

Nature of Science

Nature of Science (NOS): overarching theme that explores conceptual understandings of purpose, features, and impact of scientific knowledge

What is the purpose of science? Make observations of the natural world and try to explain what is happening

What does science require? ① falsifiable hypotheses ② replicable data ③ peer-review

How do we engage in science?

The Scientific Method

Observations can be made directly using human senses or with the aid of instruments
 * unexpected observations can open up new fields

Research Question (RQ) should be specific and include independent variable (IV), dependent variable (DV) and study species.
 ex: how does IV (range) impact the DV (unit) of ssp?

Experiments used to test a hypothesis
 ↳ IV: variable(s) being manipulated
 ↳ DV: variable(s) being measured
 ↳ controls: variables that may impact DV and need to be accounted for

Upon analysis, whether data supports hypothesis or not, experiment must be **repeated** to ensure reliability and account for random error

Theories are well-supported explanations which have been repeatedly tested and confirmed via observations and experimentation

Falsification can occur if data is repeatedly collected which contradicts a hypothesis or theory.
 ↳ can lead to a **Paradigm shift** where a new theory replaces a previous one

Patterns / trends can be found by analyzing observations. Can take the form of + or - correlation
 * correlation ≠ causation
 ↳ try to draw general conclusions
 ↳ look for discrepancies

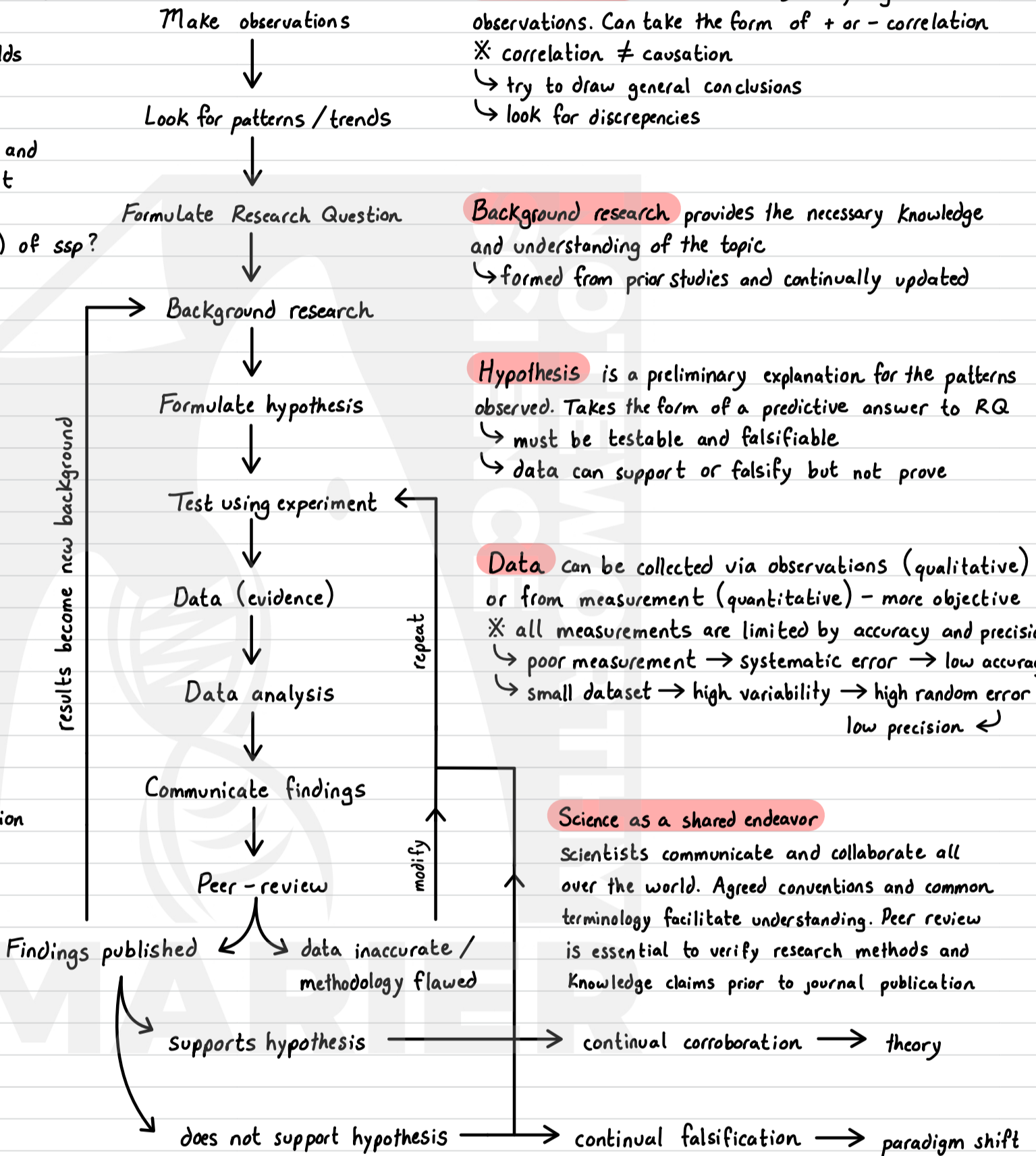
Background research provides the necessary knowledge and understanding of the topic
 ↳ formed from prior studies and continually updated

Hypothesis is a preliminary explanation for the patterns observed. Takes the form of a predictive answer to RQ
 ↳ must be testable and falsifiable
 ↳ data can support or falsify but not prove

Data can be collected via observations (qualitative) or from measurement (quantitative) - more objective
 * all measurements are limited by accuracy and precision
 ↳ poor measurement → systematic error → low accuracy
 ↳ small dataset → high variability → high random error
 low precision ←

Science as a shared endeavor

Scientists communicate and collaborate all over the world. Agreed conventions and common terminology facilitate understanding. Peer review is essential to verify research methods and knowledge claims prior to journal publication



Global impact of science - Scientists have an obligation to assess the risk associated with their work and must aim to do no harm. Developments may have ethical, environmental, political, social, cultural, and economic consequences that must be considered during decision-making. The pursuit of science may have unintended consequences. Research proposals are often filtered through ethic boards. Findings must be communicated to the public honestly and clearly

The Scientific Method is a wonderful tool as long as you don't care which way the outcome turns; however, this process fails the second one's perception interferes with the interpretation of data.

Christina Marrero

The good thing about science is that it's true whether or not you believe in it

Neil deGrasse Tyson

What can be asserted without evidence can also be dismissed without evidence.

Christopher Hitchens