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Comparing Thermal Tolerance Among Daphnia Populations

There are two morphologically identical species of the genus *Daphnia* in North America. *Daphnia pulex* and *Daphnia pulicaria*. *D. pulex* inhabits ephemeral ponds and *D. pulicaria* inhabits lakes. It has become evident to researchers that *D. pulex* and *D. pulicaria* have distinct differences in their genomes. This means that although they have the ability to interbreed, they are two distinct species.

It was hypothesized that populations of *D. pulex* would have higher thermal tolerances than *D. pulicaria* because of the natural variation they experience in temperatures in their shallower, pond habitats. This habitat distinction is important when it comes to the research that has been done in the Miner Lab, due to the fact that it is hypothesized that these two species have different responses to thermal exposure. This is what was tested within this research. *Daphnia* were collected from bodies of water that varied in depth. Throughout this experiment it was unknown to researchers which organisms tested were *D. pulex* and which were *D. pulicaria* in order to avoid biased results.

The experimental set-up included a PCR machine, which allowed us to measure the Critical Thermal Maximum (CT_{max}) of individual animals. A fast ramping assay was used, in which adult animals were began at a water temperature of 25°C and were heated until they fainted. The time at which the animals fainted was recorded as their CT_{Max}.

The trials ran for approximately 30 minutes each. While the trial was running it was recorded on digital camera in order to later review the videos and determine at which temperatures individuals fainted. After the trials were completed each individual was measured under a dissecting scope, and their lengths were recorded.

In order to maintain the *Daphnias'* unique genome, it had to be made sure that only *Daphnia* that reproduced asexually were being used in the trials. In order to do this new "generations" of each population had to be made weekly. This means that every week the sexually mature mothers that were carrying asexually reproduced eggs would be moved from their original jar into another. The day that they were moved became that population's "birthday" or generation date. This date was recorded during trials as another method of preserving the genomes.

We compared CT_{max}es that were recorded upon completion of the thermal trials. This will allow researchers to understand the differences that result from the different ecosystems of two very different species.

This work is important in understanding the environmental characteristics that have influenced the evolutionary process of *Daphnia*. The key to these potential influences is that the ponds *D. pulex* inhabits are much more shallow, and variable than the lakes where *D. pulicaria* are found. This is what is hypothesized to lead to variability in their thermal tolerance levels, as *D. pulex* would be able to withstand higher temperatures and greater temperature changes due to

the shallow water, and *D. pulicaria* would be better adapted to more even temperatures because of living in long-standing bodies of water.