

Daphnia dissection



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Abstract

This experiment is designed to find out how drugs affect the heart rate. This experiment will use Daphnia in order to monitor the effects certain drugs have on heart rates. I will observe the changes in the heart rate of Daphnia when exposed to Caffeine, Ibuprofen, Alcohol, and Nicotine. I will have several separate samples of Daphnia in my study. Each community will be exposed to a different drug and observe how the heart rate of the Daphnia changes accordingly. I believe the Daphnia heart rate will increase when the Daphnia are exposed to Caffeine and Nicotine because both of these drugs are stimulants. I believe the Daphnia heart rate will decrease and slow down when the Daphnia are exposed to Ibuprofen and Alcohol. This experiment will show not only the effects of these drugs on Daphnia but also what they similarly do to the human body when it is exposed. Daphnia is used as a humane alternative to Humans when performing this type of experiment. The results on the Daphnia will be very similar to how the human heart would react if exposed to these drugs. Key Words Nicotine Alcohol Caffeine Ibuprofen Effects of Drugs Daphnia Magna Heart rate Drugs Heart

Introduction My experiment deals with the effects of different drugs on the heart rate of daphnia. I will focus on the daphnia's body itself first.

Then I will give information pertaining to the drugs used: Caffeine, Ibuprofen, Alcohol, and Nicotine. Daphnia is small crustaceans that live in the water. They are commonly called water fleas. Daphnia is freshwater zooplankton and consumes phytoplankton and some other zooplankton as well. The daphnia's bodies are transparent and their internal structures can easily be seen. The heart is the internal organ I focused on within the daphnia. The

heart can be easily seen within the body cavity of the daphnia which made it easy to find and easy to count the heartbeat. Caffeine is a very important drug to consider because 90% of American consumes caffeine on a daily basis. Half of all Americans consume more than 300 mg of caffeine a day which makes it America's most consumed drug to date. Caffeine is found in coffee, soda, tea, chocolate, etc. Caffeine is known as trimethylxanthine in the medical community. Caffeine can be used as a cardiac stimulant and also as a mild diuretic. Cardiac stimulants increase the heart rate, and diuretics increase urine production. Caffeine is a very addictive drug and operates just like amphetamines such as cocaine and heroin.

Caffeine not only stimulates the heart of humans but also the heart of daphnia. Ibuprofen is commonly used to relieve pain, tenderness, swelling, and stiffness caused by arthritis. It is also used to relieve mild to moderate pain in the body and reduce fever. Ibuprofen is called an NSAIDs. It works by stopping the body's production of a substance that causes pain, fever, and inflammation. Ibuprofen is most often used to treat arthritis. Alcohol is often used as a solvent in medical drugs, because of its low toxicity and ability to dissolve non-polar substances. Ethanol is often used as an antiseptic, to disinfect the skin before injections are given. When processed correctly Alcohol is drunk in recreation. Alcohol affects the body as a nervous system depressant (Wong 1997). Nicotine like caffeine is a stimulant. This stimulant is found in cigarettes. Cigarettes contain 8 to 20 milligrams of nicotine but when smoke only 1 mg of nicotine actually enters the body. Nicotine can have two effects on the body, it can relax a person or it can stimulate a

person, this is based on the amount and the regularity of smoking or nicotine intake.

Nicotine works by causing a release of adrenaline into the body. Statement of the Problem How do certain drugs affect heart rate? Objective/Hypothesis Statement This experiment is designed to find out how drugs affect heart rate. This experiment will use Daphnia in order to monitor the effects certain drugs have on heart rates. I will observe the changes in the heart rate of Daphnia when exposed to Caffeine, Ibuprofen, Alcohol, and Nicotine. I will have several separate samples of Daphnia in my study. Each community will be exposed to a different drug and observe how the heart rate of the Daphnia changes accordingly. i. e. Foster 1997 I hypothesize that the Daphnia heart rate will increase when the Daphnia are exposed to Caffeine and Nicotine because both of these drugs are stimulants. I hypothesize the Daphnia heart rate will decrease and slow down when the Daphnia are exposed to Ibuprofen and Alcohol.

I used a modified version of the experiment performed by Jasmine Kamai and Varner Allbrett when they studied the effects of Kava on the heart rate of Daphnia. My procedure is as follows: Before beginning my experiment I must mix the drug solutions to be used. First I will dissolve ibuprofen and caffeine tablets into a solution of water in two different containers, that I will later determine what strength to make each. I will also tear open cigarettes and mix the tobacco with water and let sit for 24 hours after which I will drain the water off into a container which will make up my nicotine solution. For alcohol, I will just mix vodka and water to the desired strength in a 4th container. Next, I will cipher out daphnia and drop it onto a slide to be

viewed under a microscope. I will record its normal heart rate. Next, I will add a drop of the alcohol solution and over the next 5 minutes, I will record the changes in heart rate after one minute of exposure, 3 minutes of exposure and then 5 minutes of exposure. After recording my results I will dispose of this Daphnia. I will do this same portion of the experiment with two more daphnias. I will then continue with this procedure while using the other three drugs. I plan to use the lab facilities in the Biology Building on Tennessee Tech's Campus. Along with most of their lab equipment including a microscope, slides, vials, Petri dishes, droppers, and other equipment.

Materials Water Depression Slides

Cover slips

Droppers Daphnia Magna Microscope Watch Petri Dishes Daphnia Anatomy Chart Cigarettes 80 proof vodka No-dos Ibuprofen tablets Expected Results and Benefits After performing this experiment I expect to find that the Daphnia's heart rates will increase with Nicotine and Caffeine because both of these drugs are stimulants and that the Daphnia's heart rates will decrease with Alcohol and Ibuprofen solution. This experiment will show not only the effects of these drugs on Daphnia but also what they similarly do to the human body when it is exposed. Daphnia is used as a humane alternative to Humans when performing this type of experiment. Heart Rate of Daphnia when exposed to Caffeine and Alcohol Change in Heart Rate of Daphnia when exposed to Caffeine Change in Heart Rate of Daphnia when exposed to Alcohol Discussion After performing my experiment I found that Daphnia Magna heart rate greatly increases when exposed to Caffeine.

Caffeine is a stimulant and should produce that effect. Caffeine has similar effects on humans.

The heart rate increased anywhere from 10 to 20 beats per minute. As seen in my data table the heartbeats sometimes jumped from a normal heartbeat in the 80s to a heartbeat in the 100s when exposed to caffeine. Gerald Adams also found the same result when he tested his hypothesis. I also found that Daphnia's heart rate slightly increased with exposure to Alcohol. The heart rate does not have as drastic a change when exposed to Alcohol as it did when exposed to Caffeine. The heart rates just increased by about 5 to 10 beats per minute. As seen in my data table the heart beats only jumped from a normal heartbeat in the 80s to a heartbeat in the 90s when exposed to Alcohol. This was disproved by several different experiments. Wong found that the heart rate of daphnia decreased. Since alcohol is a depressant it should have lowered the heart rate of daphnia. I feel that the increase in stress on the Daphnia may have caused this time of increase. When Daphnia is exposed to Nicotine and Ibuprofen, the heart rate of the daphnia could not be seen as any different. Although Cluevers said that there should be a change in the heart rate. Conclusion In conclusion I have determined that the heart rate of Daphnia can be affected by adding different drugs. Daphnia heart rate increased by ten to twenty beats per minute when exposed to Caffeine. Daphnia heart rate increased by five to ten beats per minute when exposed to Alcohol. Unfortunately, the results for Ibuprofen and Nicotine could not be seen. There was not enough evidence to determine how the Heart rate changed when the Daphnia were exposed to Ibuprofen

and Nicotine. By doing this experiment it can be assumed that some of the same reactions could be found if Humans are exposed to these Drugs.

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