

What is science?

- Three natures:
 - A description
 - Observations/data that have been collected by individual conducting scientific study
 - An explanation
 - Explains the data and observations, understanding the pattern of them
 - Defines a purpose or a goal
 - Based on the process of method that takes you from description to explanation

Purpose

- The purpose is to seek increasingly accurate, natural explanations for understanding the natural world
- Assumptions
 - Natural phenomena have natural explanations that follow natural patterns/rules
 - Something that can be observed in some shape or form
 - Patterns and rules are unchanged through space over time
 - Gravity, that pattern of gravity will hold true no matter where you are or the time era
 - We can uncover/understand those natural rules (explanations, descriptions) using some common method
 - **The Scientific Method**

Science

- The body of knowledge regarding the natural world
- A systematic process of acquiring, organizing and communicating knowledge
- Science also must be....

- Based upon the best available evidence
- Objective
 - Being unbiased
 - Allows us to trust for later interpretation
- Verifiable, testable and repeatable
 - Benefits: self-correcting... as new work is done, **accuracy and knowledge increase, bias decreases**
- Acquired through the scientific method

The Scientific Method (first essay: applying the Scientific Method)

- Observation/data (single or multiple)
 - Must be objective, have to avoid being bias
 - “Restricted to the use of our senses”
 - Can be improved using measurement devices/instruments
- Question: formed or generated based upon our observations/data that have been collected
- Hypothesis: A tentative explanation in what is seen in the data points
 - NOT a random guess
 - Based on inductive or deductive reasoning
 - **Induction:** going from specific observations to generate a broader idea
 - An observation: That dog has hair.
 - Hypothesis: All dogs have hair.
 - In order to prove this hypothesis correct, you must find every dog ever
 - **Deduction:** Apply a general principle/idea to predict specific results/outcomes
 - If $A=B$, $B=C$, then $A=C$
 - Every dog has hair
 - This organism is a dog
 - Therefore, this organism has hair
 - Only takes one objection to prove a hypothesis incorrect
 - Used to make clear and focused predictions
 - Not vague, but very specific

- The more general it is, the more difficult it is to test
- Has to be testable
 - Can be tested by further data collection (most popular way)
 - Experiments are the most rigorous test
 - Experiment: manipulation of different factors or variables in a system that we might suspect is driving that particular pattern of interest
 - Measurement of effect of the experimental treatment
 - Should account for most (if not all) variables influencing effect you are measuring
 - Experiments must be repeatable
 - Interpret experimental outcome relative to hypothesis
 - Hypothesis → Experiment → Results.. (compare to hypothesis)
 - If the results don't support the hypothesis, then "reject the hypothesis"
 - If the hypothesis is rejected, then: We can stop OR repeat the experiment OR design new experiments to test the same idea. If this is done, you must revisit and revise the hypothesis. If the results do not support the hypothesis, then it is definite