The effects of various solutions on Daphnia and the points at which the Daphnia can maintain homeostasis with the various toxicities of the solutions we put the Daphnia in.

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Purpose:

The purpose of our lab tests was to determine what types of environmental conditions Daphnia could live in. We tested whether or not Daphnia can maintain homeostasis in various amounts of different solutions like ammonia, depressant, antacid and vinegar, which all have various toxicities, which will each affect the Daphnia in different ways.

Research:

The division of the body into segments is not visible. The head is fused, and is generally bent down towards the body with a visible notch separating the two. In most species the rest of the body is covered by a carapace, with a ventral gap in which the five or six pairs of legs lie. ,The most prominent features are the compound eyes, the second antennae, and a pair of abdominal setae.Daphnia are often referred to water fleas but the daphnia is actually a crustaceans so they are more closely related to shrimp then to fleas. In many species, the carapace is translucent or nearly so and as a result they make excellent subjects for the microscope as one can observe the beating heart. Since daphnia are translucent they can be studied with ease. Daphnia' s hearts are very visible and can be observed for different reactions to different stimuli. Daphnia are often used to determine the effect of different toxins on an environment, (this process is called bio assay).Daphnia have a specific toxicity; daphnia do not thrive in acidic nor basic environments and since daphnia are freshwater dwelling creatures.The lifespan of a Daphnia does not exceed one year and is largely temperature-dependent. For example, some individuals can live up to 108 days at 3°C (37°F), while others live for only 29 days at 28°C (82°F). A clear exception to this trend is during the winter, when harsh conditions limit the population. Under these conditions, females have been recorded to live for over six months; they generally grow at a slower rate, but

are larger than those under normal conditions.

(picture is attached to back)

Hypothesis:

If Daphnia could maintain homeostasis in harsh environments like very basic, acidic, high or low concentrations of different types of solutes, then it can be considered an extremophile.

Procedure of the Daphnia Lab:

1) Got Daphnia from Scheman.

2) Found the average beats per minute of the daphnia (control group).

3) Started testing the effects of substances with different pH levels on the Daphnia's heart beat (baseline data).

4) The first substance we tested was: ammonia. When we dropped ammonia on the daphnia, the Daphnia died instantaneously.

5) Got new Daphnia...

6) The next substance we tested was vinegar. When we applied vinegar, the Daphnia would have died, but Logan intervened for further testing purposes.

7) After that, we put depressant on the daphnia and its heart rate was slowed down by a large percent. The daphnia' s would have most likely died (but its is unknown). Logan intervened for further testing purposes.

8) Then, we put the Daphnia in antacid. Coated in antacid, the Daphnia's heart rate speed up.

DAY 2:

9) On day two of the daphnia testing, we tested the toxicity of ammonia in relation to the Daphnia. The results went as follows:

-100% Ammonia- death on contact

-50% Ammonia- death after a minute

-25% Ammonia- heart rate slowed down to a near stop but did not die (daphnia was paralyzed)

-12.5 Ammonia- a livable condition but heart rate slowed down by 69.5 beats per minute from control

-6.25 Ammonia- the best condition we tested the heart rate only slowed down by 39.96 beats per minute.

Data Table:

Solution	BPM (Beats Per Minute) (Average)
Control (Pond Water)	276 (Normal living conditions.)
Vinegar	198 (Would have perished, but was saved by distilled water for other testing purposes.)
Depressant	140 (Still alive, heart rate extremely slow. Saved by distilled water.)
Antacid	418 (Heart rate extremely fast, but still living. Intervention with distilled water kept it alive.)
Ammonia (100%)	0 (Death on contact)
Ammonia (50%)	138 (Death after 1 minute, heart rate really fast then a dead stop.)

Ammonia (25%)	186 (Heart sped up then slowed down to almost a dead stop. The daphnia was not moving he was paralyzed.)
Ammonia (12.5%)	213.61 (This is a livable condition, a slightly slow heart rate though with a difference of 69.5 BPM.)
Ammonia (6.25%)	236.04 (This is a perfect amount of ammonia, the best livable condition we tested, with only a difference of 39.96 BPM.)

Analysis: The daphnia showed normal conditions in water and its heart rate was a healthy 276 beat per minute. The daphnia' s heart rate began drop once we placed it in vinegar to 198 and it probably would have died but Logan saved the daphnia for further testing purposes.The daphnia was next placed in depressant and its heart rate dropped drastically to 140 beats per minute but once again Logan save the for further testing purposes. The daphnia was then place in antacid and its heart rate rocketed to 418 beat per minute but Logan saved the daphnia for further testing purposes. The daphnia died immediately in 100% ammonia. The daphnia also died in 50% ammonia, but the daphnia survived for a minute with a low heart beat of 138 beats per minute. The daphnia was then placed in 25% ammonia and the daphnia survived with its heart beat sped up but then the daphnia became paralyzed and its heartbeat was almost zero. Then we placed the daphnia in 12.5% ammonia and the daphnia lived, but it was with a slightly slow heart rate. So, we put the daphnia in a 6.25% ammonia solution and it was the best possible conditions in ammonia that the daphnia could live in.

Conclusion:

Daphnia are great specimen to observe the various effects of different stimuli and because of this ease data, the data can be compiled for a large range of conditions and stimuli. The

daphnia lab leads to many great discoveries in how an organism attempts to maintain homeostasis. Homeostasis is the processes in which an organism tries to keep itself within a specific set of conditions. During our experiments we tested the daphnias ability to maintain homeostasis by placing the daphnia in various solutions that were either basic, acidic, hypotonic and hypertonic. The various daphnias that were tested seemed to not be able to sustain high concentrations of basic liquids, acidic liquids or basic solutions. Daphnia seem to have a very slight tolerance to acidic substances and a lesser tolerance to basic substances. The daphnia's reaction to the toxicity of ammonia led to its death when the percentage of ammonia in the environment was between 100% and 50%. The higher the levels of ammonia (which is a base) in the solution, the daphnia could not maintain its homeostasis. After 25% of ammonia in the solution (the solution is ammonia and dihydrogen monoxide) the tolerance to the base started to grow. At 25% the daphnia did not die; however, the daphnia became paralyzed and its heart rate dropped to a near zero. If we let the daphnia live for another two minutes, the daphnia would inevitably become a dead daphnia.The daphnia seemed to not be able to stand the harsh conditions, and with further testing it was clear that the daphnia was not an extremophile.The daphnia began to show stable living conditions at a dilution of 12.5% ammonia with only detriment of 69.5 beats per minute from our control beats per minute (the control was 276). Then we did one more test at 6.25% ammonia and that test was the best test at which the daphnia could maintain homeostasis, and the detriment was only by 39.96 beats per minute from the control group. The daphnia lives best in freshwater environments (they can achieve homeostasis). When the daphnia is placed in a hypertonic (the environment has a higher level of solute than the cell) solution of salt water; the daphnia died very quickly. The environment and the daphnias cells must reach dynamic equilibrium (Dynamic equilibrium is the point at which the object and the cell achieve a balance of both solute and water, however the water and solute still move in and out of the object and the environment) so that everything is at balance. The daphnia's cells give up their water so that there is an equal amount of water and solute in both the environment and the cells. The daphnia becomes dehydrated and that lead to its death. The daphnia does this to maintain homeostasis; the daphnia must keep the level of water and salt at a specific ranges and in the processes it leads to it own death. Daphnia must live in very specific conditions in order to

maintain homeostasis. The environment has to be just right, not too basic, acidic, or have a very high concentration of salt. The daphnia is a great test subject for many different substances. The test that we would like to run would be temperature test to see what kind of temperatures the daphnia prefers. The other not so orthodox test we would like to run would be placing the daphnia in pure mercury.