Lab report daphnia heart rate

Laboratory 3 Scientific method goals · Understand the steps included in the scientific method · Define and identify: independent, dependent and control variables · Calculate Daphne's heart rate under different experimental conditions · Analyze the obtained data · You draw conclusions about the different variables tested and Daphne's heart rate information All areas of science have one unifying principle that is a common link between these different scientific disciplines. This unifying theme is a scientific method . The scientific method is simply an organized, methodical and structured way of observing and/or researching the situation in an effort to find information about what is being observed. There are six steps to the scientific method. 1. Determining the situation to be investigated. This is vital because there is no work to be done to understand the situation unless it is known exactly what is being investigated. Let's consider the example. Suppose you notice (observe) a list of essential nutrients on the label of a box of plant fertilizer. You wonder how this could affect plant growth if plants are deprived of only one of these essential nutrients. Decide to investigate the effect of potassium deficiency on pepper plants. 2. Get information about the situation being investigated. One of the biggest advantages in solving problems is knowing background information about what is being investigated. For this reason, researchers search scientific literature when writing work or conducting research. Accordingly, you would go to the library and read as much as you could about plant nutrition and how potassium affects plant growth. 3. Hypothesis formulation. The hypothesis is a possible explanation of the problem or situation only on the basis of what is known about it so far. The hypothesis must be tested: the experiment must be designed to test its validity. Another important characteristic of the hypothesis is that it must be forged. This means that the hypothesis must make predictions that could prove false to experimental results. Your first hypothesis may be: Plants grown in a medium that lack potassium will show some specific signs of malnutrition. 4. Anticipate the results. Assuming your hypothesis is correct, you should be able to predict the outcome of a situation where your hypothesis has actually been applied to the problem. Now you can try to imagine what a pepper plant would look like when grown in a medium without potassium. There may be obvious changes in the leaves and/or height of the stem. 5. Design and conduct an experiment to test the hypothesis. The experiment is a study conducted in very specific conditions in which all variables except the one studied are controlled. A variable is an event or condition subject to change. In a potassium study, potassium deficiency is a variable being investigated. If, at the end of the experiment, the hypothesis found to be wrong and can then be modified, further tested or discarded al more. The scientific method usually results in a long series of repeated testing and modification of hypotheses. The hypothesis can never be unequivocally proven correct. With more and more experimental evidence to support this, the hypothesis is gradually evolving into more and more valid for a situation or problem. The evolution of the hypothesis is based on conducting experiments, observing, collecting data, etc., all of which are done to investigate the validity and challenge the hypothesis under consideration. The design of experiments to test hypotheses requires considerable thought. Variables must be identified, appropriate measures developed and influences beyond experimental variables must be controlled. An independent variable is one that will change during an experiment; That's what caused it. A dependent variable is an effect; should be changed due to a change in the independent variable. Controlled variables are also identified and constantly kept throughout the experiment. Their impact on the dependent variable is unknown, but it is postulated that if kept constant they cannot cause changes in the dependent variable and confuse the interpretation of the experiment. For example, suppose you grow plants with the intention of studying how the amount of water affects their growth. In this case, an independent variable would be the amount of water provided (the variable you deliberately change). An addictive variable could be the length of the stem (that is, which changes as the amount of water changes deliberately), and controlled variables would include the quantity and quality of light provided, temperature, minerals and so on. Going back to the initial experiment on the role of potassium in pepper plants, you can conduct your experiment based on a technique discovered in literature search. You can grow your pepper plants hydroponic (in water with plant nutrients and without soil). In your experiment, you would have two groups of plants, each group consisting of six pepper plants of the same variety and all of them of the same age, size and general health status. In addition, both groups of plants would be grown under exactly the same environmental conditions of heat, light, tank size, etc. It is important that all conditions (except the one being investigated, potassium) are exactly the same for both groups. The only difference between the two groups is that one will be grown with complete nutrients, the other with all the nutrients except potassium. When your experiment is done, plants should be allowed to grow for several weeks, after which the plants would be compared. In this design, plants growing in a complete nutrient solution serve as a control group, which is the group that forms the basis for judging any differences that may occur in the experimental group, grown without potassium. Control is essential in any experiment because it reveals all the differences in the experimental situation. 6. Form a conclusion based on the results. The validity of the hypothesis may or may not be established. Either the results of the experiment support the hypothesis or the results show that the hypothesis needs modification. If you found that control plants are lush and green with an increase in height of three inches from the beginning of the experiment, and experimental plants that do not have an increase in height, that they have weak stems and have yellowish leaves with brown spots, you would support your hypothesis. The experiment does not prove that your hypothesis is correct beyond any shadow of doubt. What the experiment shows is that under the conditions of the experiment it seems necessary potassium, and the hypothesis is supported. The scientific method is neither complicated nor frightening – nor unique to science. It is a powerful tool of logic that can be used each time by a problem or question about the fundamental nature of something. In fact, we all use elements of the scientific method every day to solve small problems, but we do it so quickly and automatically that we are not aware of the methodology. In short, the scientific method consists of observation, prediction, testing and interpretation. Today's experiment will be based on observations of the American way of life of the twentieth century. You've probably noticed that when people drink too much coffee, they're often hyperactive. I can be nervous, nervous and complain that I can't relax. On the other hand, often when people consume alcoholic beverages, their speech can become slurred, they can lose control of muscle coordination, and their reactions can be slowed down. You'll be looking at the effect of alcohol and caffeine on Daphnia magna, a small water crab. You will assess the effects of these drugs by measuring the heart rate of Daphnia when exposed to different concentrations of alcohol and caffeine. NOTE: All organisms are classified by Latin names that specifically identify them. You always need to identify the organism by its proper scientific name so that other scientists know what you're talking about. You must also remember that you always resemble or underline the Latin names (genus and species) of organisms EVERY TIME YOU USE THEM! The advantage of studying Daphni is that they are almost transparent. You can see heart rate, bowel squeezing action, muscle movements and occasional babies in a litter bag. Also, since Daphnia is a small, aquatic organism, it makes an excellent object for studying the effects of drugs on circulation. Even if you have carefully performed all your experiments, you can not be sure that the effect you see is due to medications. Perhaps the change in heart rate that you can observe between alcohol and caffeine is caused by the warmth of microscopic light, may be affected by removing or adding a solution. Without a control experiment, your data is meaningless. You will start the experiment by performing control procedures and getting a base pulse for Daphne before she is exposed to drug solutions. Activity 3-1: Control procedure The control process must be performed exactly as the experimental procedure is. The only difference is that the variable is omitted. In this case, this means that alcohol and caffeine are not added. 1. Catch a living Daphne and put her in a small drop of water on a depression landslide. To easily observe and study Daphnia, you will need to get 3 strands and arrange the threads on the slide around Daphne to limit it to a small area (Figure 3-1). Fig. 3 - 1 Set your depression slide with threads as indicated in the image. The black spot represents Daphnia. This arrangement will limit Daphnia in a small area and make it easier for you to identify Daphnia's heart. 2. Observe Daphne under the LOWEST POWER TARGET on a complex microscope. 3. Using fig 3-2 as a reference, find the following structures: · The most obvious structure is the eye. · The brain is a bright-colored organ that lies above the eye. Pairs of antennae protrude from the head. They are used for locomotion and feel the environment. · Inside the exoskeleton are five pairs of legs. Combs like gills are attached to some legs. When the legs hit forward, they bring a jet of water over the gills and rinse the pieces of food to the mouth, which is located just below the beak. · From the mouth of the esophagus flows to the head, and then down into the body, where it spreads into the stomach, which connects to the intestines. · The heart lies in the upper part of daphnia (above the digestive tract), it is a clear structure and will quickly become infected. Before proceeding to the laboratory you will need to take some time observing Daphnia and make sure you can find the heart. · In females, behind the heart there is a large brood chamber. It will usually contain eggs, but occasionally it can be filled with baby Daphnia. A bag of litter is unlikely to be present in most of Daphne's. 4. Working in pairs, one person should monitor the time while the other person counts the heart rate in 15 seconds. Heart rate in healthy Daphne will be very fast (3-5 beats per second). 5. You will take 3 readings of normal Daphnia heart rate. After every 15 seconds of observation, you need to absorb water from the slide using KimWipe. To do this, gently place KimWipe on one edge of the water and all the water will be absorbed. Antennae Eye Anus Heart Gut Egg Ovary Drawing by Carlos Pacheco - Perez, 2004 Figure 3-2. Use this image as a reference to locate the indicated structures and organs in Daphne. 6. As soon as the water disappears, use a plastic transfer tube on the tray to add another drop distilled water in Daphnia and count heart rate for the next 15-second observation period. It is important not to allow Daphnia to dry. However, you need to absorb distilled water between each 15-second reading as this will be the same procedure you will follow when testing different solutions of alcohol and caffeine. To maintain good scientific practices, you need to follow exactly the same control process as for the experiment. 7. When you finish measuring the control, leave Daphne in a drop of water. 8. Record your data in table 3-1 as control values and calculate the number of beats per minute. One way to do this is to use the ratio. For example, if you count 10 beats in 15 seconds, the calculations are as follows: X beats = 10 beats X = 600 60 seconds 15 seconds; 15 or 40 beats/minutes Another (simpler way) is to count the beats for 15 seconds and multiply that by 4. Calculate the average heart rate of Daphne per minute. Table record 3-1. Applying the scientific method: Make sure you read the introduction to the lab before trying to answer these questions. Now you will begin to test daphne's reaction to different concentrations of caffeine and alcohol solutions. All tests will be performed by every couple of students in the lab. Before you start the experiment, answer the following questions (A-E) that ask you to apply a scientific method to this experiment. If you need more space to respond, you can use a separate sheet of paper to continue answering these questions: A. Identify the situation you are investigating. B. Where can you get information about the situation you are investigating? What kind of information would you be looking for? C. What variable do you think is an independent variable (one that is diverse to call for an answer)? What variable do you think is the dependent variable (the one that is the effect)? What variables will be controlled and how will they be controlled? D. What do you think will happen in this experiment? Predict what results are possible; what do you think can realistically happen in this experiment. Activity 3-2: Daphnia heart rate measurement in two different conditions 1. Use KimWipe to absorb water in a depression slide. Put one drop of 1% alcohol on Daphnia. Wait 1 minute, then count your heart rate for 15 seconds. Record the data in table 3-1. 2. After counting your heart rate by 15 seconds, absorb a solution of 1% alcohol using KimWipe as you did earlier. Immediately add 3-5 drops of distilled water to Daphne and monitor your heart rate. It is very important that Daphnia you get time to recover and allow your heart rate to return to normal between each different solution. Turn off the microscope and wait 3-5 minutes. Why is this an important step? 3. When the heart rate reaches the average speed observed in the control experiment, you are ready to continue Absorb distilled water with KimWipe and add a drop of 3% alcohol. Wait 1 minute and count your heart rate for 15 seconds. Note the results in table 3-1. 4. Quickly absorb a 3% alcohol solution with KimWipe and add 3-5 drops of distilled water and repeat step 2. When the heart rate returns to normal, continue this process using a 5% alcohol solution. Record your data from these tests in Table 3-1. 5. At the end of a series of alcohol tests, swap 1% and 2% caffeine solutions for alcohol concentration solutions and repeat the tests. Be sure to remove the caffeine solutions, add water to Daphnia and let the heart rate stabilize between caffeine solutions. Note the results in table 3-1. 6. When you're done with the caffeine batch, let your Daphnia recover in water. Table 3-1. The results of a series of alcohol and caffeine tests. Beats/15 sec experiment. BPM (beats per minute.) (average class results) Control 180 Alcohol 1% 166 Alcohol 3% 150 Alcohol 5% 129 Caffeine 1% 112 Caffeine 2% 152 Analyzing the results of data from experiments must be presented in a clear, scientific way. The first lab of the class is the time to learn this step. If tables and charts are well constructed, they provide a concise summary and allow the reader to see key results of the experiment at a glance. Use graph paper to plot your results. Create a chart Follow these steps to plot your data with graph paper included in the laboratory manual: 1. Decide which variable is a dependent variable and which is an independent variable. A dependent variable is a variable you know as a result of experimental measurements. An independent variable is information you know before the experiment began. It does not change as a result of a dependent variable, but changes independently of another variable. 2. Always place the independent variable on the x-axis (horizontal axis), and the dependent variable on the y-axis (vertical axis). 3. Always select the ax with a few words that describe the variable and ALWAYS INCLUDE VARIABLE UNITS in parentheses after a variable description. 4. Select the appropriate scale for the dependent and independent variable so that the highest value of each of them fits on the graph paper. 5. Plot data set (y values for certain x values). In this case, you will have 3 charts: one that includes the results of the alcohol test series, one that includes the results of a series of caffeine tests and one that includes the results of the Experimental Beverage series. However, remember that all of these charts should have the same scale so that you can compare three charts and that all three should include the average control value. 6. You can choose to draw bar graphs. If you want to draw line charts instead, draw smooth curves or straight lines to match the values plotted for any data set. A smooth line or curve through a set of points is on average from the chance of variability in the data. 7. Each graph should have a legend, a sentence that explains what it is about and the title !!! Interpretation and conclusions One of the most important features of scientific research is the exchange of information. Scientists publish experimental results to make them known to others, and include their interpretations of what these results mean. Write a brief, single paragraph, discussion of this experiment, making sure that you do not let preconceived terms interfere with objective analysis. Also be sure to use proper grammar and complete sentences in this discussion. Further experiments The scientific method is a continuous cycle of Q&A. A good experiment not only answers the question originally asked, but also raises further questions. List as a final task several questions posed by this experiment and procedures that could be used for testing. Cleaning Restore all materials and solutions and clean your work area according to the direction of your laboratory instructor. References: 1. Dolphin, W.D., Biological Research: Form, Function, Diversity and Process, 6. Jacklet, A., Laboratory Manual for Accompanying Life, 1998, McGraw Hill company 3. Skavaril, R., Finnen, M., Lawton, S., General Biology Laboratory Manual, Life Phenomena Research, 1993, Harcourt College Publishers Picture : Shows effect of alcohol concentration on Daphnia heart rate Alcohol Bar Graph 0 1 3 5 180 166 150 129 Daphnia heart rate (BPM) 3-2 3-9 3-9 3-9