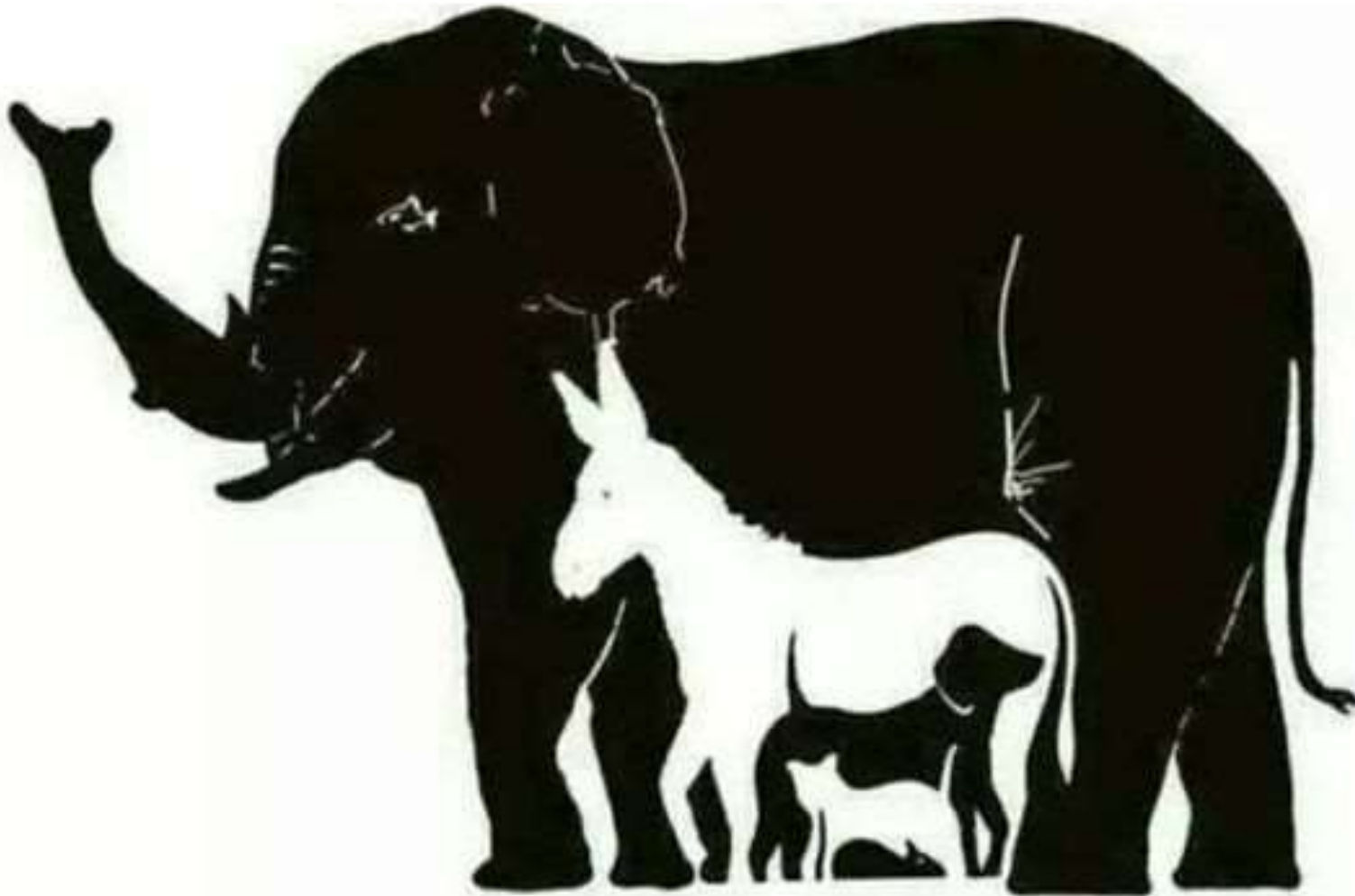


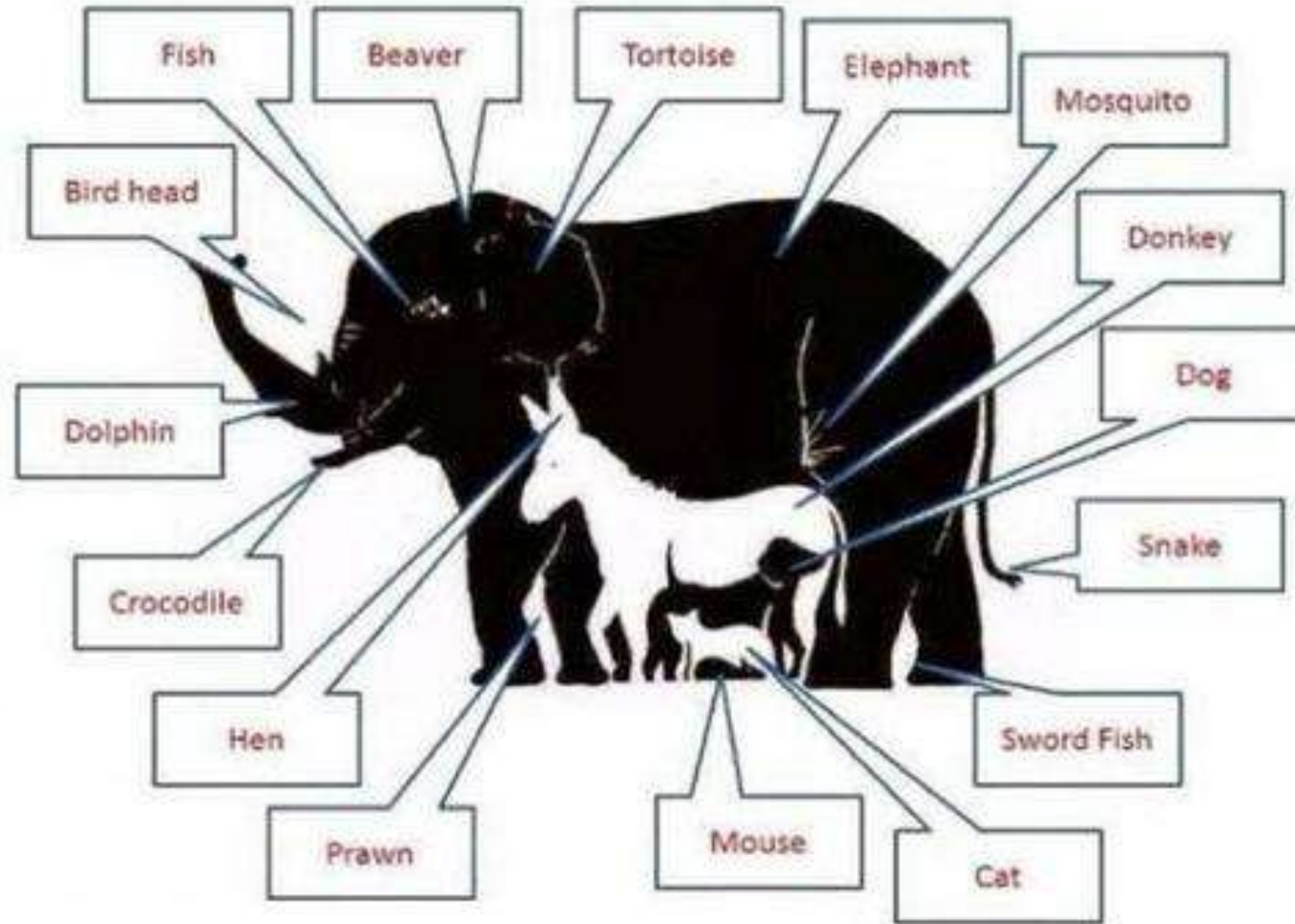
# Nature & Philosophy Of Science



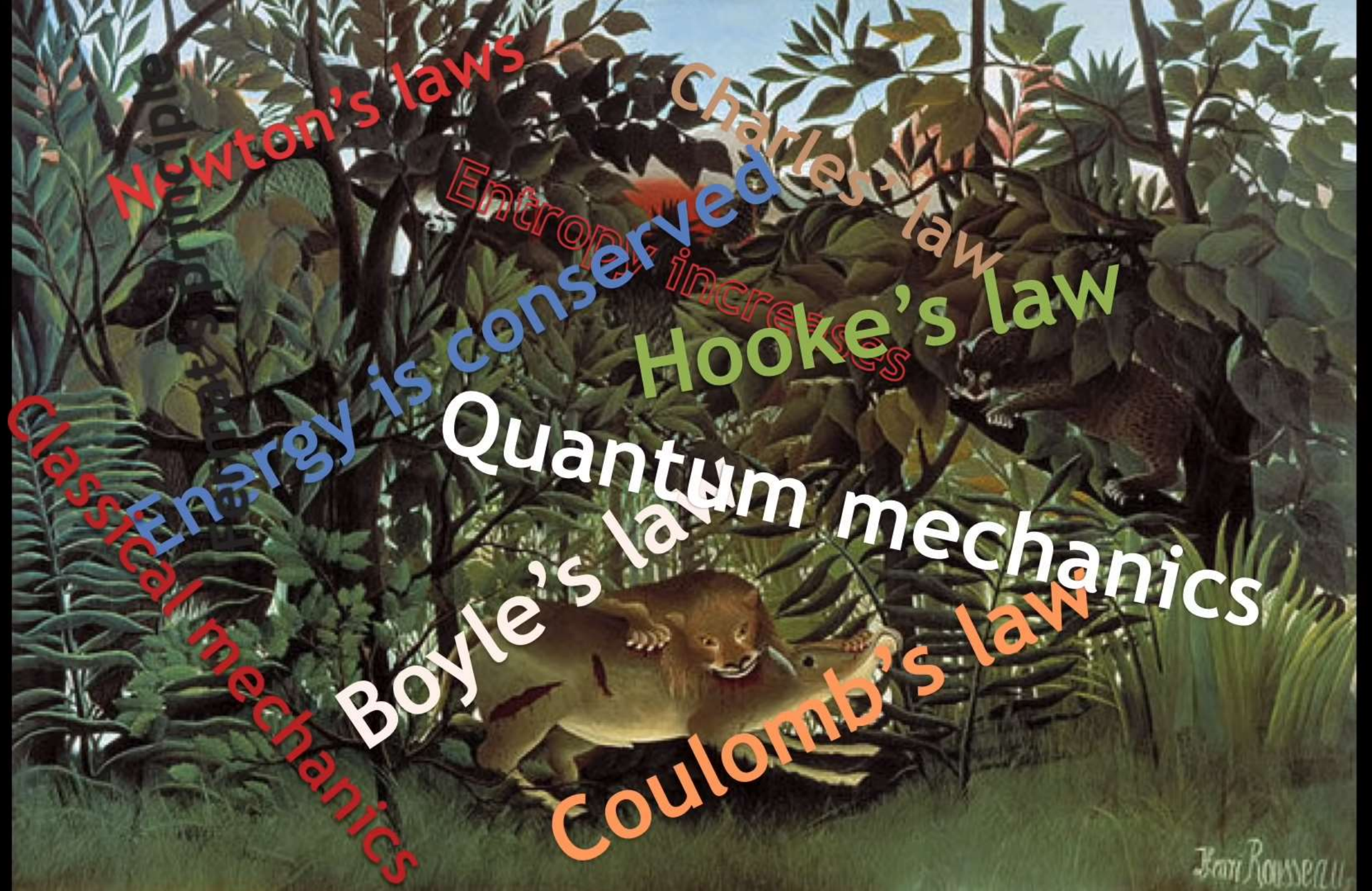


Can u count how many animals in this pic?









Newton's laws

Charles's law

Entropy increases

Hooke's law

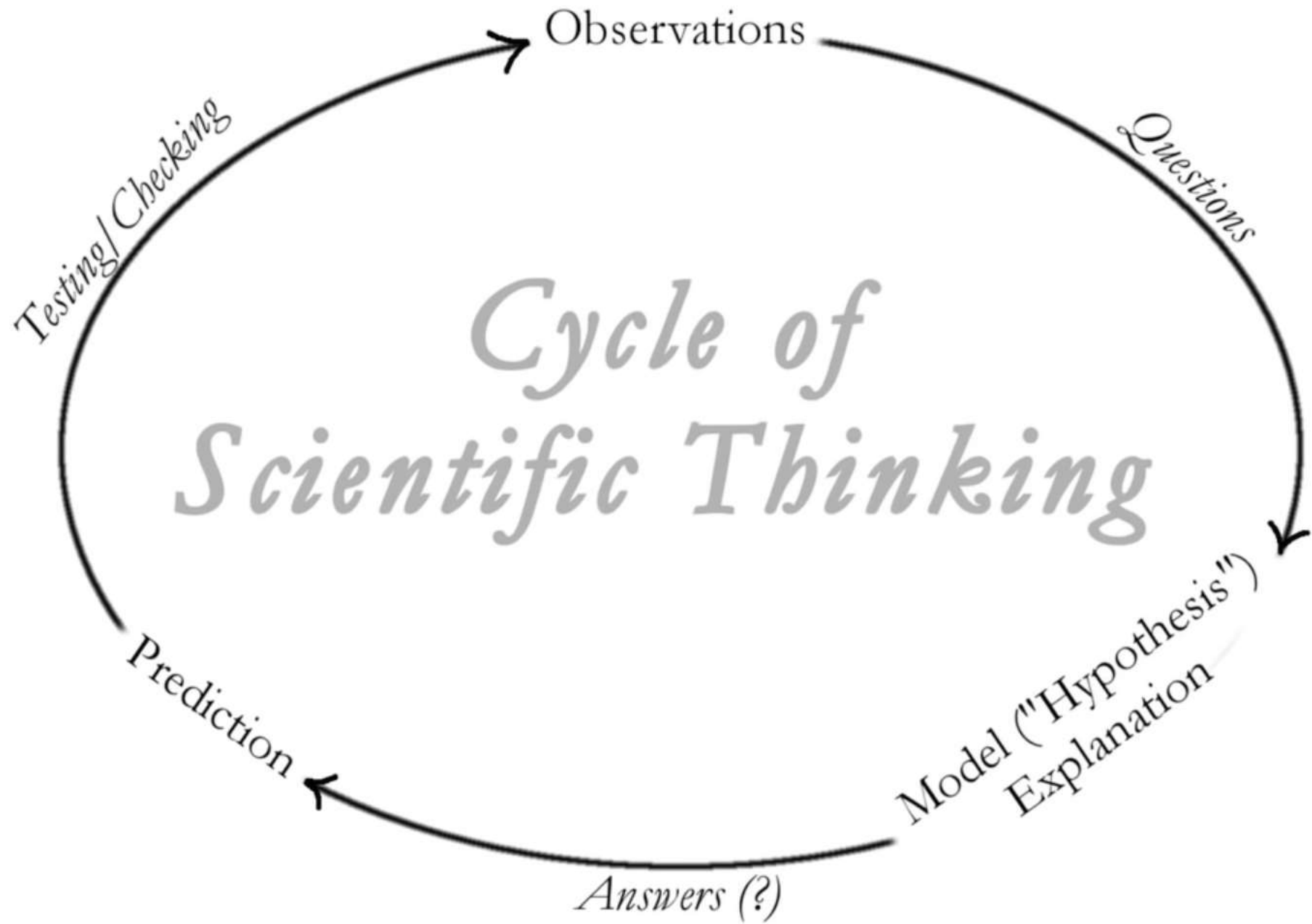
Classical mechanics

Energy is conserved

Quantum mechanics

Boyle's law

Coulomb's law







# The Scientific Method

1. Observation

2. Ask question - Why?

3. Testable explanation (Hypothesis)

\* Saltwater has lower freezing point than freshwater

~~\* Fairy that performs magic on the pond to freeze it faster~~



Experiment

4. Prediction:

Fresh freezes @

0°C but

Salt water doesn't

5. test.

#1



Fresh

#2



Salt





# HOW TO FORM A HYPOTHESIS

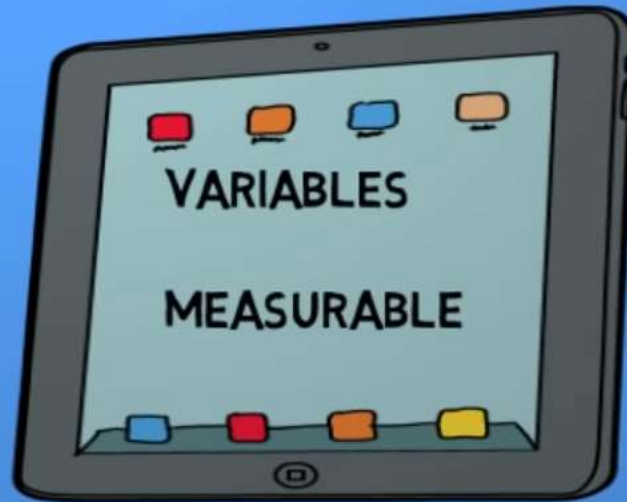
VALENCIA COTY-BARKER ED.D



# WHAT IS A HYPOTHESIS?

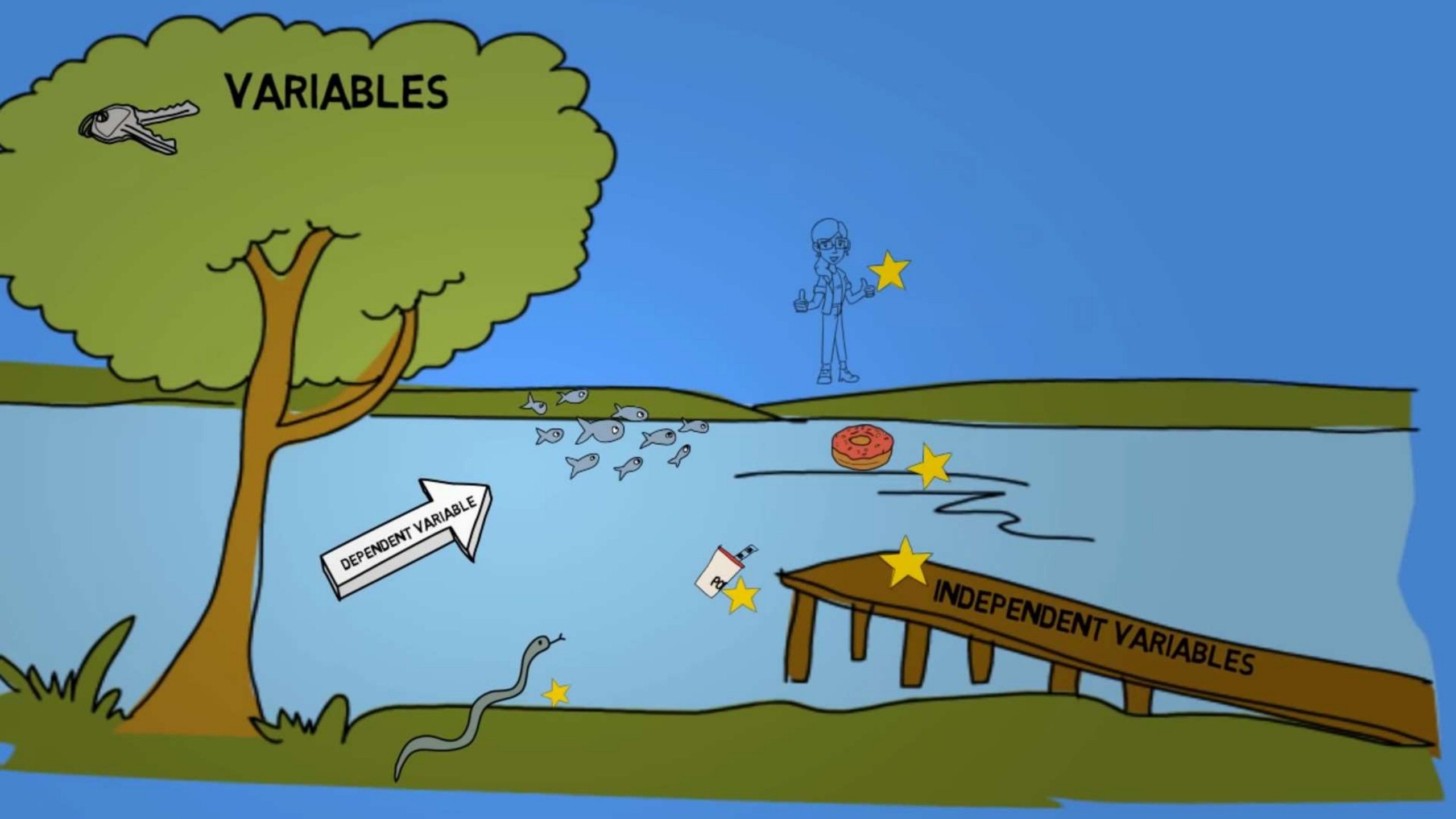
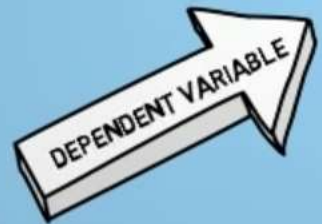


## PREDICTION STATEMENT





VARIABLES



SUPER TIP!  
USE "IF AND THEN"

## FISH SOMETIME BEHAVE STRANGELY IN LAKES

FISH LEAP FROM THE WATER IF THERE ARE DOUGHNUTS NEARBY. 

IF THERE ARE PREDATORS LIKE SNAKES NEARBY, THEN FISH WILL JUMP FROM THE WATER. 

IF THERE IS TRASH IN THE WATER, FISH ARE MORE LIKELY TO JUMP UP AND DOWN. 





## **LET'S REVIEW**

**A HYPOTHESIS IS A  
PREDICTION STATEMENT  
THAT INCLUDES VARIABLES  
AND A MEASURABLE OR  
TESTABLE SCENARIO.**



theory.

hypothesis.

fact.

law.



**FACTS**



**OBSERVATIONS ABOUT  
THE WORLD AROUND US.**

# HYPOTHESIS

**A PROPOSED EXPLANATION FOR A PHENOMENON MADE  
AS A STARTING POINT FOR FURTHER INVESTIGATION**



hypothesis



hypothesis



hypothesis



hypothesis



hypothesis



# theory



```
graph TD; A([theory]) --- B([a well-substantiated explanation acquired through the scientific method and repeatedly tested and confirmed through observation and experimentation.]);
```

a well-substantiated explanation acquired through the scientific method and repeatedly tested and confirmed through observation and experimentation.



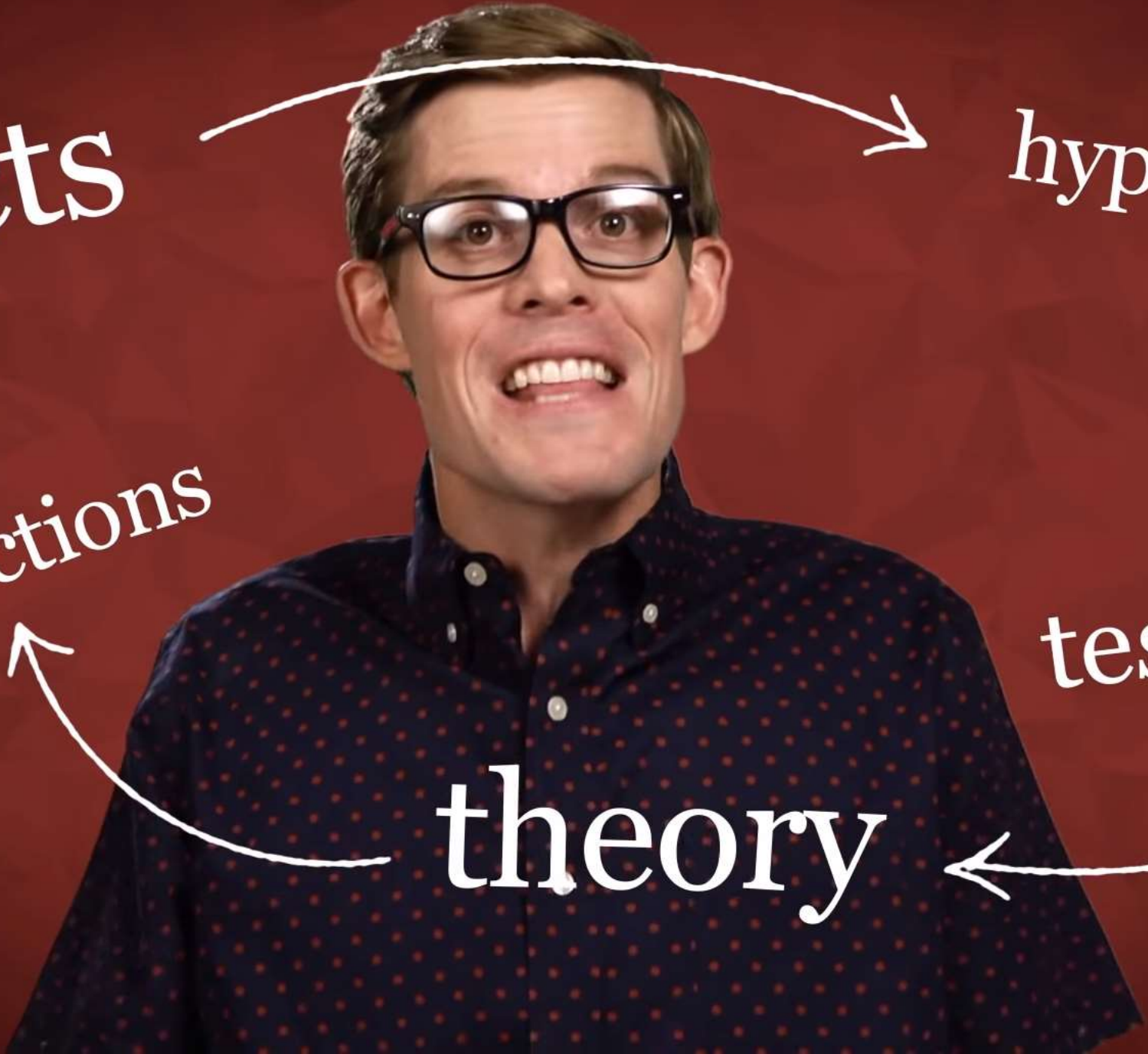
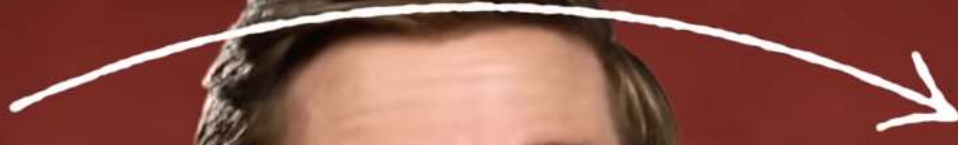
facts

hypothesis

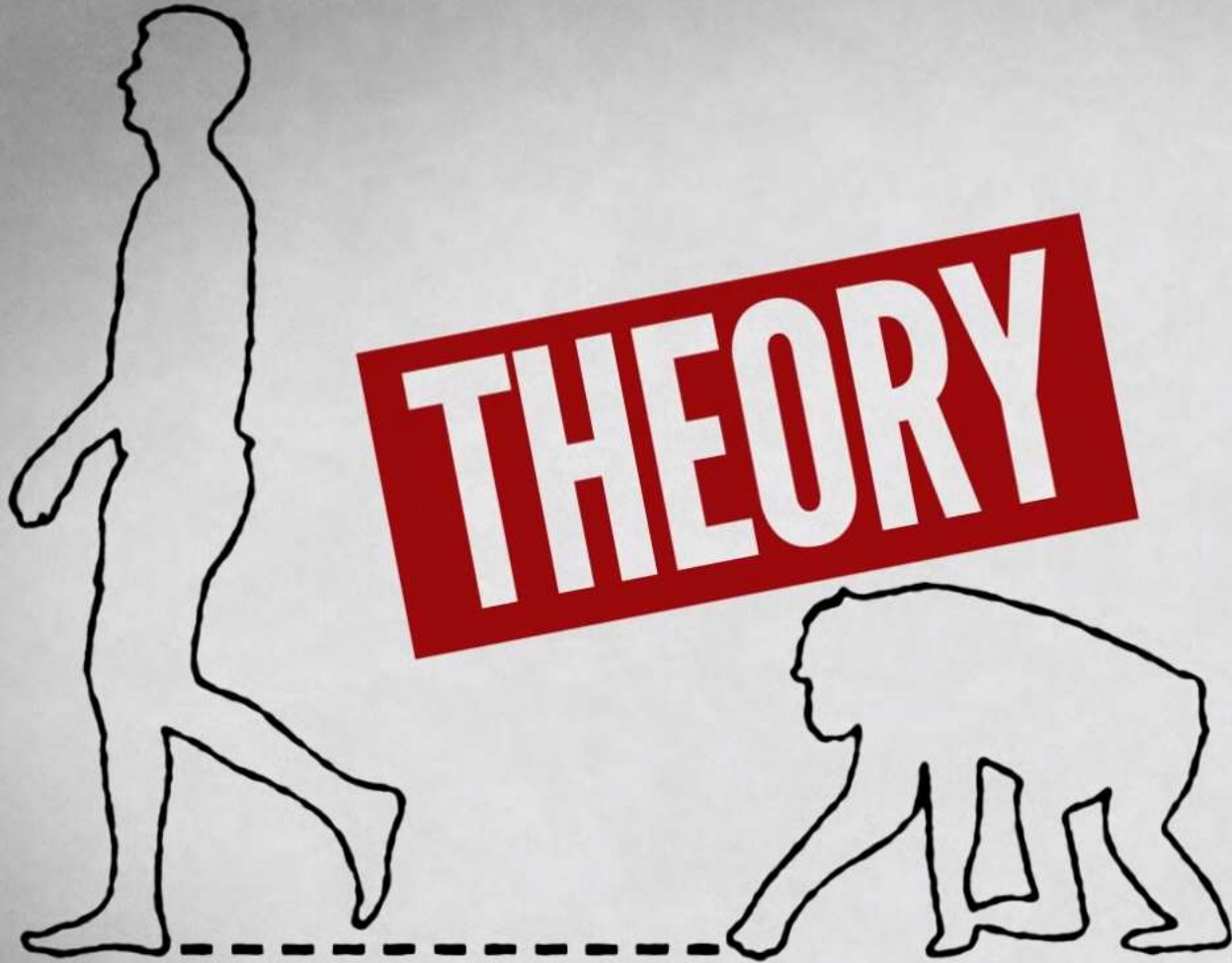
predictions

testing

theory

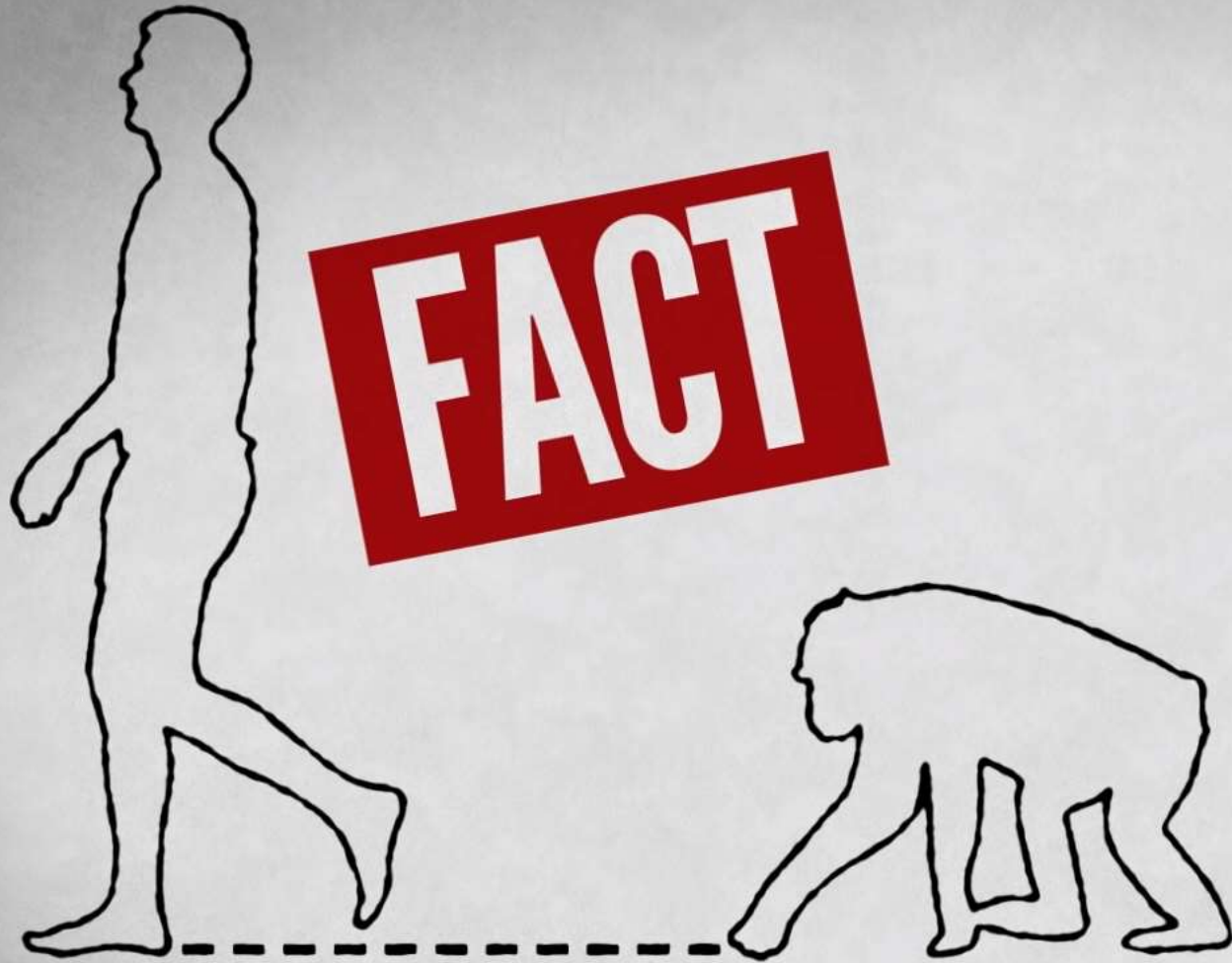






evolution by  
natural selection





evolution





**FACT**

people get sick

**HYPOTHESIS**

something gets  
in their body  
and starts doing  
bad things.



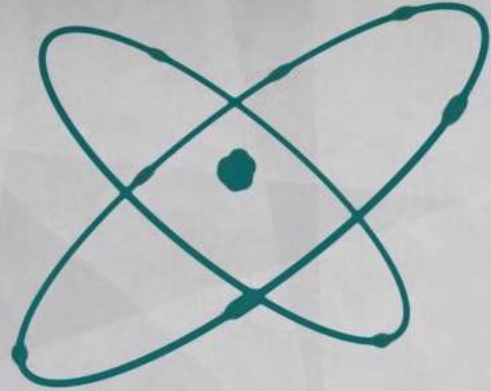


the germ

**THEORY**

of disease





**LAW**

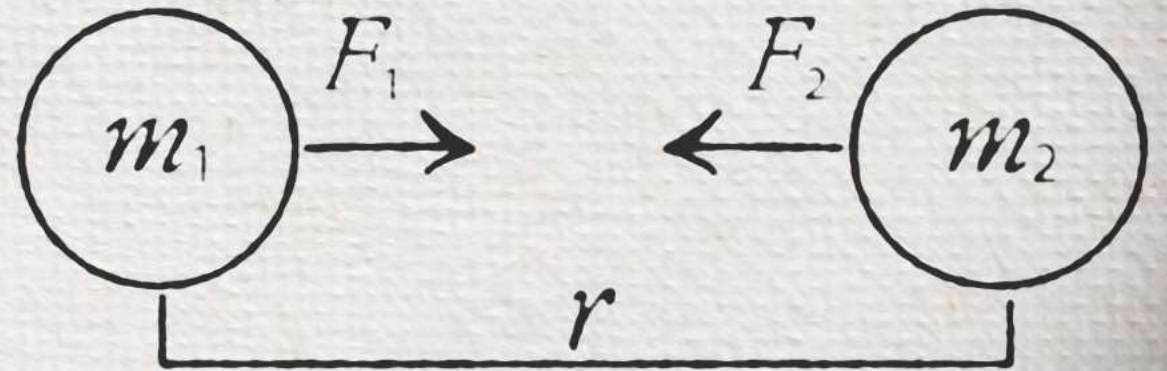
**A STATEMENT BASED ON REPEATED  
EXPERIMENTAL OBSERVATIONS THAT  
DESCRIBES SOME PHENOMENON OF NATURE**



# Newton's Law of Universal Gravitation



Isaak Newton.

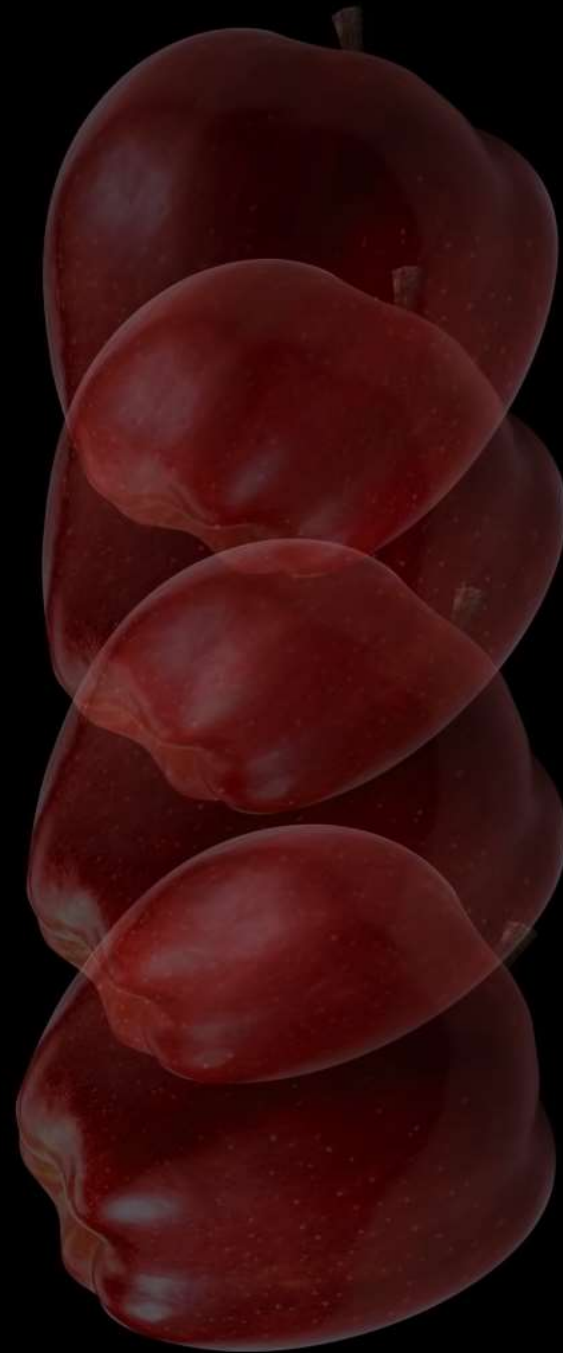


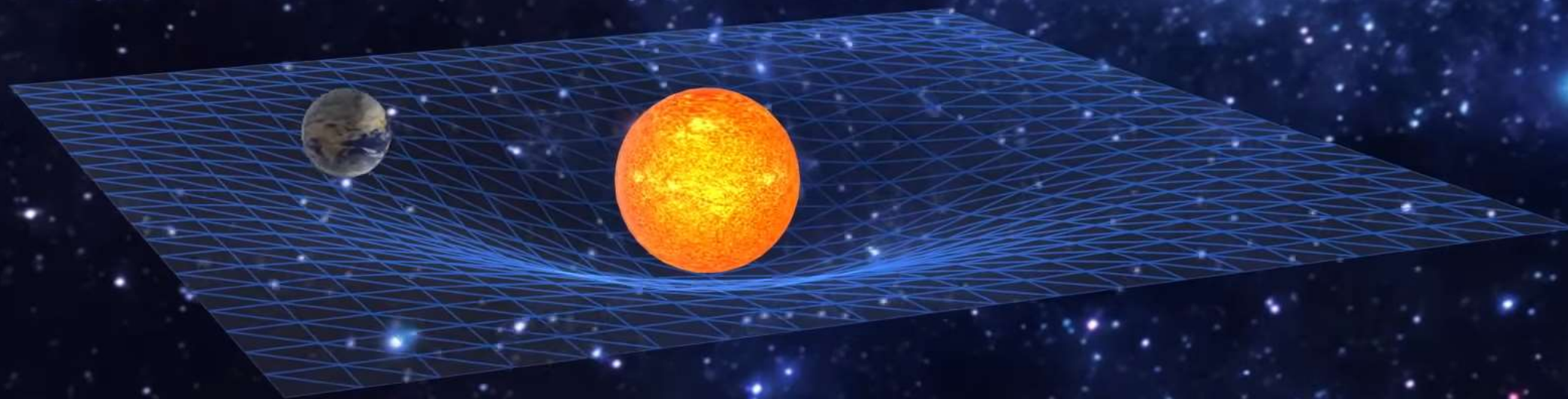
$$F_1 = F_2 = G \frac{m_1 \times m_2}{r^2}$$



# LAW

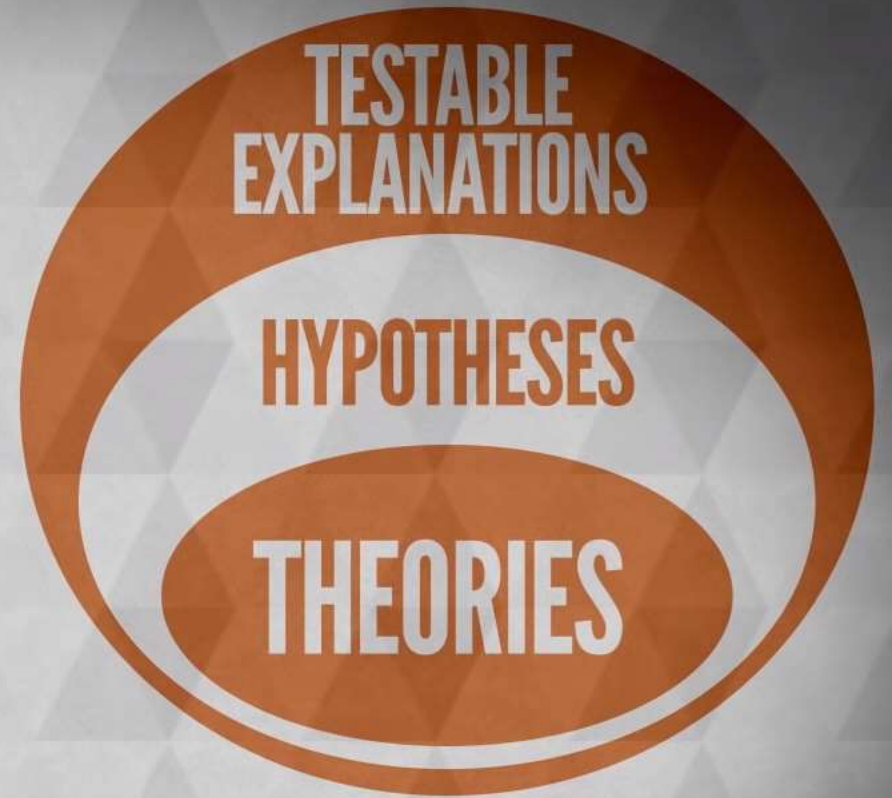
$$F_1 = F_2 = G \frac{m_1 \times m_2}{r^2}$$





# general relativity





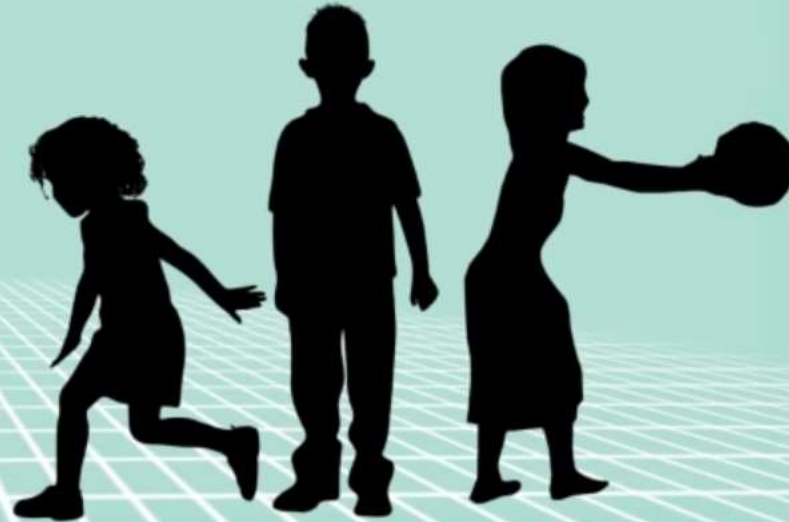


# HYPOTHESIS:

**IF** students study 15 minutes/night, **THEN** they will have *higher* test grades than those who don't study.



**STUDENTS STUDYING  
15 MIN./NIGHT**



**NON-STUDYING STUDENTS**





# INDEPENDENT VARIABLE: *STUDY TIME*



## DEPENDENT VARIABLE:

*A*

*B-*

*C+*

*D*



# HYPOTHESIS:

**IF** people who have headaches take aspirin, **THEN** they will get relief *faster* than those who don't.





# INDEPENDENT VARIABLE: *TAKING AN ASPIRIN*



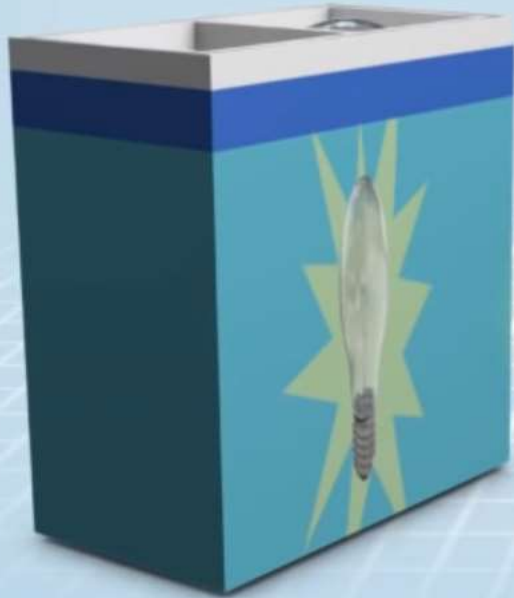
# DEPENDENT VARIABLE: *TIME TO HEADACHE RELIEF*





# HYPOTHESIS:

**IF** a brand name light bulb is left on, **THEN** it will burn *longer* than a bargain brand light bulb.



Brand name bulb

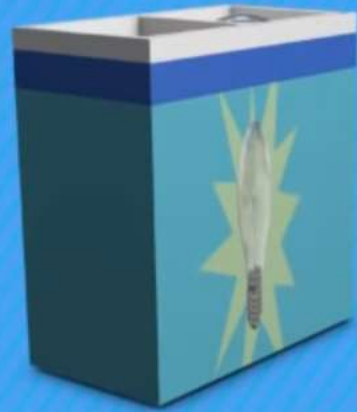


Bargain brand bulb





**INDEPENDENT VARIABLE: BRAND NAME LIGHT BULB**



**DEPENDENT VARIABLE: TIME LIGHT BULBS WORK**

**1000 HOURS**

**750 HOURS**



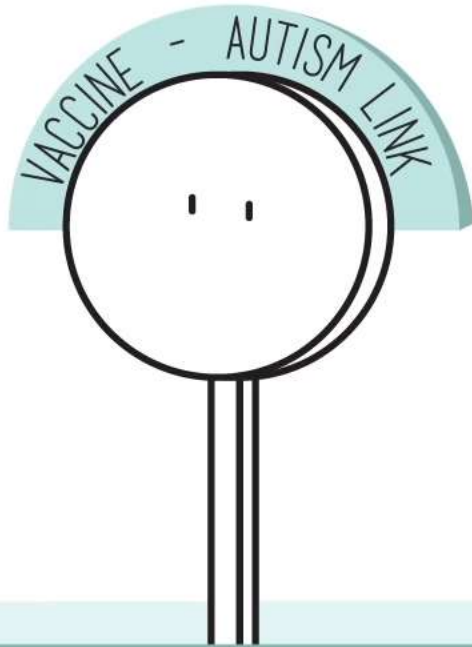
# INDEPENDENT VARIABLE (IV):

The thing you are  
*testing* (CAUSE)

I  
F

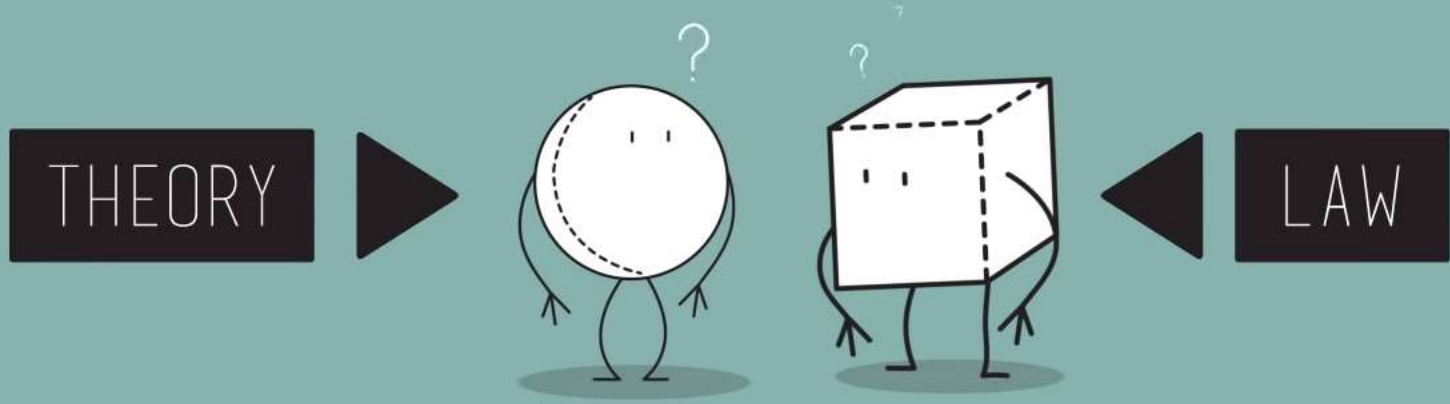
# DEPENDENT VARIABLE (DV):

The thing you are  
*measuring* (EFFECT)



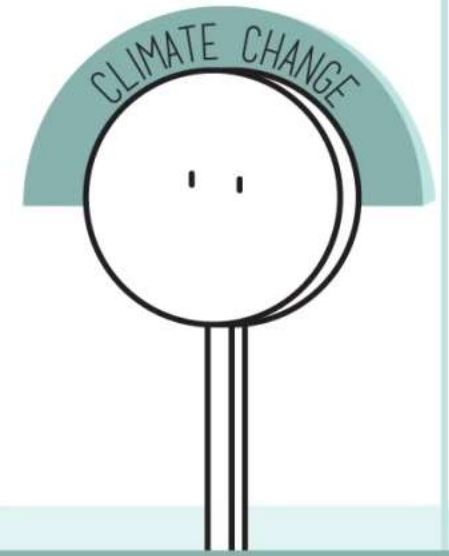
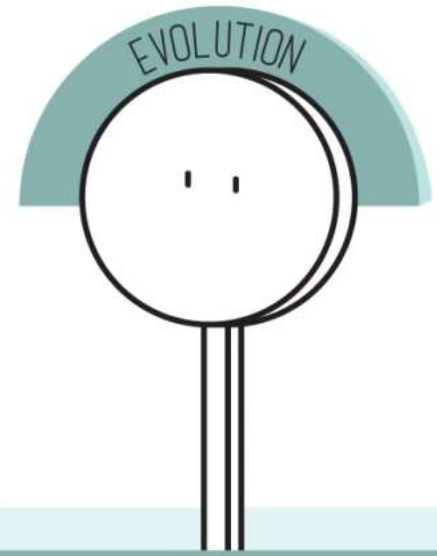
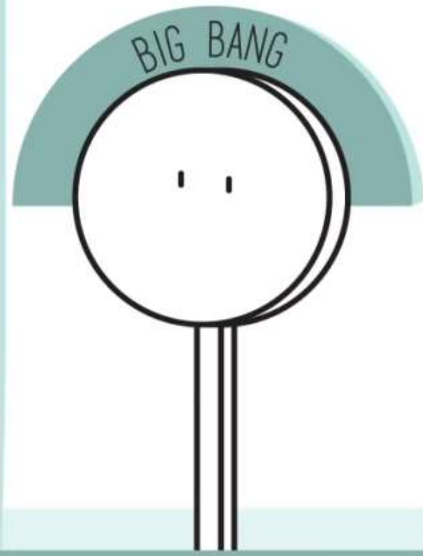
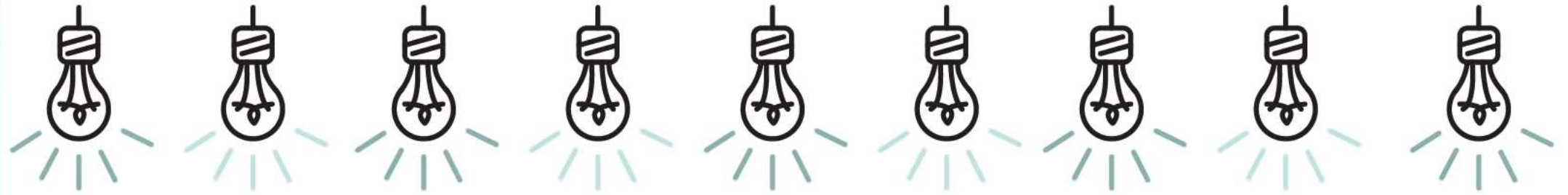
SCIENTIFIC THEORY



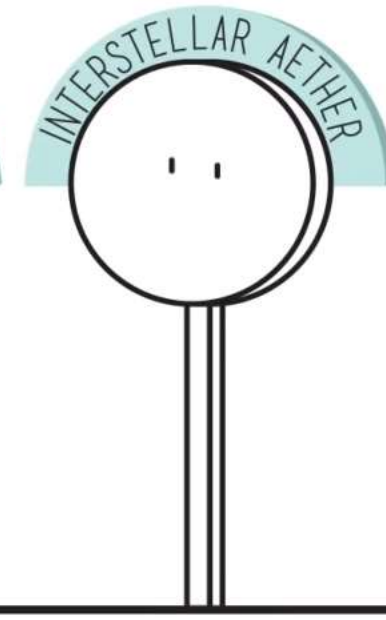
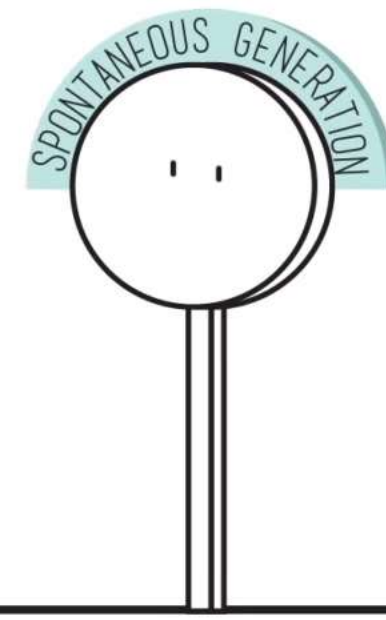
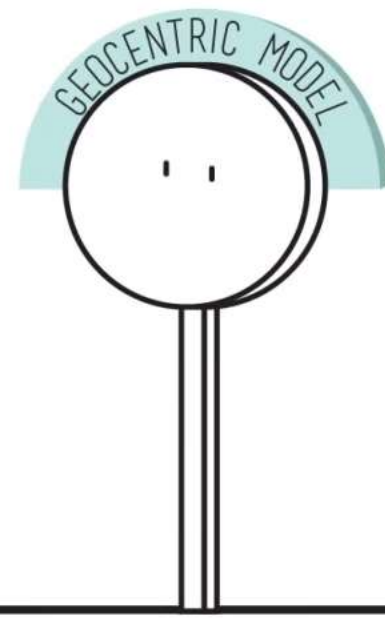
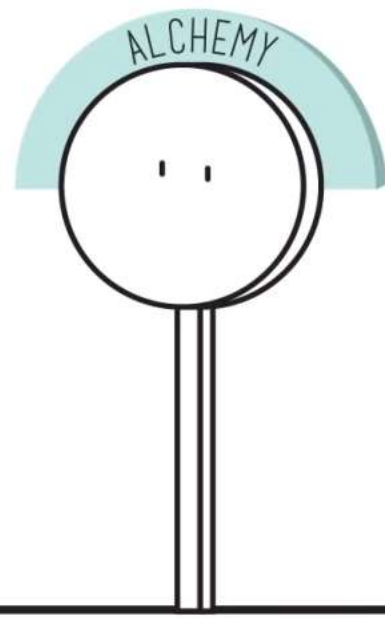
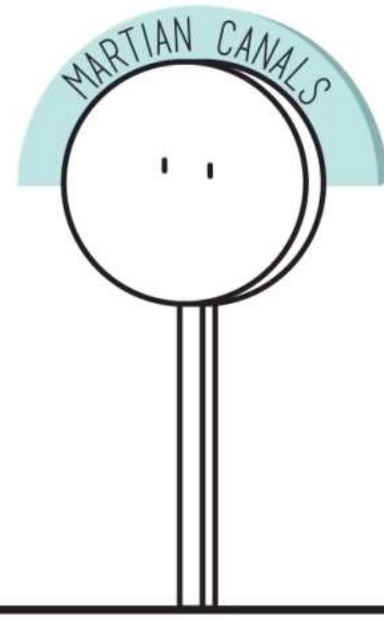
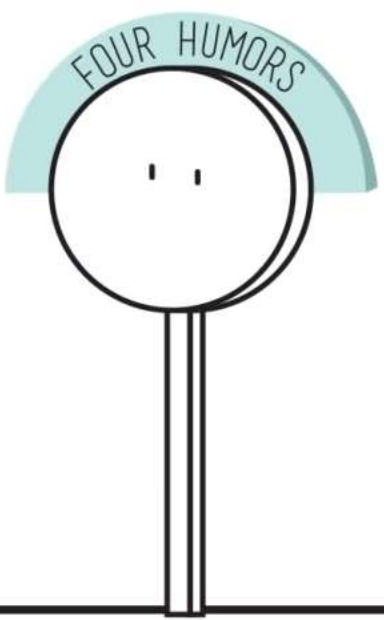
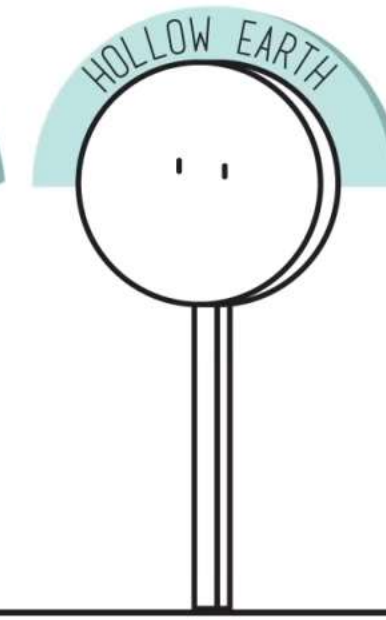
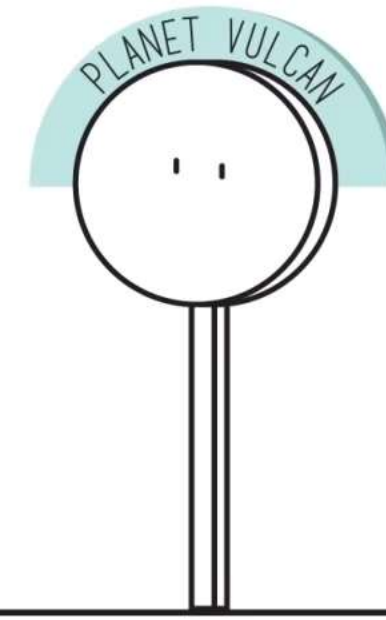
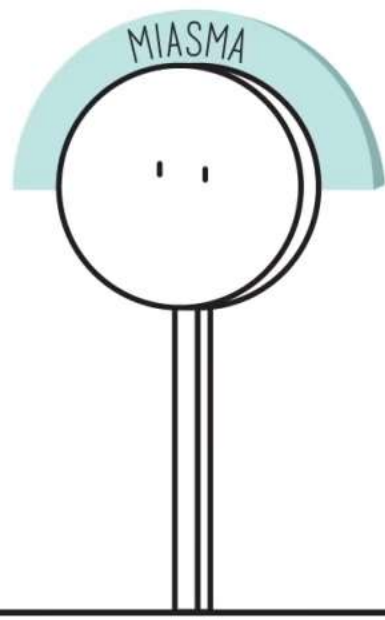
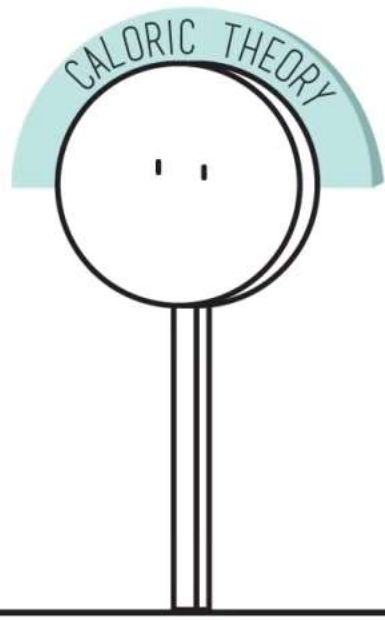
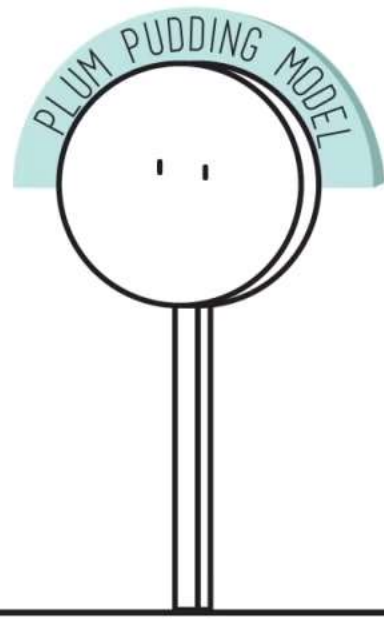
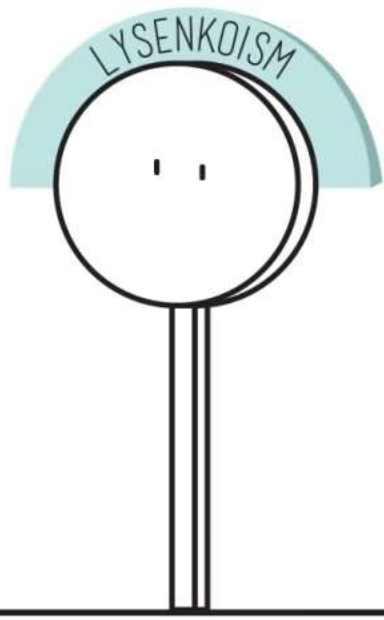








SCIENTIFIC THEORY





# Problems!

- **Very Linear**
- Not Intuitive
- “Facts” vs. “Process”
- Focused on experiment

# Statistics

- 65% of Americans don't know what scientists do, but half consider it "dangerous"<sup>1</sup>
- 68% of 8<sup>th</sup> graders performed below proficiency in science in 2011<sup>2</sup>
- Less than 30% of elementary teachers feel well prepared to teach science<sup>3</sup>



## Statistics

- 50% of parents surveyed (in the UK) feared answering their childrens' science questions<sup>4</sup>
- 20% (1 in 5) reported that they responded by making something up or saying "no one knows"<sup>4</sup>





Mahidol University  
Faculty of Science

