Module 3: Cell Biology - Structure and Function
Topic 2 Content: Spontaneous Generation Scientific Investigation

Before you begin the scientific investigation below, make sure to download the *Spontaneous Generation Scientific Investigation Report*. As you complete this scientific investigation, fill in any needed information on the report template. If you need more information about each section of the report, please visit the Developmental Module.

Introduction

The idea that life sprang from non-life was believed by many until the middle of the 17th century. Even after experiments performed by Francesco Redi demonstrated that large organisms could not appear from nothing, scientists were unclear about how microbes were formed. However, Louis Pasteur's work showed that microbes do not appear spontaneously either. In this lab, you will simulate how Pasteur disproved the spontaneous generation of microbes.

Objective

In this scientific investigation, you will:

- simulate an experiment of Louis Pasteur to determine if life can arise from non-life.

Hypothesis

Using the **Procedure and Data Collection** section below, read through the procedural information for this scientific investigation. Based on your understanding of the procedure, develop your own hypotheses which describe your expected results. You should consider the following questions: what will become of the broth exposed to different conditions? What will this prove or disprove about spontaneous generation? Record your hypotheses in the **Hypothesis** section of your *Spontaneous Generation Scientific Investigation Report*.

Equipment and Materials

- Apron
- 500 mL Beef broth
- 250 mL Bleach
- 500 mL Chicken broth
- Large pot
- Rubber gloves
- Safety Goggles
- 4 Small glass jars with lids and seals
- Stove top
- Tongs

Safety Precautions

This scientific investigation requires the use of a stove top and boiling water. In addition, it requires the use of bleach. Make sure to conduct this scientific investigation under the supervision of an adult AND in a properly ventilated area. In addition, make sure to use all safety apparel and equipment as advised in the **Procedure and Data Collection** section.

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Procedure and Data Collection

1. Gather all of your materials. Put on your apron, gloves, and safety goggles.
2. Fill the large pot 3/4 full with water, leaving enough room to add the jars and lids without overflowing the pot.
3. Pour the bleach into one of the glass jars.
4. Place the pot on a stove top and bring the water to a boil.
5. Using the tongs, submerge the jars and lids into the boiling water.
6. Boil the small jars and the lids for 10 minutes in order to sterilize them.
7. Dip tongs and the fingers of your rubber gloves in the bleach.
8. Use the tongs to remove the jars and lids from the pot and set them on a heat-proof surface. Make sure not to touch the jars or the lids with anything else but the sanitized tongs or gloves.
9. Pour 250 mL beef broth into two different jars.
10. Pour 250 mL chicken broth into two different jars.
11. Place the seals and lids on all of the jars.
12. Using the tongs, place all four jars back into the pot of boiling water.
13. Boil all four jars filled with broth in the large pot of water for 10 minutes to sterilize them.
14. Use tongs to remove the jars from the pot.
15. Allow broth to cool completely.
16. After the broth has cooled completely, remove the lids from one of the jars containing beef broth and one of the jars containing chicken broth.
17. Place all four jars out of direct sunlight and away from any drafts. Make sure that the jars are located in an area where they will not be disturbed.
18. Observe the jars every day for two weeks, recording your observations in the **Data** section of your *Spontaneous Generation Scientific Investigation Report*.

Data

Use the table provided in the **Data** section of your *Spontaneous Generation Scientific Investigation Report* to record your data from this scientific investigation. The data table is also shown below:

Day	Beef Broth		Chicken Broth	
	Observation for Jar Without Lid	Observation for Jar With Lid	Observation for Jar Without Lid	Observation for Jar With Lid
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				

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Data Analysis

In the **Data Analysis** section of the *Spontaneous Generation Investigation Report*, provide responses to the following questions.

1. Describe your observations in each of the four jars at the end of two weeks.
2. Which conditions were more conducive to the growth of microbes in the broth?
3. Compare your results with Pasteur's findings. Were you able to replicate Pasteur's results? Why is that important?
4. Explain how your findings disprove spontaneous generation.

Conclusion

Using the **Conclusion** section of the *Spontaneous Generation Investigation Report*, compose three to four sentences describing an overall conclusion based on your data. Write an explanation about how Pasteur's work is related to the theory of biogenesis, as well as to the cell theory. Use the data and notes that you collected from your investigation to form your conclusion. Make sure that you include information that you gained from data analysis to support your conclusion.

Experimental Sources of Error

On your *Spontaneous Generation Investigation Report*, provide responses to the following questions: Are there any sources of error? If so, what are they, and what could be done to minimize error?

Once you have completed the *Spontaneous Generation Investigation Report*, please submit your work to the dropbox.