Scientific Method Practice

Breath Mints

Mr. Novak created a secret ingredient for a breath mint that he thinks will "cure" the bad breath people get after waking up. He asked 100 people with a history of bad breath to try his new breath mint. He had fifty people (Group A) eat the new breath mint after they woke up. The other fifty (Group B) also received a breath mint after they woke up; however, it was just a regular breath mint and did not have the secret ingredient. Both groups were told that they were getting the breath mint that would cure their bad breath. Two hours after eating the crabby patties, thirty people in Group A and ten people in Group B reported having better breath than they normally had after waking up.

1. Which people are in the control group?

2. What is the variable?

3. What should Mr. Novak's conclusion be?

Clean Pants

Mr. Novak noticed that his favorite pants were not as clean as they used to be. His wife told him that he should try using Clean-O detergent, a new laundry soap she found on pinterest.

Mr. Novak made sure to wash one pair of pants in plain water and another pair in water with the Clean-O detergent. After washing both pairs of pants a total of three times, the pants washed in the Clean-O detergent did not appear to be any cleaner than the pants washed in plain water.

4. What was the problem Mr. Novak wanted to investigate?

5. What is the variable?

6. What should Mr. Novak conclusion be?

2. You are conducting an experiment to determine if increased ultraviolet radiation from the decrease in the ozone layer is killing off frog tadpoles. After examining all of the data available in the library, you decide to go with a hypothesis that increased ultraviolet radiation from the sun is killing off the tadpoles.

You design an experiment with a control and an experimental group. Group 1 involves 100 tadpoles in a five gallon container of water, which is covered by glass (knowing that the glass will filter out the ultraviolet radiation). Group 2 will be set up exactly like group 1, except that instead of being covered with glass, it is covered with an acrylic plexiglass, which will not filter out the U.V. radiation. You then place the groups outside for a period of a month, and observe the results.

Results

	Group 1	Group 2
Number of tadpoles started with	100	100
Number finished	96	96

Using this information, answer the following questions.

a. What is the independent variable and what is the dependant variable?

b. Does the information from this experiment support the hypothesis?

c. If no, then what might be causing the decrease in frog populations?

d. Which is the control group, and which is the experimental group?

e. What is the difference between the two groups? Should they be different in any other way?

1. Niko Tinbergen (1907-1988) was a Swedish Ethologist (animal behaviorist) famous for studying animals in their native habitats. One of his classic experiments involved a bird called the black-headed gull (*Larus ridibundus*). Black-headed gulls build nests of twigs on the ground and lay light brown eggs that are covered with dark brown spots. However, the inside of the egg is white in color. Tinbergen noticed that adult gulls pick up the eggshells shortly after a chick has hatched, and fly them to a location far from the nest, where they are left. Since this behavior required expending energy and time that could have been spent feeding and protecting the chicks, Tinbergen wanted to know why the birds did this.

Problem: Why do black-headed gulls remove eggshells from the nest?

Hypothesis: The white interior of the shell is not camouflaged and attracts predators to the nest.
Therefore, the gulls remove the shells to decrease predation.

Test: Tinbergen and his co-workers collected gull eggs and painted 69 of them white and left 68 of them with their natural color. (Statistically, these numbers are close enough to be considered equal.) The researchers then scattered the eggs next to a gull breeding area and observed from a nearby blind. Predation rates were recorded for white versus natural colored eggs.

Data:	**Original Number of Eggs**	**Eggs Taken by Predators**
White Eggs	69	43
Natural Eggs	68	13

a. Do the results of this experiment support the hypothesis? Why, Why not?

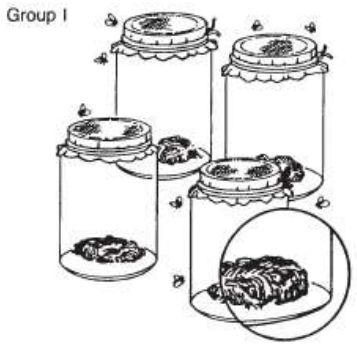
b. Are you 100% sure (without a doubt) that your hypothesis is correct? (Is it proven?) Explain.

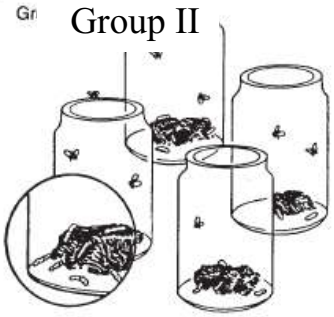
c. If you were working with Tinbergen, what would you suggest be done next?

d. Identify the independent and dependent variables

Long ago, many people believed that living things could come from nonliving things. They thought that worms came from wood and that maggots came from decaying meat. This idea was called spontaneous generation. In 1668, an Italian biologist, Francesco Redi, did experiments to prove that maggots did not come from meat. One of his experiments is shown below.

Group I





Redi placed pieces of meat in several jars. He divided the jars into two groups. He covered the first group of jars with fine cloth. He left the second group of jars uncovered. Redi observed the jars for several days. He saw flies on the cloth of the covered jars, and he saw flies laying eggs on the meat in the uncovered jars. Maggots appeared only on the meat in the group of jars left uncovered.

Questions

1. What was the problem in Redi's experiment?

2. What do you think his hypothesis was?

3. How did he test his hypothesis?

4. What was the variable in his experiment?

5. What do you think Redi's conclusion was?

3. Honeybees play an important role in agriculture, by pollinating at least 90 different species of food plants, worth about 15 billion dollars in the U.S. alone. As a result, beekeeping or *apiculture*, is a multi-million dollar business. However over the last year, honey bee populations are crashing (Colony Collapse Disorder) with hives dying off in less than a week, without an obvious cause. Ian Lipkin a senior researcher in the Epidemiology (infectious disease) Department of Columbia University's Mailman School of Public Health believed the cause to be a pathogen (virus, bacteria or fungus) of some sort. Use the information given to answer the following questions.

a. What is the hypothesis (Hint, it is already given)?

b. Help Dr. Limpkin design an experiment to test this hypothesis. (Be sure you can explain how you are going to conduct the test and predict what the results will be if they support the experiment.) You are **not** to create the data for your results section.

c. If your hypothesis is to be supported, what should the data indicate?

d. If your hypothesis is disproven, what should the data indicate?