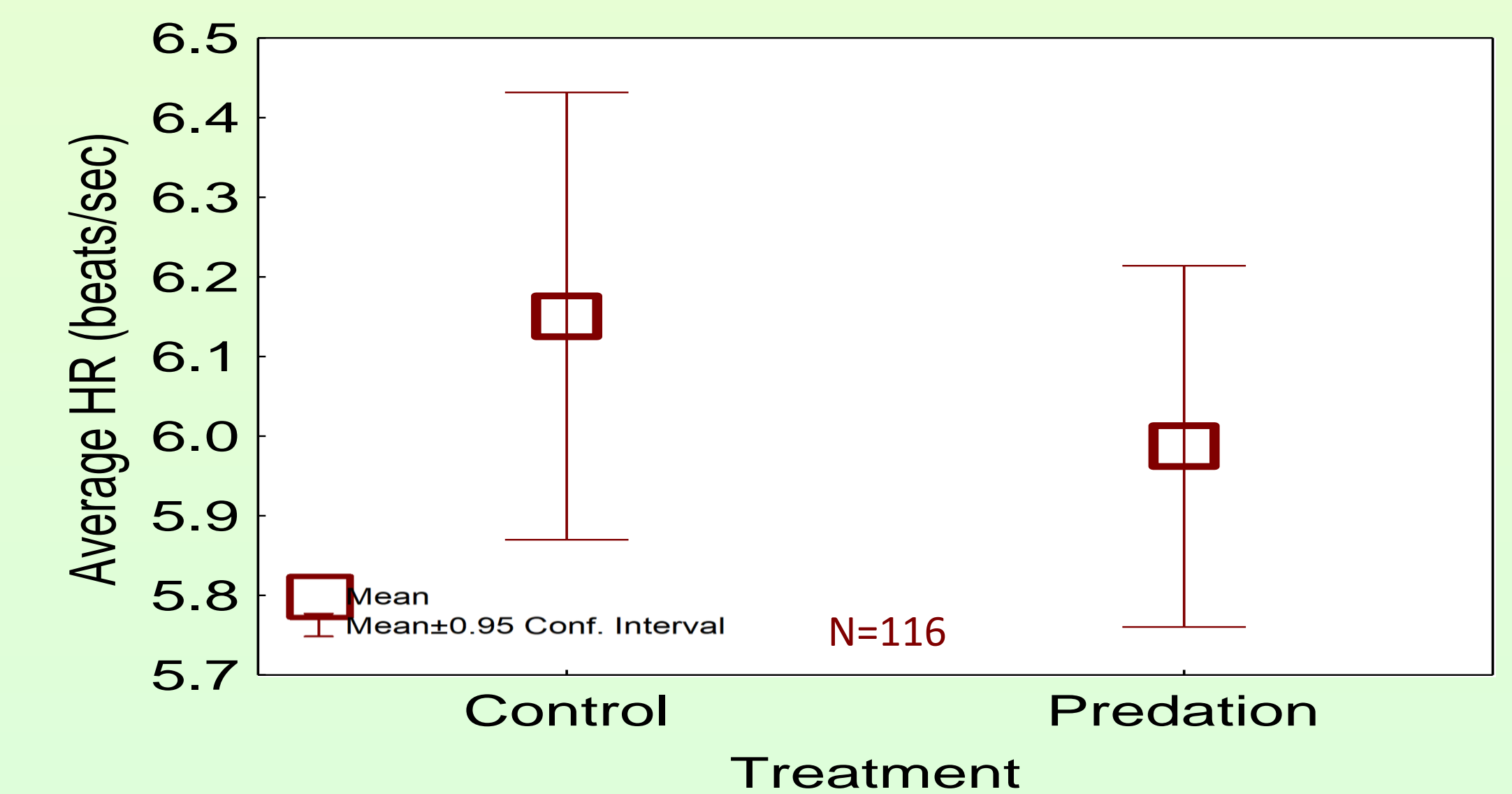


Figure 4. Average Heart Rate within the treatment. There was no statistical effect of predator exposure on average HR of daphnia.

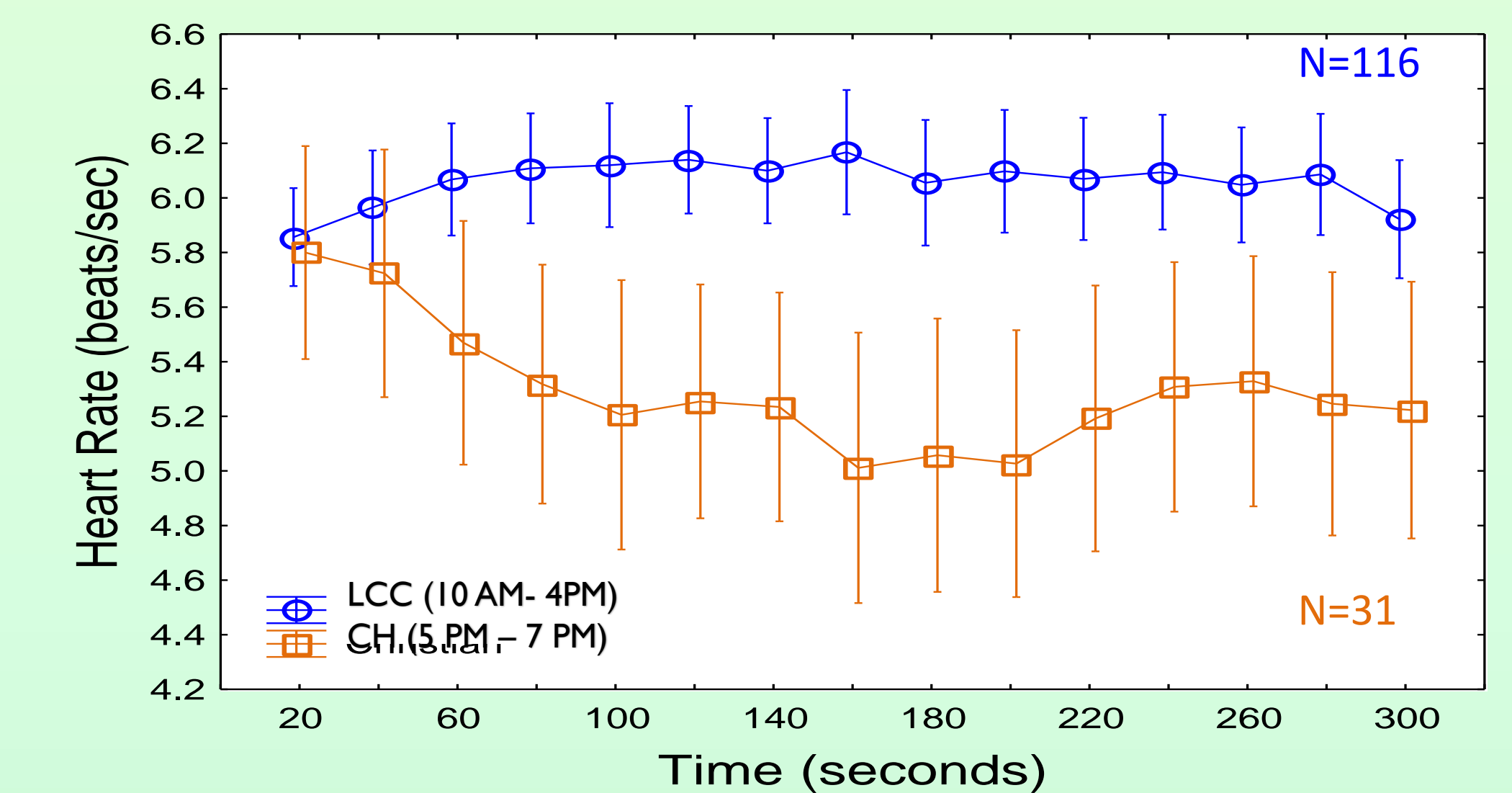


Figure 5. Heart Rate relationship between the observer effect. A potential cause of the discrepancy between the observer is time.

CONCLUSIONS

- » Naturally-occurring parasites and predators appear to have no statistical effect on the heart rate of daphnia.
- » We discovered (by accident) that the daphnia HR response differed between the morning trials and the evening trials. This suggests a possible diurnal effect on HR, or the HR reaction to stress (in this case, the microscope slide).

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