

What is Biology?

The scientific study of life.

What is Science?

Characteristics of Science:

1. Observable

- Scientific knowledge is obtained only through observation

2. Explained by natural laws, empirical evidence

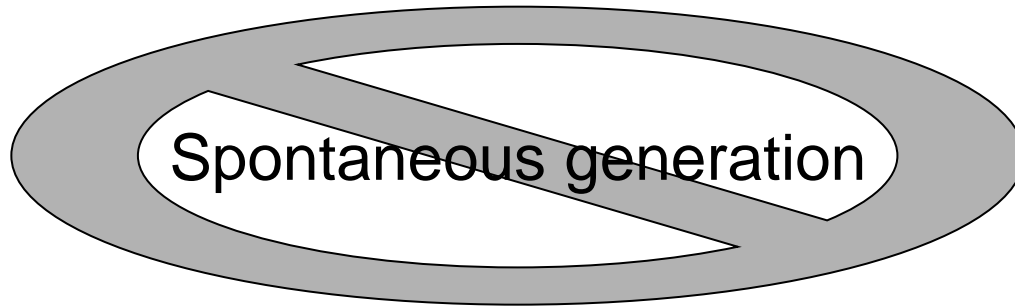
- MUST be made without reference to supernatural forces or beings

3. Testable

4. Conclusions are tentative

5. Falsifiable

Scientific Method



Scientific Method

1. Observation

- Carcasses are covered with flies.

2. Question

- Does rotting meat turn into or produce flies?

3. Hypothesis -- answer to the question

Testable explanation for what was observed.

H1: Rotten meat does not turn into flies. Only flies can make more flies.

H2: Rotten meat does turn into flies.

Scientific Method

4. Prediction -- what you expect to see if your hypothesis is correct

P1: If meat cannot turn into flies and only flies can make more flies, then meat that is not exposed to flies (e.g. is in a closed container) should not produce any flies.

P2: If rotten meat gives rise to flies, then all rotting meat, whether exposed or unexposed, should produce flies.

Scientific Method

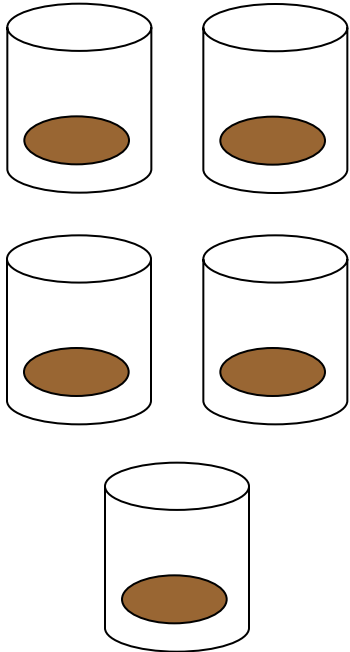
5. Tests

- “Controlled” experiment
 - Experimental group = is changed or adjusted
 - Control group = is left alone, “natural”
- Pieces of fresh meat are placed into wide-mouthed jars and subjected to different levels of “openness”.
- Jars were left outside for 2 weeks.
- Presence or absence of flies in each jar is recorded.

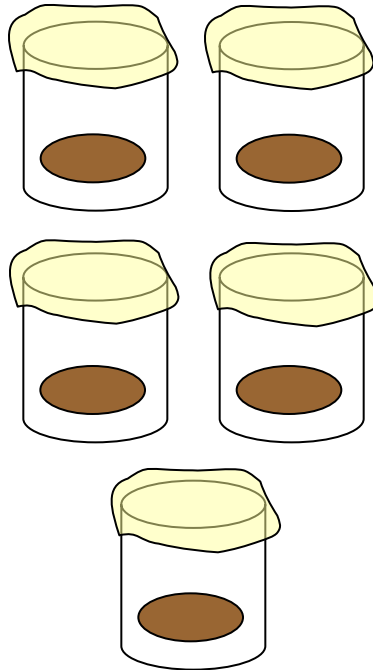
Scientific Method

5. Tests

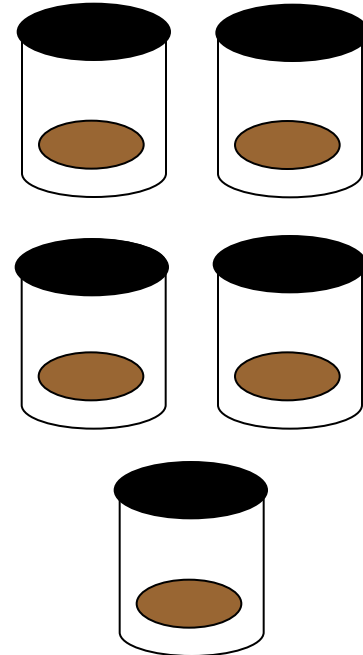
Control Group



Experimental Group 1



Experimental Group 2



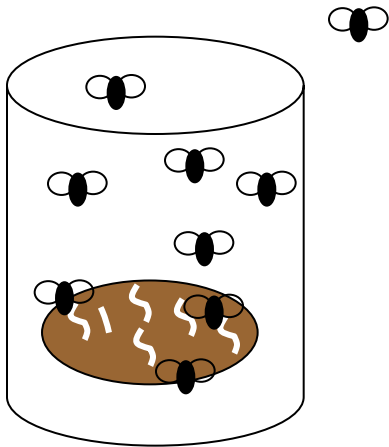
Replication = 5 jars used for each group

Scientific Method

5. Tests

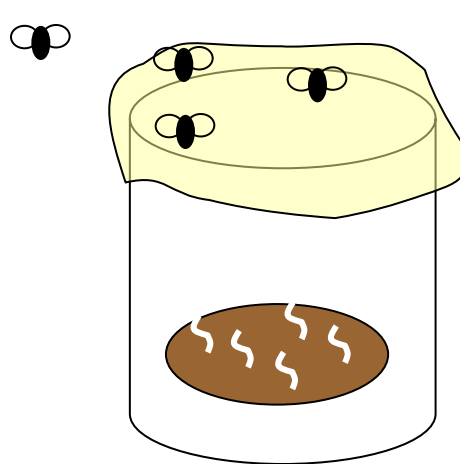
Results

Control Group



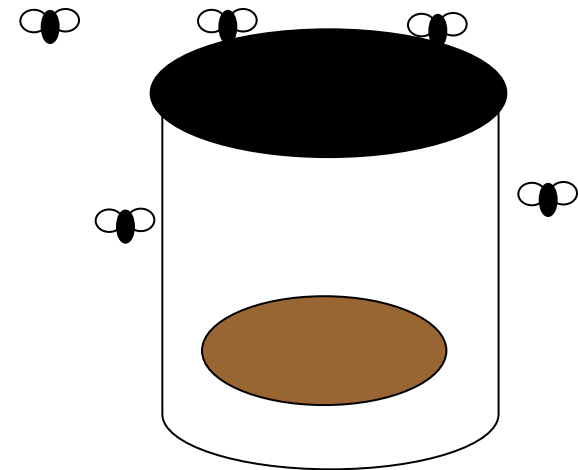
Numerous flies and maggots on meat.

Experimental Group 1



Numerous maggots on meat. Flies only on cheesecloth.

Experimental Group 2



No maggots on meat.

Conclusions: What does it mean?

Prediction 1 ➤ True

- If meat cannot turn into flies and only flies can make more flies, then meat in a closed container should not produce any flies.

Hypothesis 1 ➤ Supported

- Rotten meat does not turn into flies. Only flies can make more flies.

Conclusions: What does it mean?

Prediction 2 ➤ False

- If rotten meat gives rise to flies, then all rotting meat, whether exposed or unexposed, should produce flies.

Hypothesis 2 ➤ Rejected/falsified

- Rotten meat does not turn into flies.



Theory & Fact

Theory = structure of ideas that explain and interpret facts

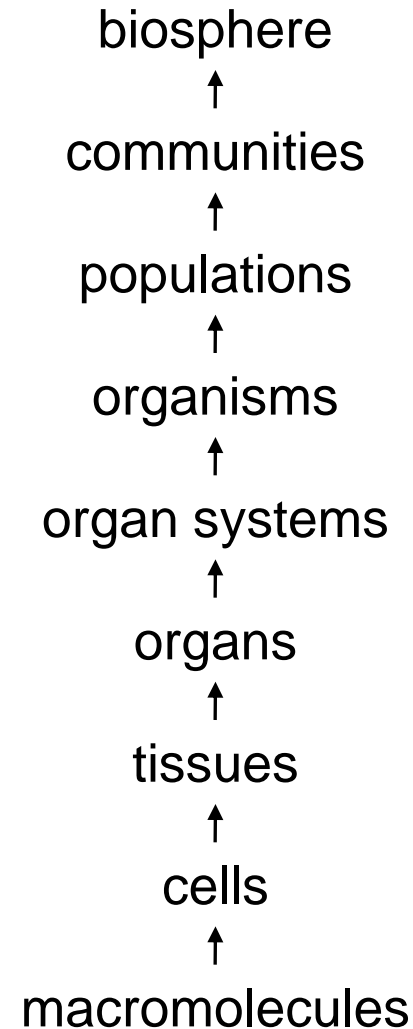
Fact = confirmed to such a degree that it would be considered foolish to dispute it

= an objective and verifiable observation

What is Life?

Properties of life:

1. Chemical uniqueness
2. Hierarchical organization
3. Reproduction
4. Possess a genetic program
5. Metabolism
6. Development
7. Environmental interaction



Water

Properties of water:

1. High heat of vaporization
 - much energy to convert from liquid to vapor
2. Unique density behavior
 - most dense while liquid
3. High surface tension/cohesion
 - molecules stick together
4. Versatile solvent
 - many substances easily dissolve in it

Macromolecules

1. Carbohydrates

- fuel source

2. Lipids

- stored energy, cell membranes

3. Proteins

- structure, contraction, defense, transport, enzymes

4. Nucleic acids

- genetic code, directions for protein synthesis