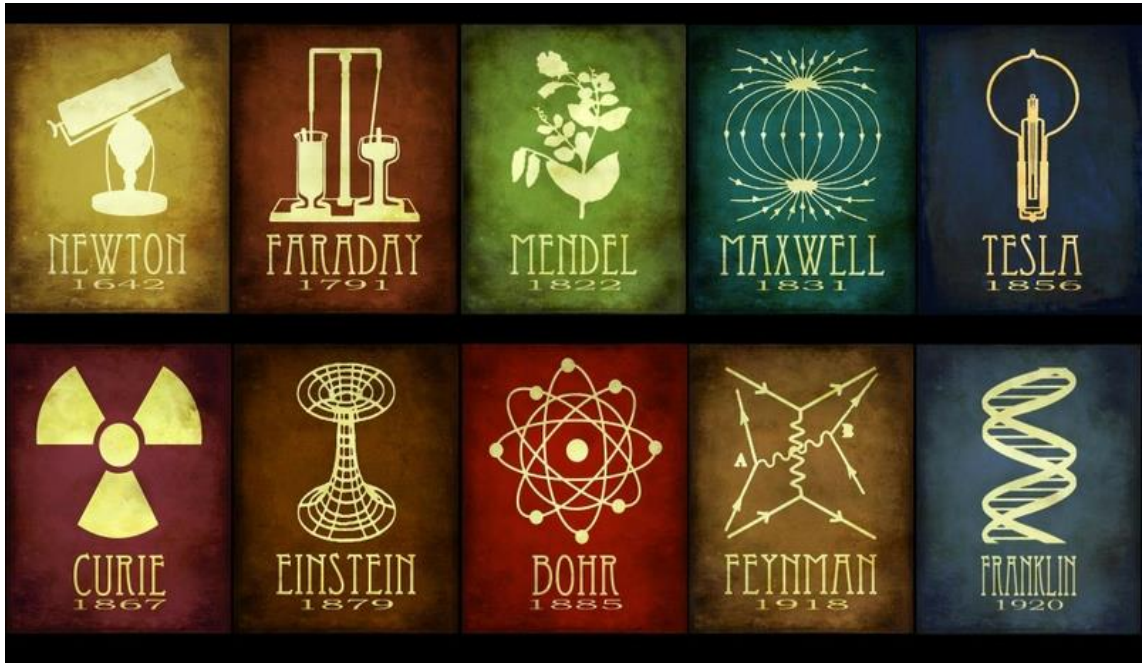
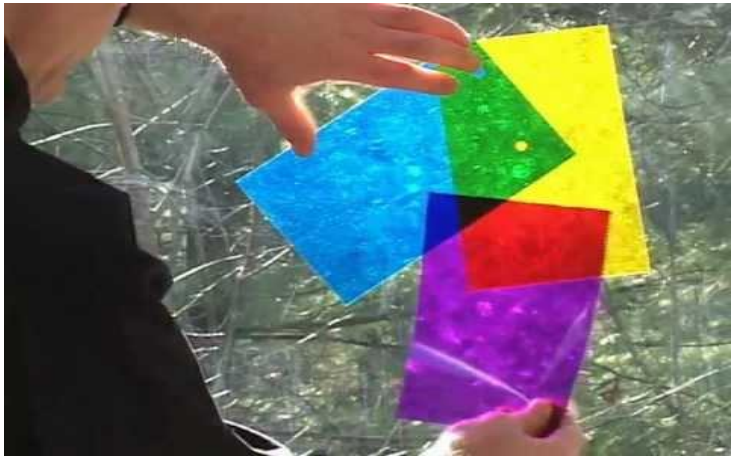
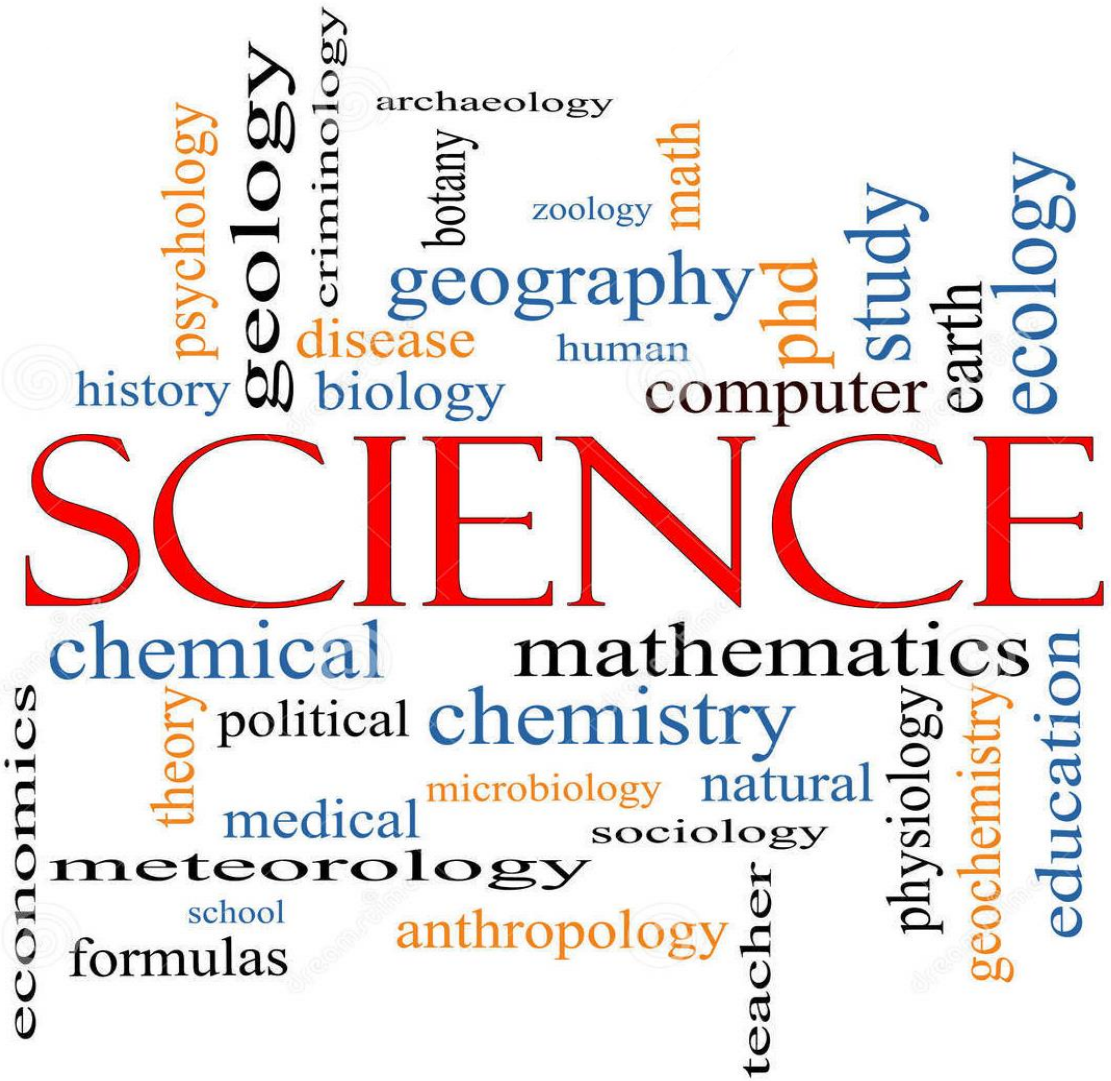
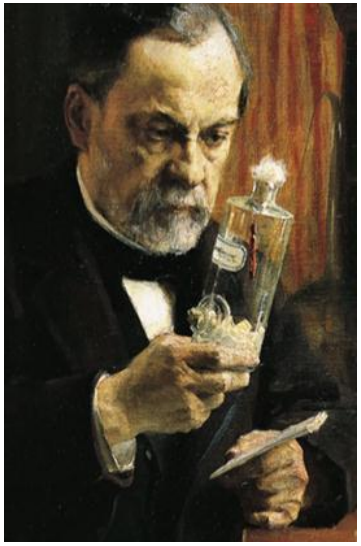
What is Science?

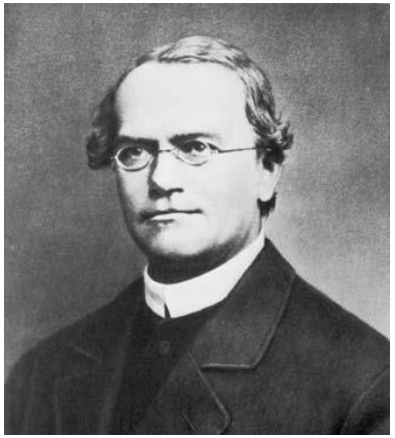


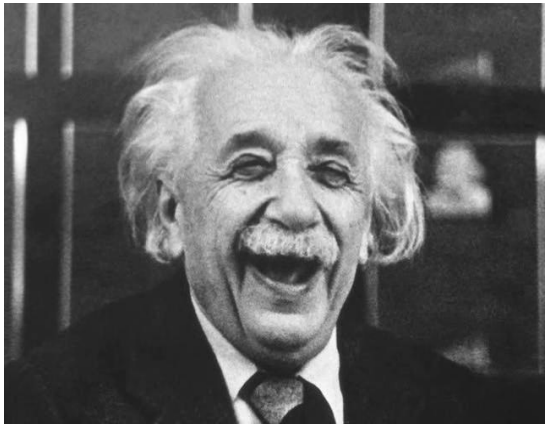


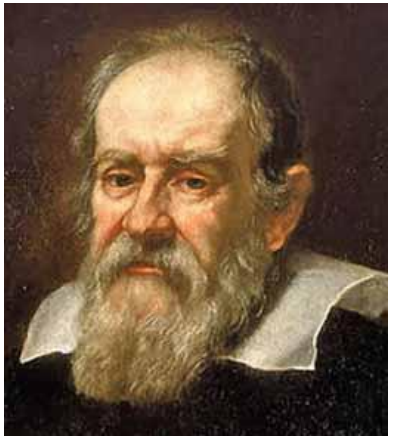


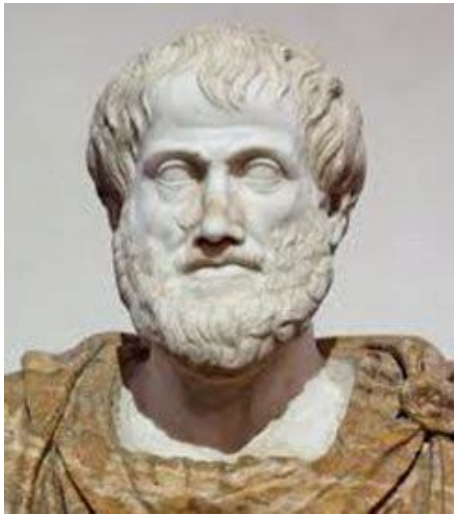
- from Latin ***scientia***, meaning "**knowledge**"

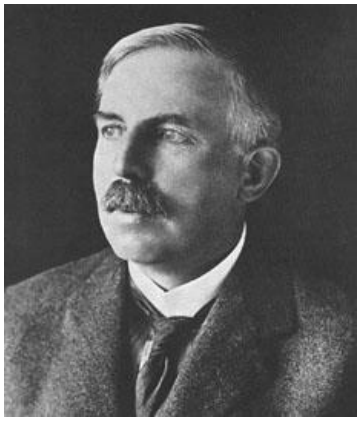


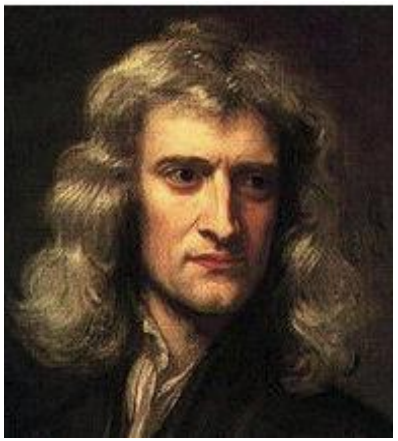












Your picture here?

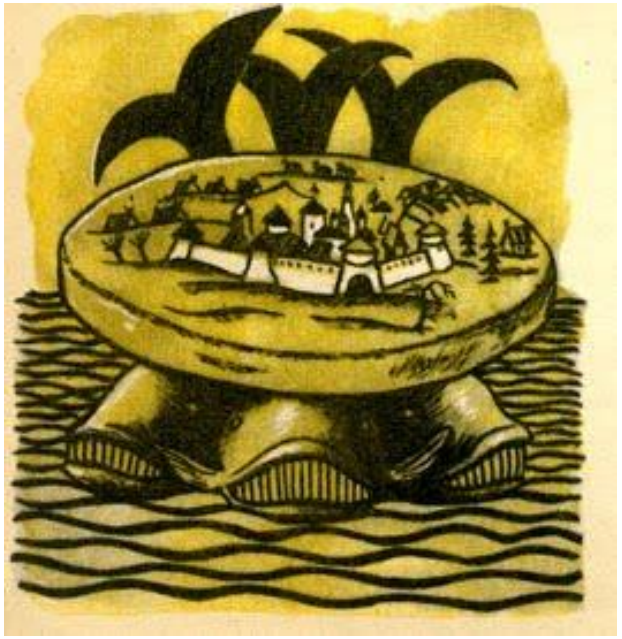
Founding Fathers

What is Science?

Science is an **organized** way of **attempting to understand the natural world**, structurally and operationally.

- **a *way of knowing***
- **a *process* of study of natural world**
- **involves observing, proposing explanations, testing explanations (experimenting)**
- **is *evidence-based***

The Three Whales



- **Hypothesis**:

  possible explanation of an experience or observation.

- **Theory**:

  the best possible scientific explanation of an experience or observation in nature.

- **Scientific Law**:

  always true, can not be circumvented or broken.

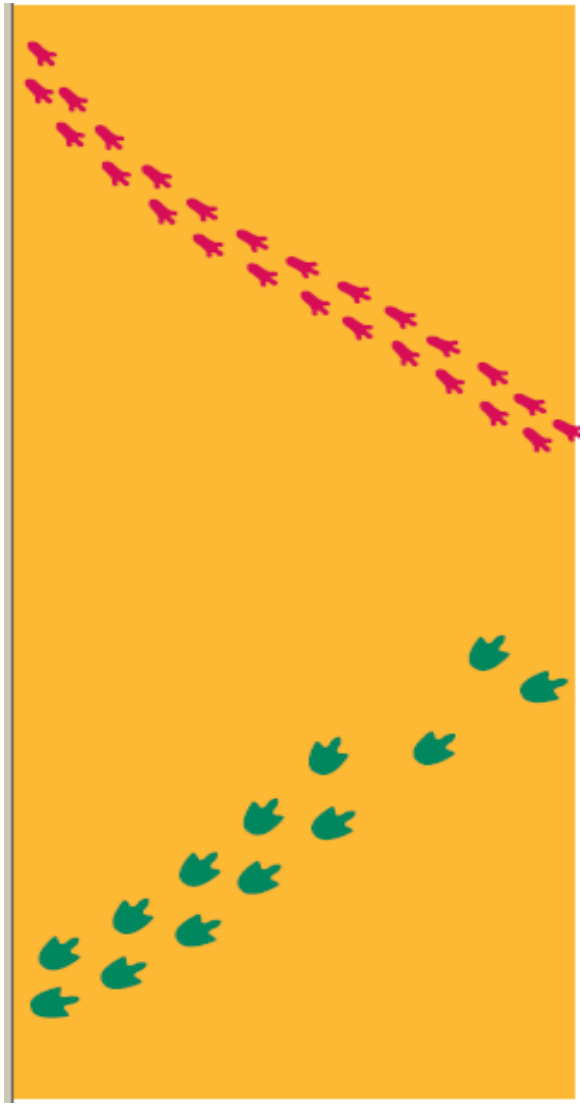
The Need for Proof

- **Science is based on evidence.**
- **Evidence is based on observations.**

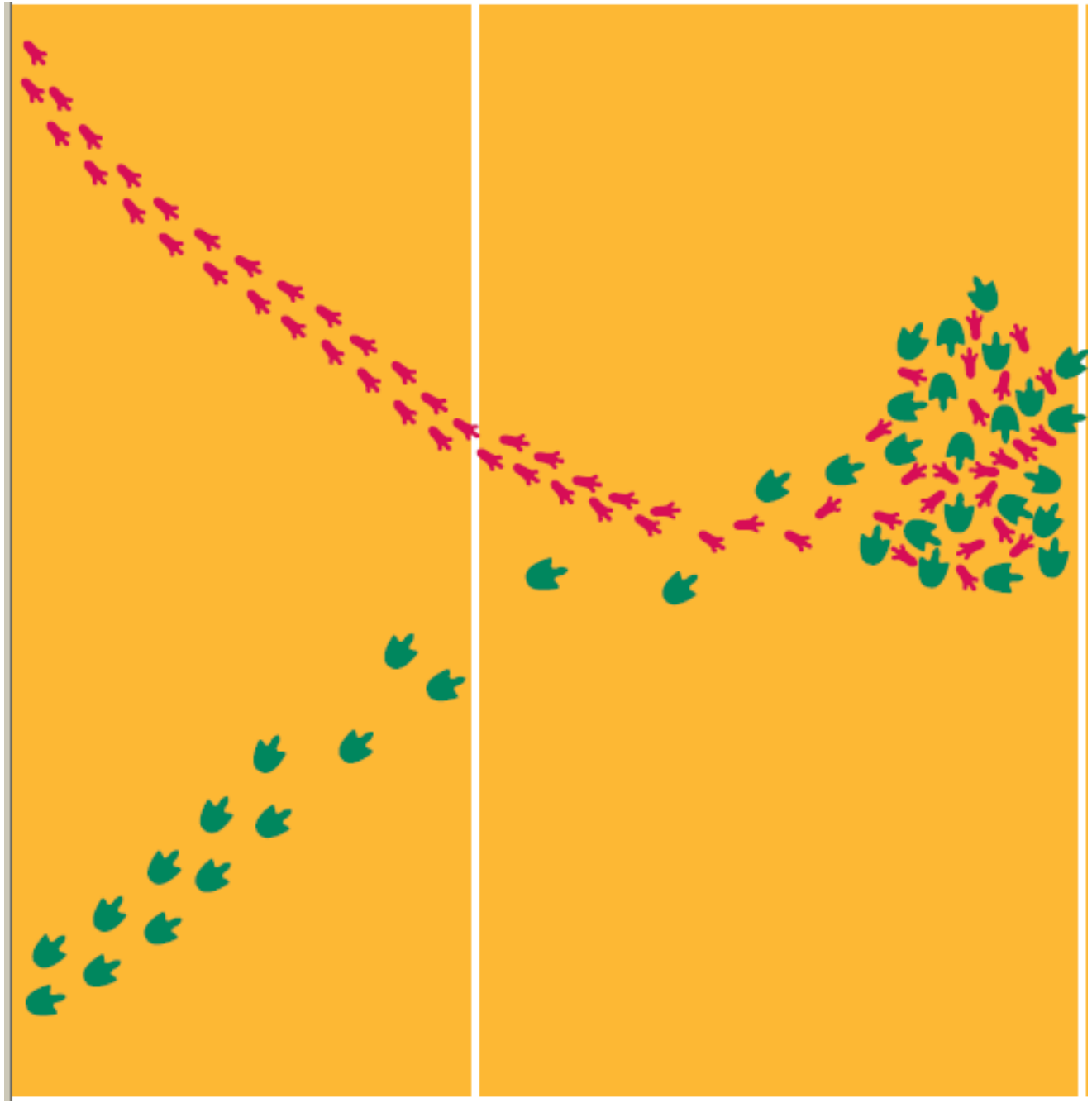
- **It is important to <u>distinguish observation and *inference*</u>!**

Inference: an estimation or prediction based on *previous* experience or observations.

What happened here?



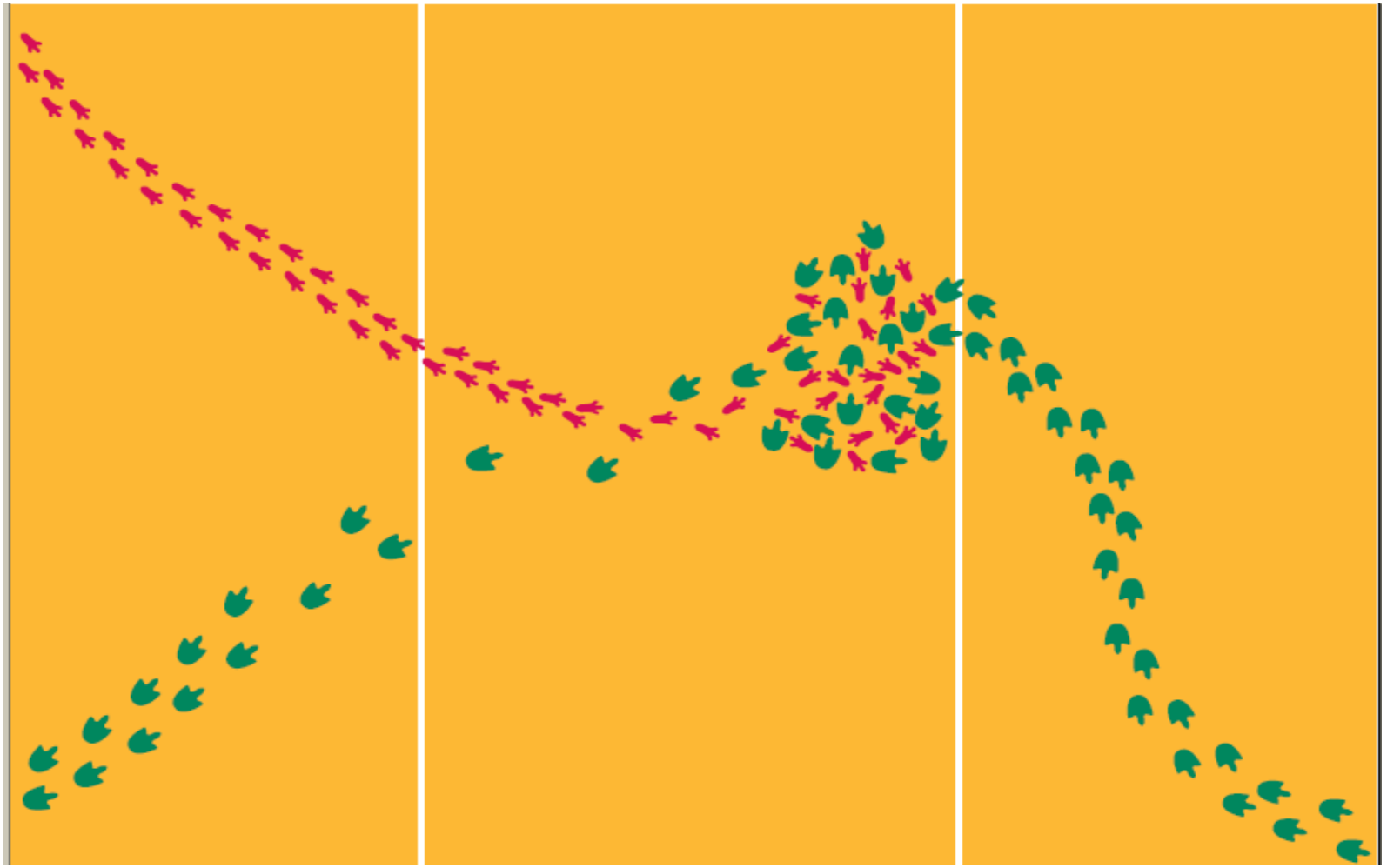
What do you OBSERVE?



Now what do you OBSERVE?

And what do you THINK?

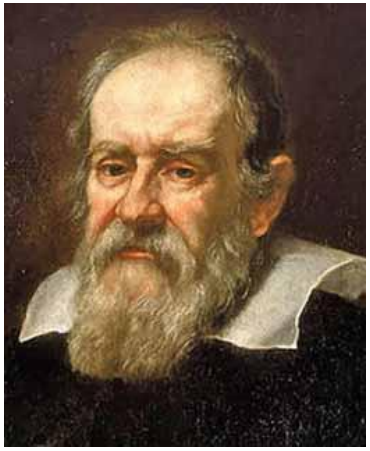
Propose your explanation of what happened based on your observations.



Prior knowledge has an effect on observation!

Equality of falling objects

Galileo Galilei, early 1600s



- **Common wisdom (Aristotle):**
  heavier objects fall faster than lighter ones.
- The story is now legendary: Galileo **dropped two different weights (balls)** from the top of the Leaning Tower of Pisa and **showed them landing at the same time**.
- **Result:** while *losing his job* as a mathematics professor at the University of Pisa for establishing a new fact, Galileo became famous throughout the continent…
- **Demonstration repeated:** Apollo 15 astronaut dropped a feather and a hammer on the moon, again demonstrating Galileo's equality of falling bodies. This was possibly the "most watched experiment" of all time!

Foucault's Pendulum

Leon Foucault, 1851

- Demonstration showing that **the Earth revolves on its axis**.
- A 62-pound iron ball was suspended from 220 feet long steel wire attached to the dome of the Panthéon and set in motion. A marker extending from the ball barely touched a circle of damp sand underneath.
- **Common wisdom:** the pendulum will *trace the same places* over and over again.
- **In reality**, the **pendulum appeared to shift positions** leaving a slightly different trace with each swing.
- **The reason: the Earth** and therefore the floor **was rotating**!

Science in Hollywood!!!

A part of the National Academy of Sciences,
Science and Entertainment Exchange (based in Los Angeles, CA)
helps connecting scientists and filmmakers.

- **Mathematical equations and computer software was used in *Frozen* to create some of the most realistic animated snow ever to fall on the Big Screen.**

- **Physical properties of Merida's curly hair in *Brave* were thoroughly simulated through the complex network of points and springs.**

Additional Info

Apollo 15 Hammer and Feather drop on the Moon:

https://www.youtube.com/watch?v=5C5_dOEyAfk