**Famous Examples of the Scientific Method**

**Introduction**

The scientific method is not a new idea; it has been utilized by generations of scientists. This activity will introduce you to some of the most famous scientific experiments and discoveries – ones that continue to influence our lives even today! See if you can identify the different parts of the scientific method and experimental design in each.

**The Strange Case of BeriBeri**

In 1887 a strange nerve disease attacked the people in the Dutch East Indies. The disease was called “beriberi”. Symptoms of the disease included weakness and loss of appetite, victims often died of heart failure.

***Experiment #1:***

******Scientists thought the disease might be caused by bacteria. They injected chickens with blood from patients with the beriberi disease. The injected chickens became sick. However, so did the other group of chickens that were not injected with bacteria.

1. What was the initial hypothesis in this example?
2. A hypothesis is always based on prior knowledge, research, or observation. What do you think scientists based this hypothesis on?
3. What **independent variable** were the scientists studying in this case? What **dependent variable** were the scientists measuring?

1. What was the **experimental group** in their study? What was the **control group**?
2. Why is a control group important? What conclusion might the scientists have reached if they did not use a control group in this example?
3. Would this first experiment be considered a failure? Explain why or why not.

***Experiment #2:***

One of the scientists studying Beriberi was named Dr. Eijkman. He realized that before the experiment, all the chickens had eaten whole-grain rice, but during the experiment, the chickens were fed only polished rice. Dr. Eijkman researched this further by testing two new groups of chickens. One group was fed the polished rice, the other group was fed the whole-grain rice. Only the polished rice chickens got the illness. As a result, he believed that the polished rice was missing a nutrient needed to prevent the disease.

1. What **observation** did Dr. Eijkman make during the first Beriberi experiment?
2. What **independent variable** was Dr. Eijkman studying in this case? What **dependent variable** did he measure?
3. What was the **experimental group** in this study? What was the **control group**?
4. Explain what Dr. Eijkman would need to do next in order to share his discovery with other scientists and have his conclusions be considered valid.

**The Discovery of Penicillin**

In 1928, Sir Alexander Fleming was studying Staphylococcus bacteria growing in culture dishes. He noticed that a type of mold called Penicillium was also growing in some of the dishes. A clear area existed around the mold because all the bacteria that had grown in this area died.

***Experiment #3:***

Fleming thought that the mold must be producing a chemical that killed the bacteria. He decided to isolate this substance and test it to see if it would kill bacteria. Fleming transferred the mold to a liquid broth solution. This solution contained all the materials the mold needed to grow. After the mold grew, he removed it. He then grew two identical groups of bacteria. He then took the mold-infused broth and added it to of the groups of bacteria. Those bacteria died. Fleming then added a liquid broth that did not contain mold to the second group of bacteria. This group survived.

1. What **independent variable** were the scientists studying in this case? What **dependent variable** were the scientists measuring?
2. What was the **experimental group** in their study? What was the **control group**?
3. When an experiment is designed, all variables between the experimental group and control group must be held **constant**. How did Fleming’s experimental design meet this requirement?

**Spontaneous Generation**

From the time of the ancient Romans, through the Middle Ages, and until the late nineteenth century, it was generally accepted that some life forms arose spontaneously from non-living matter. Such "spontaneous generation" appeared to occur primarily in decaying matter. For example, a seventeenth century recipe for the spontaneous production of mice required placing sweaty underwear and wheat in an open-mouthed jar, then waiting for about 21 days, during which time it was alleged that the sweat from the underwear would penetrate the husks of wheat, creating mice.

***Experiment #4:***

The first serious attack on the idea of spontaneous generation was made in 1668 by Francesco Redi, an Italian physician and poet. At that time, it was widely held that maggots arose spontaneously in rotting meat. Redi believed that maggots developed from eggs laid by flies.

Place yourself in the role of Francesco Redi. Design an experiment that will test this idea. Remember, you are challenging an idea that has been accepted for *hundreds of years*! You must follow the scientific method closely, account for all variables, and carefully document your procedure to have a chance at disproving this theory!

1. State a hypothesis. Remember to include the **variable** you are testing and a **prediction** of the effects of this variable.
2. Write a step-by-step procedure for this experiment. Include an **experimental group** and a **control group**. Remember that every variable should be held constant between your two groups except the one you are testing. This even includes exposure to air!