

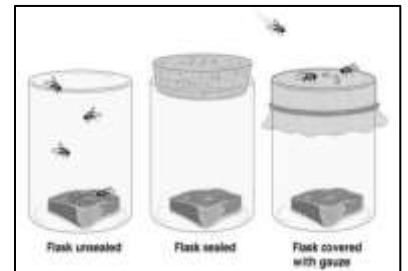
## The Swan Neck Flask Experiment & the Theory of Spontaneous Generation

### Spontaneous Generation

For most of history, humans have believed that life could come from nonliving things, such as mice from corn, flies from cow manure, maggots from rotting meat, and fish from the mud of previously dry lakes. The theory that nonliving things are capable of producing life is known as *spontaneous generation*.

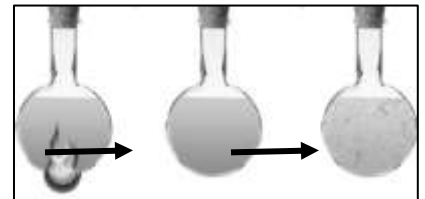
### Redi's Experiment and Needham's Response

In 1668, Francesco Redi, an Italian scientist, designed an experiment to test the spontaneous creation of maggots by placing fresh meat in each of three different jars. One jar was left open; a second jar was sealed; a third was covered with a cloth. Days later, the open jar contained maggots, but the covered jars contained no maggots.



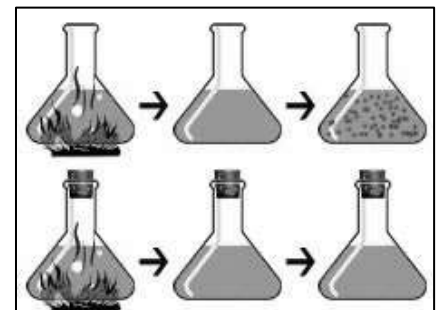
He did notice maggots were found on the outside of the cloth that covered the jar. Redi showed that the maggots came from fly eggs and thereby helped to disprove spontaneous generation. Or so he thought.

In England, John Needham challenged Redi's findings by conducting an experiment in which he placed a broth into a bottle, heated the bottle to kill anything inside, and then sealed it. Days later, he reported the presence of life in the broth and announced that life had been created from nonlife.



### Spallanzani's Experiment

Lazzaro Spallanzani, also an Italian scientist, reviewed both Redi's and Needham's data and experimental design and concluded that perhaps Needham's heating of the bottle did not kill everything inside. He constructed his own experiment by placing broth in each of two separate bottles, boiling the broth in both bottles, then sealing one bottle and leaving the other open. Days later, the unsealed bottle was teeming with small living things that he could observe more clearly with the newly invented microscope. The sealed bottle showed no signs of life and did not support the theory of spontaneous generation.



However, critics said Spallanzani had deprived the closed bottle of air, which they said was necessary for spontaneous generation. So although his experiment was successful, a strong rebuttal weakened his claims.

### Our Purpose

We will perform an experiment in class to settle the debate over the validity of the theory of spontaneous generation, or the ability of living things to come from nonliving things.



Name \_\_\_\_\_ Block \_\_\_\_\_ Date \_\_\_\_\_

## Swan Neck Flask (Spontaneous Generation) – Experimental Design Guide

### PURPOSE AND PREDICTION

- Restate the **question**. What debate are you trying to settle?
- **Hypothesis** (Write a possible answer to the question above).
- Why do you believe your hypothesis is true?
- **Prediction** (If your hypothesis is true, **what will happen to the experiment to each flask?**)
  - The open flask will \_\_\_\_\_  
because \_\_\_\_\_
  - The closed flask will \_\_\_\_\_  
because \_\_\_\_\_
  - The swan neck flask will \_\_\_\_\_  
because \_\_\_\_\_

### EXPERIMENTAL DESIGN

- Identifying **Variables**
  - Independent variable (What is different on purpose among the flasks?):
  - Dependent variable (What will we be looking for at the end of the experiment?):
- **Control** - Which flask is the standard, “comparison” flask? **Explain.**
- **Constants** - What factors (at least **three**) are the same among the flasks?

### CONDUCTING THE EXPERIMENT

- **Materials** (Be as detailed as possible so the experiment could be repeated. Look at the demo. List at least **6 different items**.)
- **Procedure** (Be as **detailed** as possible so the experiment could be repeated. What did the teacher do during the demo? List **at least 4 steps**. Do not include “Get materials” or “Set up experiment.”)