

# Scientific Method

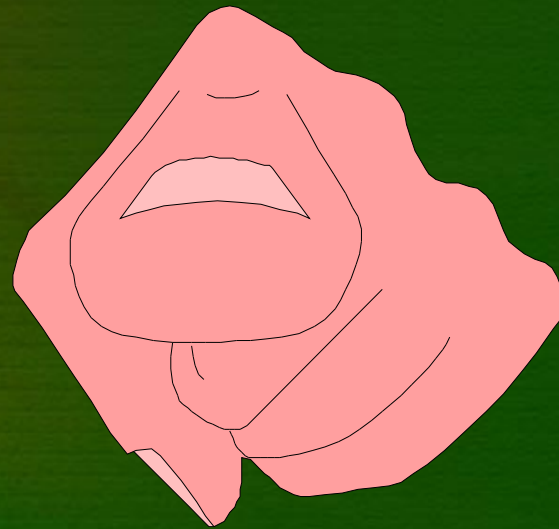
Who uses it?

What is it?

Why should I care?

*Everyone* uses it everyday.

Yes, Even You!!!!!!!!!!!!!!



It's a way to solve problems.  
Do you have any problems to solve?

**Big** ones?



Small ones?



# Any of these sound familiar?

- Where are my shoes?
- What should I have for lunch?
- What class do I have next?
- Did I do my homework for that class?
- What is the cure for cancer?
- Which deodorant works the longest?

# Take 5!

Share with a partner some problems you have, other than the ones listed. Tell

them one **BIG** problem and one small problem. Be prepared to share with the class.



# How the Scientific Method Came into Being

## The Idea of Spontaneous Generation

### Egypt

- Observation: Every spring, the Nile River flooded areas of Egypt, leaving rich mud so the people could grow crops. With the rich soil, large numbers of frogs appeared that weren't around at other times.
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- Conclusion: Muddy soil produces frogs.

# How the Scientific Method Came into Being

## The Idea of Spontaneous Generation

### Europe

- Observation: Medieval farmers stored grain in barns with thatched roofs. As a roof aged, it usually started to leak. Grain spoiled and molded. There were lots of mice around.
- Conclusion: Mice came from the moldy grain.

# How the Scientific Method Came into Being

## The Idea of Spontaneous Generation

### Europe

- Observation: No sewers, no garbage trucks. Sewage flowed in the gutters. Chamber pots and leftovers were tossed out the nearest window. A gentleman always walked closest to the street when escorting a woman, so if the sewage got splashed, it was on him and lady's gown. Many cities also had major rat problems.
- Conclusion: Sewage and garbage turned into the rats.

# How the Scientific Method Came into Being

## The Idea of Spontaneous Generation

### Europe

- Observation: No refrigerators meant daily trips to the butcher shop, battling the flies around the carcasses, especially in the summer.
- Conclusion: The rotting meat produced the flies.

# How the Scientific Method Came into Being

## The Idea of Spontaneous Generation “Recipes”

### Bees:

Kill a young bull, bury it upright so its horns stick out of the ground. After a month, a swarm of bees will fly out.

### Mice:

Place a dirty shirt or rags in an open pot or barrel with a few grains of wheat or wheat bran. In 21 days, mice will appear.

# The First Real Scientific Experiment



- 1668, Francesco Redi, an Italian physician, did an experiment with flies and jars containing meat.

# The First Real Scientific Experiment

Observation: There are flies around meat carcasses at the butcher shop.

Question: Where do the flies come from? Does rotting meat turn into or produce the flies?

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

Prediction: If meat cannot turn into flies, rotting meat in a sealed (fly-proof) container should not produce flies or maggots.

# The First Real Scientific Experiment

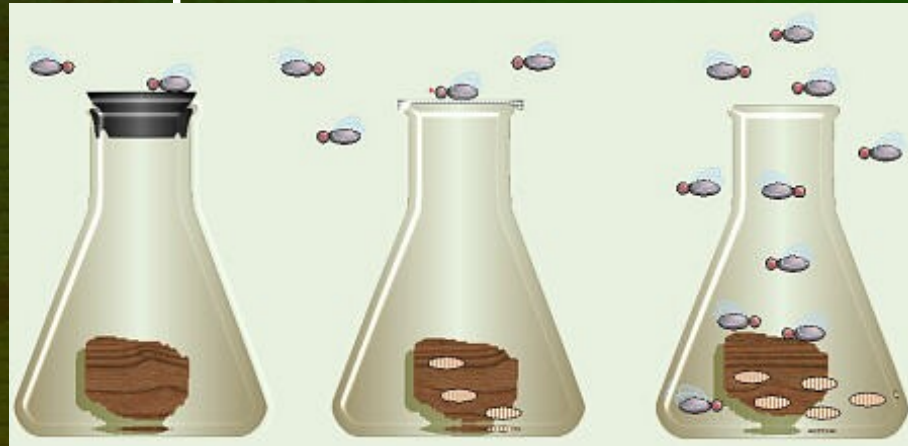
Testing: Wide-mouth jars each containing a piece of meat were subjected to several variations of 'openness' while all other variables were kept the same.

control group: jars set out without lids so the meat would be exposed to whatever it might be in the butcher shop.

experimental group(s): One group sealed with lids, and another group gauze placed over them.

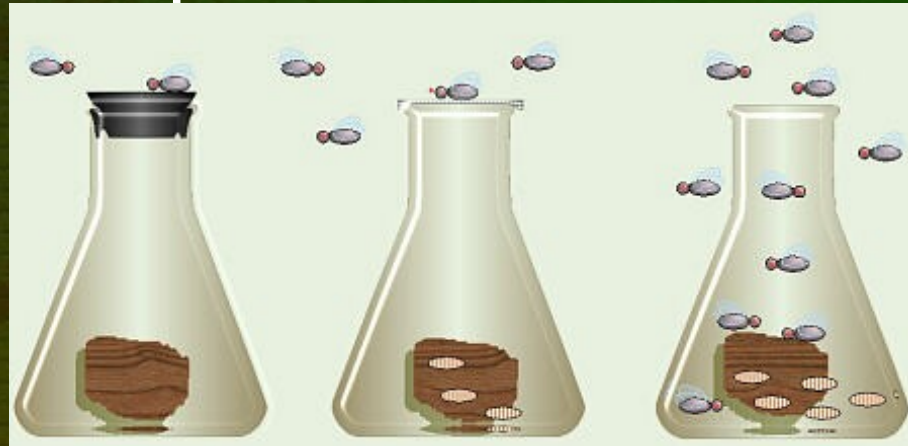
replication: Several jars were included in each group. Also, different kinds of meat (fish, snake, veal) were used.

# The First Real Scientific Experiment



Data: In the control group of jars, flies were seen entering the jars. Later, maggots, then more flies were seen on the meat. In the gauze-covered jars, no flies were seen in the jars, but were observed around and on the gauze, and later a few maggots were seen on the meat. In the sealed jars, no maggots or flies were ever seen on the meat.

# The First Real Scientific Experiment



Conclusion(s): Only flies can make more flies.

- Uncovered jars, flies entered and laid eggs.
- Gauze covered jars, adult flies laid eggs on the gauze on the gauze-covered jars.
- Sealed jars, no flies, maggots, nor eggs could enter - none were seen in those jars.

# Definition

Scientific method: basic steps that scientists follow in uncovering facts and solving scientific problems



# Seven steps to the Scientific Method

- 1. Problem
- 2. Information
- 3. Hypothesis
- 4. Experiment
- 5. Observations
- 6. Conclusion
- 7. Report your findings





By following these steps *in order* you will learn about your question.

- Notice the IN ORDER part. It's very important.

# Problem

- \*This is the question that you're trying to answer or problem that you're trying to solve.
- \*Try to narrow it down and be very specific.



# Stating the Problem

- What invisible trail does a rattlesnake follow in tracking down its bitten prey?



# Information

- gather data about your question. -

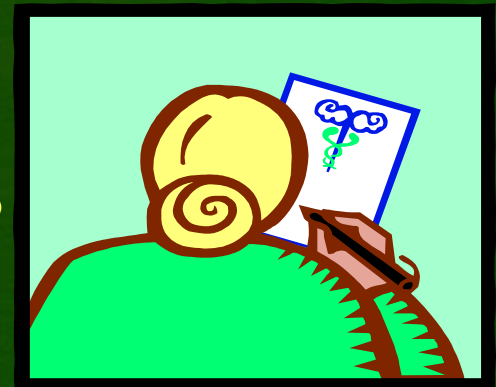
books

magazines

reports

experts

your past experiences



# Gathering Information

- A pair of organs located under the eyes detect invisible light in the form of heat
- A rattler's tongue "smells" certain odors in the air
- The sight or smell of an unbitten animal does not trigger the rattler's tracking action
- A rattlesnake's eyes are only sensitive to visible light



# Hypothesis

- -an educated guess
- -a prediction based on data
- -what *you* think the answer is based upon your gathered information



# Hypothesis

- After the snake wounds its victim, the snake follows the smell of its own venom to locate the animal

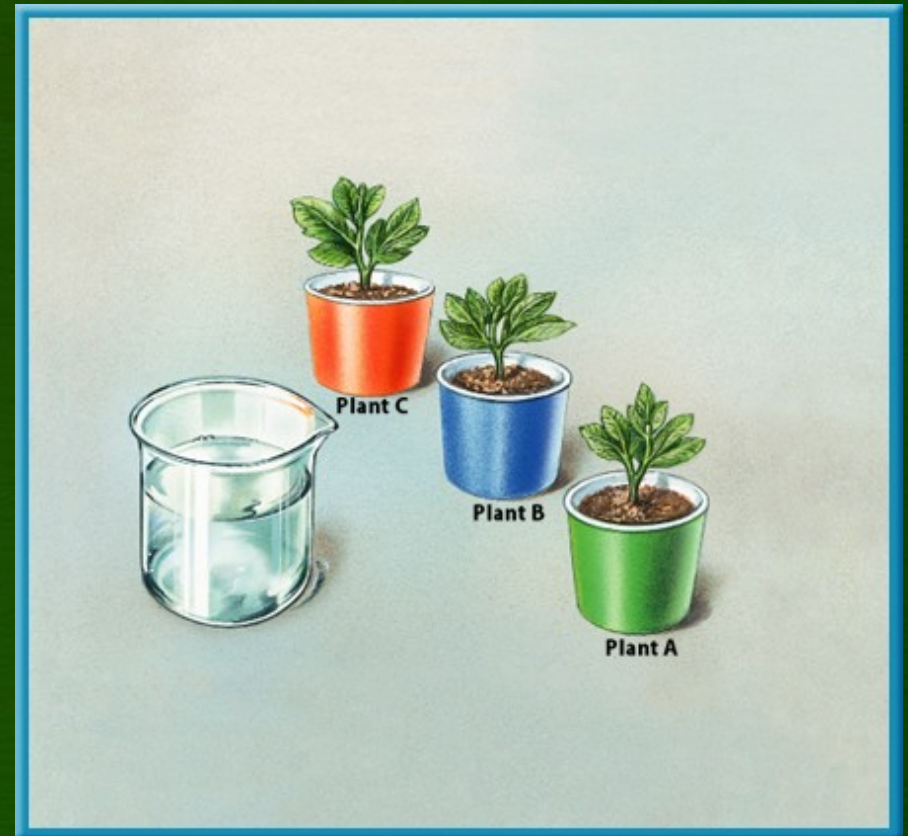


# Experiment

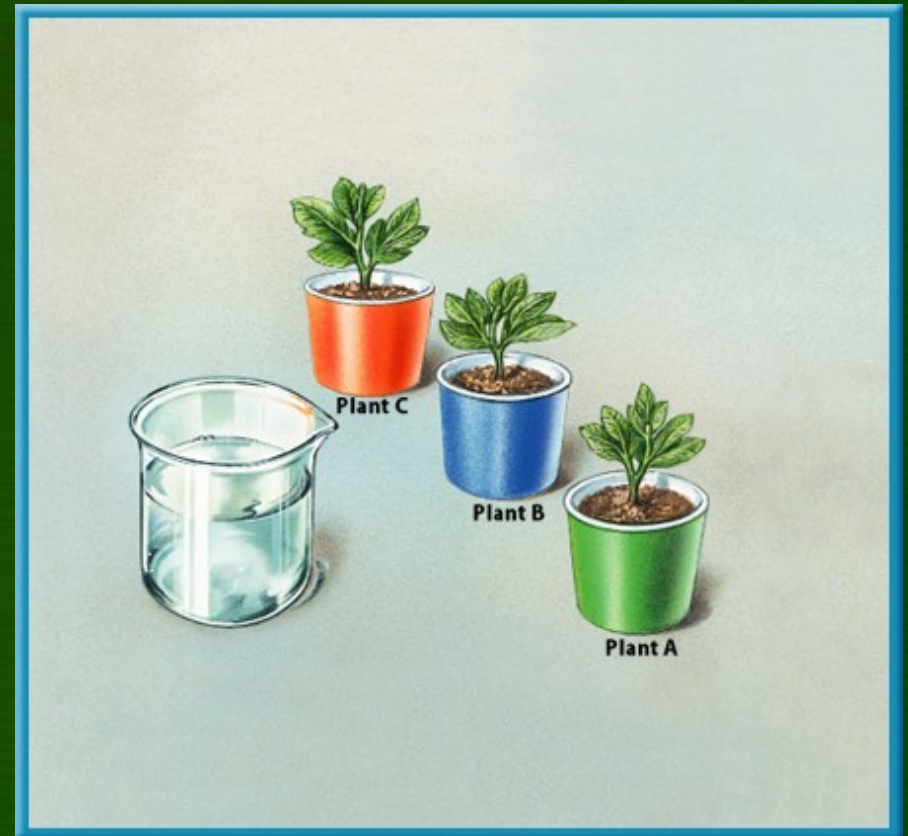
- This is broken into 2 parts - materials and procedure.
- Materials is a list of equipment that you will need for the experiment.
- Procedure is a list of instructions that you need to follow for the experiment.

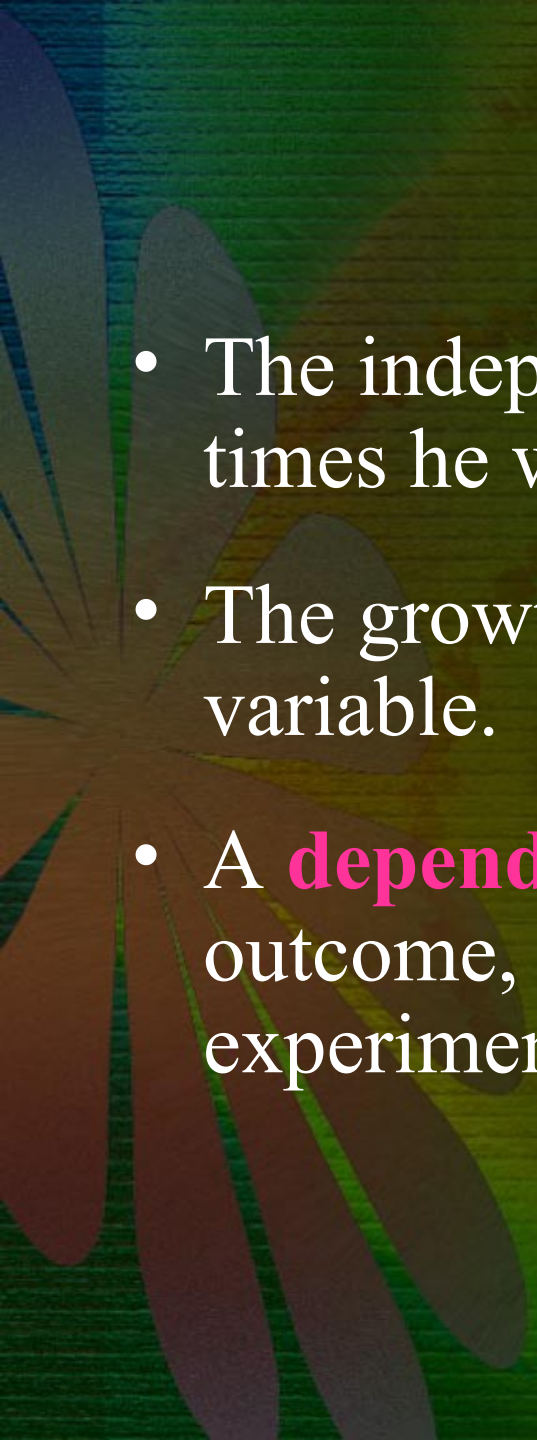


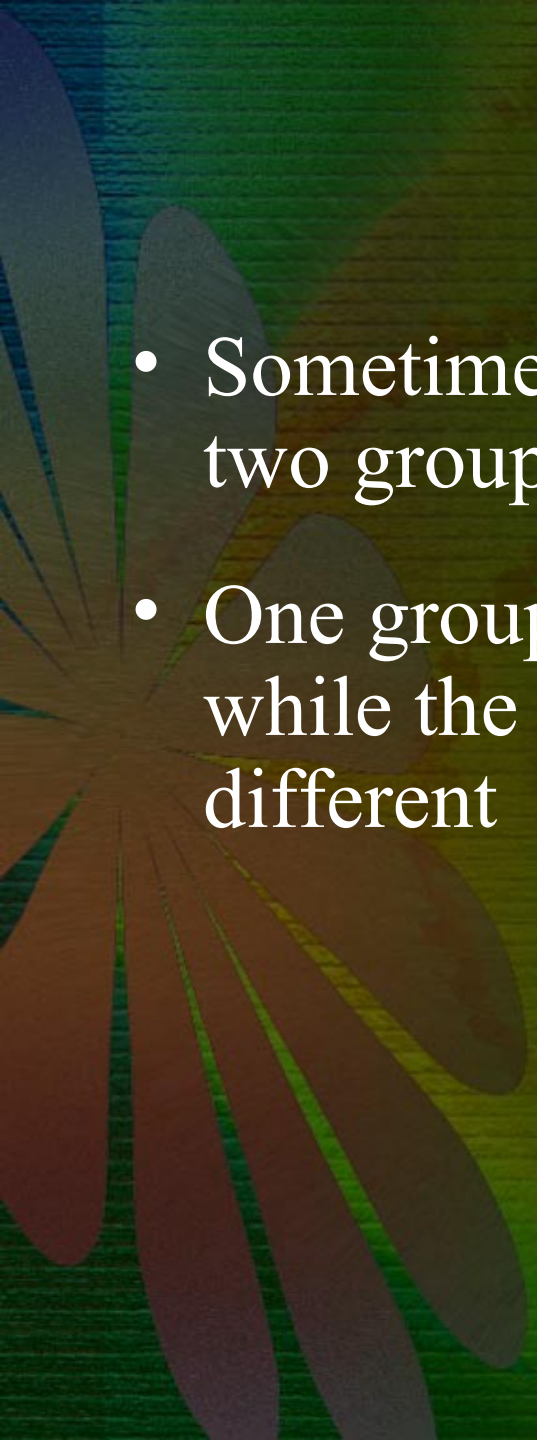
- The one factor that you change in an experiment is called the **independent variable**.
- For example, in an experiment, similar-sized fig plants received the same amount of sunlight.




- They were planted in similar containers with the same type and amount of soil.
- The hypothesis to test is that fig plants grow best when watered only once a week.



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- The independent variable is the number of times he waters each plant in a week.
  - The growth of the plants is the dependent variable.
  - A **dependent variable** is the factor, or outcome, that will be measured in an experiment.

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- Sometimes in an experiment, there will be two groups involved
  - One group gets treated the same as always while the other group gets something different

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- Then group that gets something treated the same way is the **control group**.
  - The group that gets treated differently is the **experimental group**.



## Experiment



- Drag a dead mouse that has been struck and poisoned by a rattlesnake along a curved path on the bottom of an empty cage
- Place the snake in the cage
- The snake follows the exact trail that has been laid out
- Control
- Drag an unbitten dead mouse along the path
- The snake seems disinterested

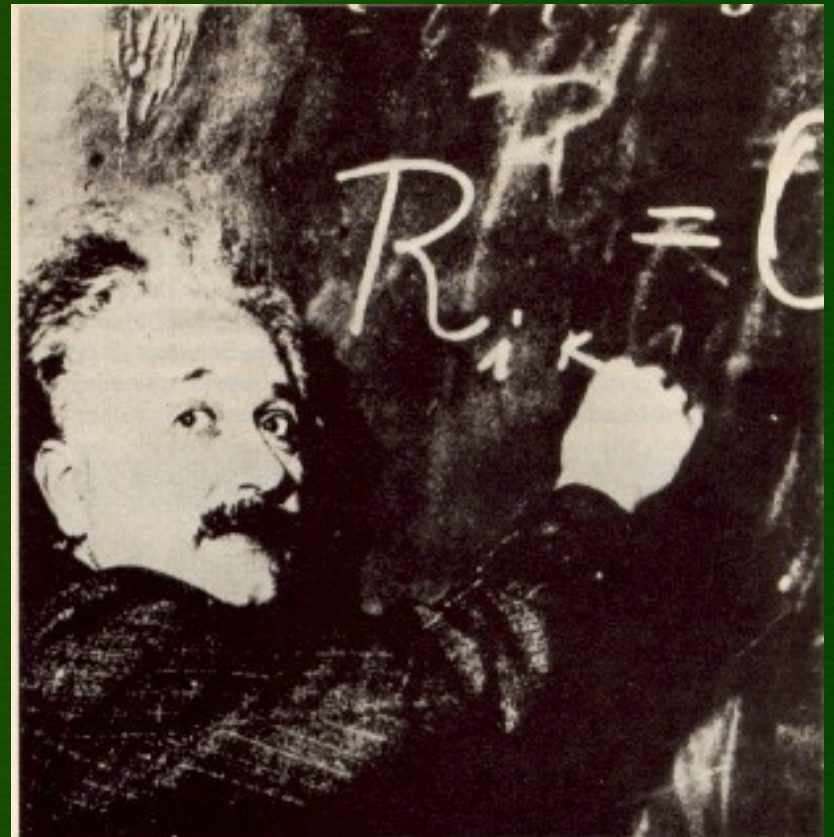
# Observations

- Definition – the process of obtaining information by using the senses
- Collection of information and data from the experiment.
- It may be organized in charts, graphs, or written work.
- This is **WHAT HAPPENED!!!!**



## Recording and Analyzing Data

- Do the experiment many times
- Record the data



# Conclusion

- What did you find the answer to the question was?
- It's **OK** if it turns out that your hypothesis was not correct. You learned!!!!!!!!!!!!



## Conclusion

- The snake was the cause of the following symptoms.



## Conclusion

- The scent of venom was the only factor that could cause a rattlesnake to follow its bitten victim.

# Report your findings

- One of the most important parts of the scientific method is to report to others your findings.
- You will help others learn.



## Hypothesis, Theory, and Law

- Hypothesis – an educated guess based on research and observation
- Theory – something that has been proven to be true in repeated trials, but may change when more information is available
- Law – something that is ALWAYS true