

# Honors Biology Chapter 1

THE SCIENTIFIC METHOD

# What is science?

- ▶ Goal is to investigate the natural world and explain it.
- ▶ Propose explanations
- ▶ Constantly changing

# Scientific Method

- ▶ Ask a question
  - ▶ Need to realize that there is a problem or something that doesn't make sense
- ▶ Observations
  - ▶ Process of gathering information
  - ▶ How? Using What?
- ▶ Inferences
  - ▶ Logical explanations based on experiences

# Observation and Inference

## Section 1-1

Statement	Observation	Inference
Object A is round and orange.	X	
Object A is a basketball.		X
Object C is round and black and white.	X	
Object C is larger than Object B.	X	
Object B is smooth.	X	
Object B is a table-tennis ball.		X
Each object is used in a different sport.	X	X

OBJECT A IS A BASKETBALL.

OBJECT B IS A TABLE-TENNIS BALL.

OBJECT C IS A SOCCER BALL.

# Scientific Method Continued

- ▶ Form a **hypothesis**
  - ▶ Proposed scientific explanation
  - ▶ Educated guess
  - ▶ Must be testable
- ▶ Set up a **controlled experiment**
  - ▶ Experiment must test hypothesis
    - ▶ Must identify all variables
      - ▶ Controls- those variables that remain the same between treatments
      - ▶ Manipulated variable
        - ▶ Independent variable
        - ▶ The one the scientists changes (only one)
      - ▶ Responding variable
        - ▶ Dependent variable
        - ▶ Measures the effect

# Figure 1-8 Redi's Experiment on Spontaneous Generation

## Redi's Experiment of Spontaneous Generation

HYPOTHESIS: Flies produce maggots.

### PROCEDURE



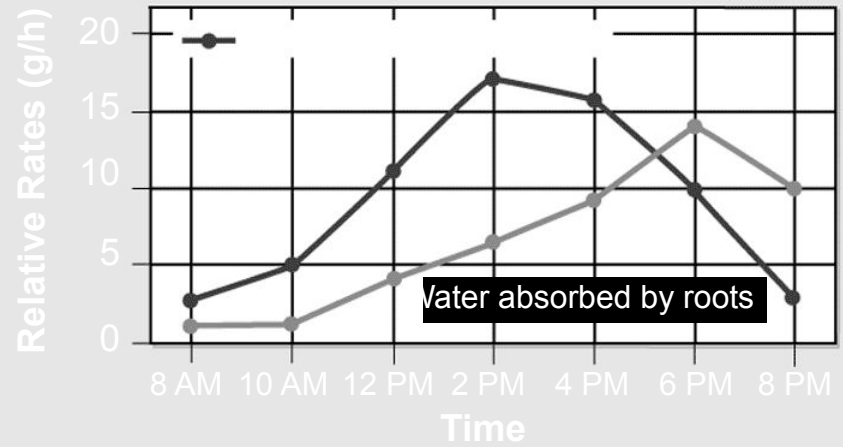
CONCLUSION: Maggots form only when flies come in contact with meat. Spontaneous generation of maggots did not occur.

# Scientific Method Continued

- ▶ **Record and analyze**
  - ▶ Record data
    - ▶ **Quantitative**
    - ▶ **Qualitative**
  - ▶ Usually in tables, charts, etc.

# Making a Graph From A Data Table

## Section 1-4





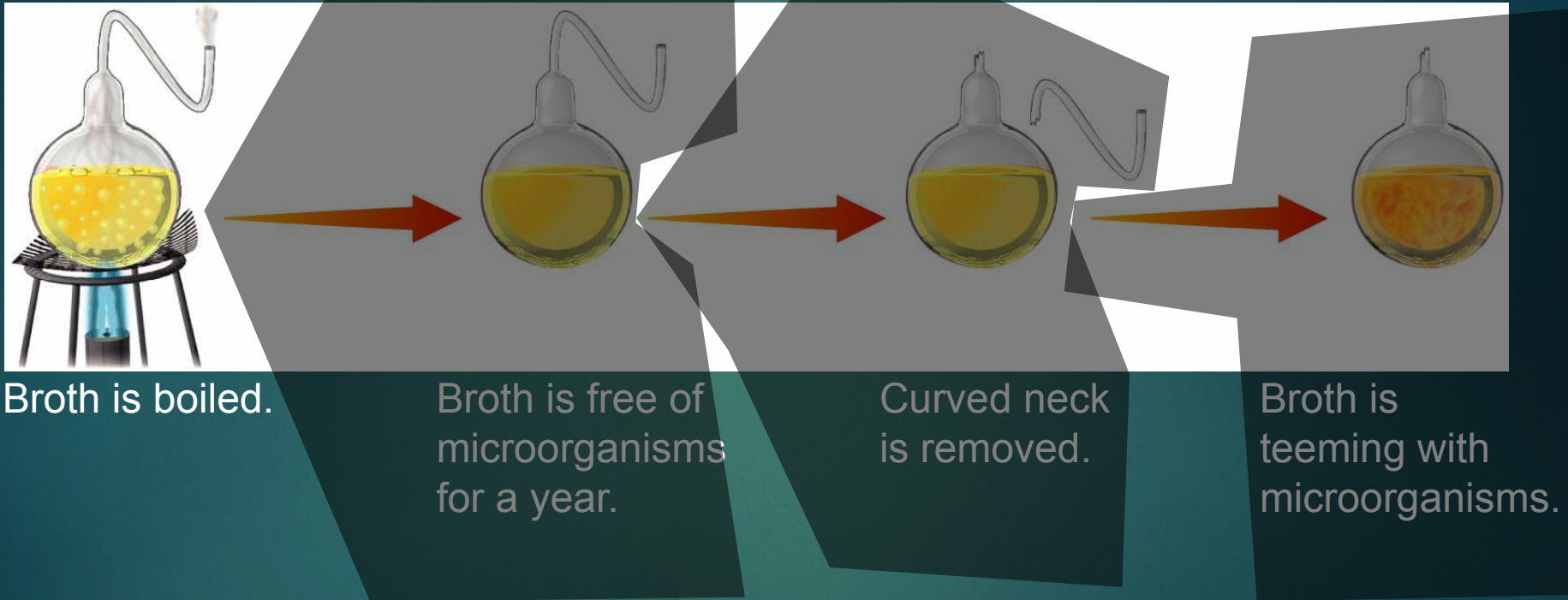
# Scientific Method Continued

- ▶ **Record and analyze**
  - ▶ Record data
    - ▶ **Quantitative**
    - ▶ **Qualitative**
  - ▶ Usually in tables, charts, etc.
- ▶ Draw a conclusion
  - ▶ Look for patterns
  - ▶ Support or reject hypothesis
  - ▶ Report and share information and conclusions
- ▶ Repeat Investigation
  - ▶ Other scientists confirm
    - ▶ Must have exact details of how experiment was performed
    - ▶ Test of Redi's experiment-Needham, Spallanzani, Pasteur



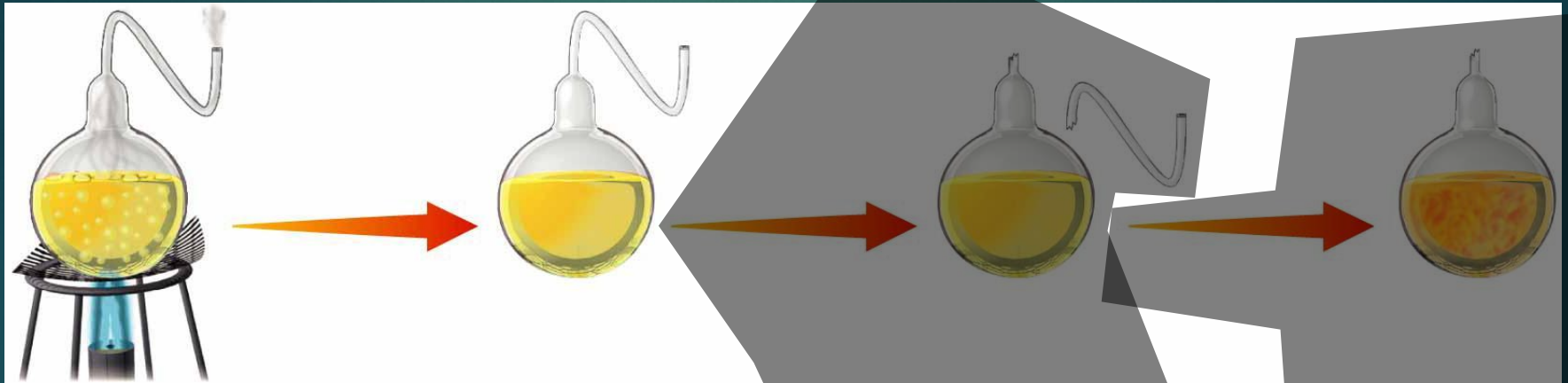
# Figure 1-11 Pasteur's Experiment Louis Pasteur's Experiment 1864

Section 1-2



# Figure 1-11 Pasteur's Experiment

Section 1-2



Broth is boiled.

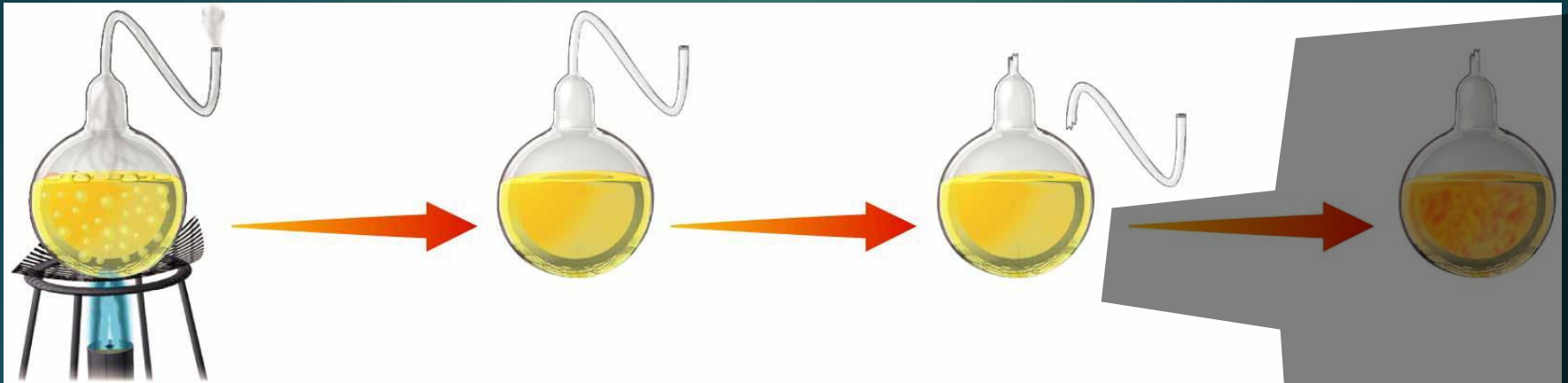
Broth is free of microorganisms for a year.

Curved neck is removed.

Broth is teeming with microorganisms.

# Figure 1-11 Pasteur's Experiment

Section 1-2



Broth is boiled.

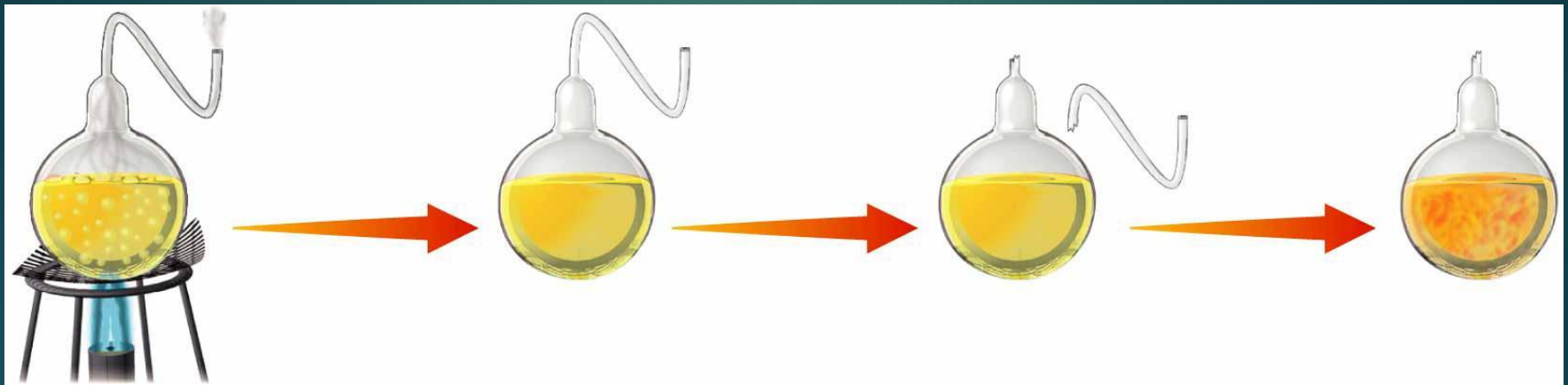
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# Figure 1-11 Pasteur's Experiment

Section 1-2



Broth is boiled.

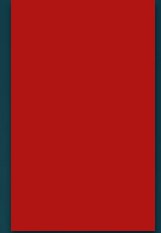
Broth is free of microorganisms for a year.

Curved neck is removed.

Broth is teeming with microorganisms.

Why was this discovery so important for life today?

# What is a theory?



- ▶ Theory
  - ▶ Well tested explanation that unifies a broad range of observations
  - ▶ Theory of biogenesis



# Is a virus living or nonliving?

1. Think
2. Discuss
3. Research
4. Support
5. Share



# Ch. 1.3 What is Biology?

- ▶ Biology is the science that studies living things
- ▶ Properties of life
  - ▶ Life is “GRIM C MAH”
    - ▶ G- growth
    - ▶ R-reproduction
      - ▶ Sexual v. Asexual
    - ▶ Irritability
      - ▶ Respond to stimulus or environment
    - ▶ M-metabolism
      - ▶ Energy
    - ▶ C-cells
      - ▶ All living things are made up of cells and have DNA
    - ▶ M-mobility
    - ▶ A-adaptability
      - ▶ Over a period of time groups of organism change
    - ▶ H-homeostasis



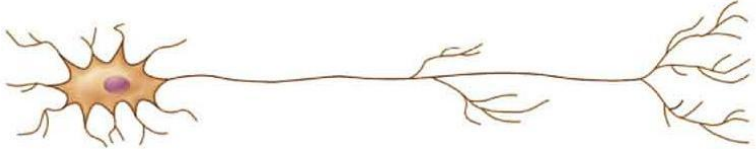

# Organization of Life



- ▶ Organization of life
  - ▶ Atom
  - ▶ Molecule
  - ▶ Cell
    - ▶ Smallest functional unit of life
  - ▶ Tissues
  - ▶ Organs
  - ▶ Organ system
  - ▶ Organism

# Levels of Organization within a Single Organism

Section 1-3





Organism		
Groups of Cells		
Cells		
Molecules		

# Organization of Life Continued

- ▶ Population
  - ▶ Group of organisms that belong to the same species living in a defined area
- ▶ Community
  - ▶ All the populations that occupy the same area/interact
- ▶ Ecosystem
  - ▶ Community and its interactions with non-living parts/ abiotic factors
- ▶ Biosphere

# Figure 1-21 Levels of Organization

## Organizational Levels Bigger than a Single Organism

Biosphere		 <p>Biosphere</p>
Ecosystem		 <p>Hawk, snake, bison, prairie dog, grass, stream, rocks, air</p>
Community		 <p>Hawk, snake, bison, prairie dog, grass</p>
Population		

# Chapter 1.4 Measurement

## Measuring system

- ▶ Metric system/System
- ▶ 1960's improved the standards
  - ▶ Idea was that it would be used worldwide
- ▶ Based on powers of ten
- ▶ Common measurements
  - ▶ **Distance/length** meter/ruler
    - ▶ Std. Wavelength of light emitted by Krypton 86
    - ▶ 1 meter=1,650,763.73 wavelengths
  - ▶ **Mass** grams/balance
    - ▶ Amount of matter in an object
    - ▶ Use balance to measure
    - ▶ Std. 1 gram= weight of a cubic cm. of pure water at 4 °C
  - ▶ **Time** second/watch

# Measurement Continued...




- ▶ **Temperature** Kelvin
  - ▶ Absolute zero =  $-273\text{ }^{\circ}\text{C}$  =  $0\text{ K}$
- ▶ **Amount of a substance** moles
  - ▶ 1 mole =  $6.023 \times 10^{23}$  atoms
  - ▶ Avogadro's number
- ▶ Derived units
  - ▶ Cannot be measured directly
  - ▶ Must combine units
    - ▶ Volume liter
      - ▶ Std. Amount of liquid that will fit in cubic decimeter
      - ▶ Water displacement method
    - ▶ Density
      - ▶ Mass per unit of volume
      - ▶  $D=M/V$

# Conversions

- ▶ Easiest way is to use and memorize the chart method
  - ▶ If unit gets smaller, number gets bigger.



# Metric Conversion

<b>K</b> ing	<b>H</b> enry	<b>D</b> ied	<b>U</b> nusually 	<b>D</b> rinking	<b>C</b> hocolate	<b>M</b> ilk
<b>Kilo</b>  <b>10 x 10 x 10 x LARGER than a unit</b> 1 kilo = 1,000 units	<b>Hecto</b> <b>10 x 10 x LARGER than a unit</b> 1 hecto = 100 units	<b>Deca</b> <b>10 x LARGER than a unit</b> 1 deca = 10 units	<b>* Unit *</b> <b>Meter</b> <i>(length)</i> <b>Liter</b> <i>(liquid volume)</i> <b>Gram</b> <i>(mass/weight)</i> <b>1 unit</b>	<b>Deci</b> <b>10 x SMALLER than a unit</b> 10 deci = 1 unit	<b>Centi</b> <b>10 x 10 x SMALLER than a unit</b> 100 centi = 1 unit	<b>Milli</b> <b>10 x 10 x 10 x SMALLER than a unit</b>  1,000 milli = 1 unit
km = kilometer kL = kiloliter kg = kilogram	hm = hectometer hL = hectoliter hg = hectogram	dam = decameter daL = decaliter dag = decagram	m = meter L = liter g = gram	dm = decimeter dL = deciliter dg = decigram	cm = centimeter cL = centiliter cg = centigram	mm = millimeter mL = milliliter mg = milligram

Example: 5 kilo

50 hecto

500 deca

5,000 units

50,000 deci

500,000 centi

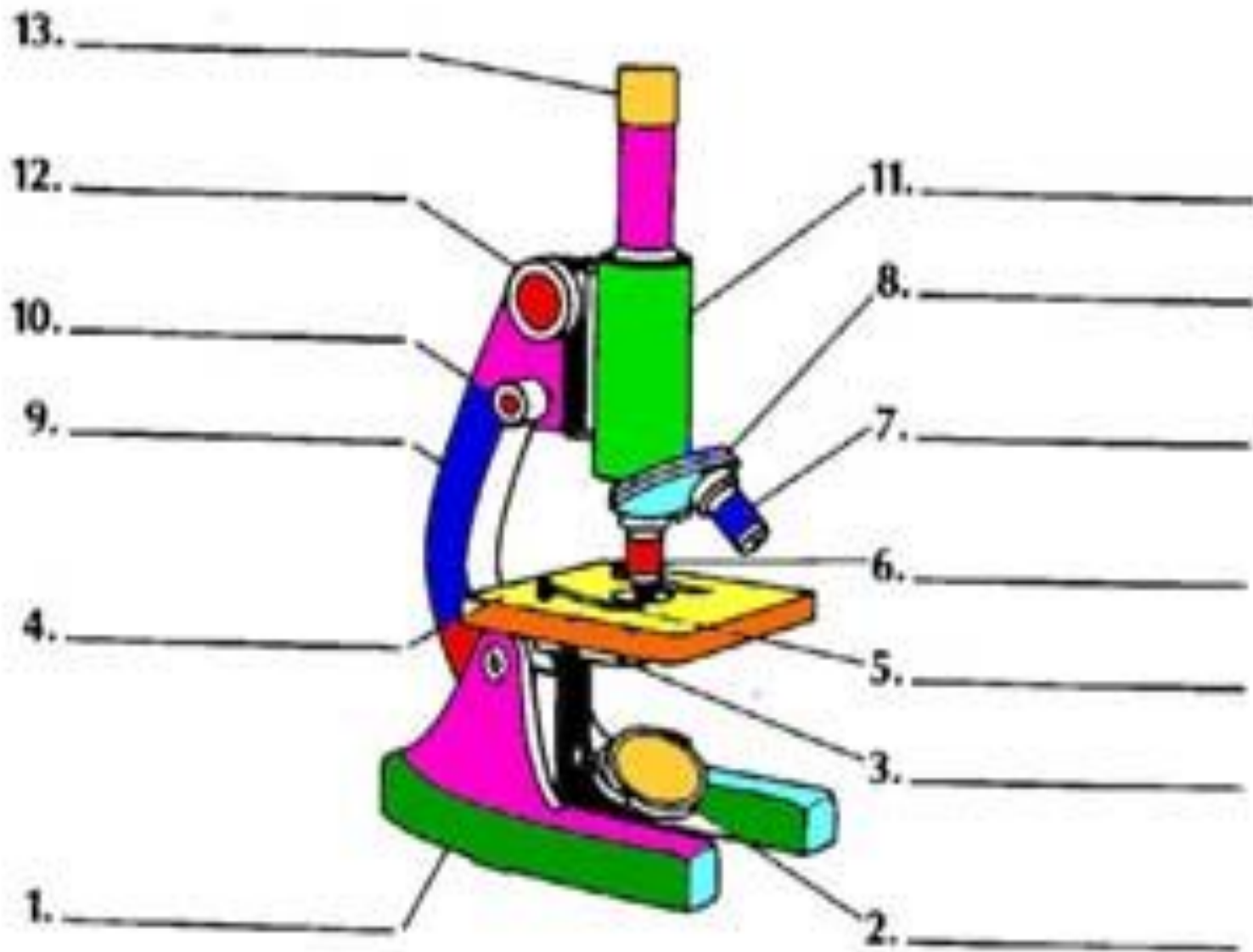
5,000,000 milli

← **DIVIDE** numbers by **10** if you are getting bigger (same as moving decimal point one space to the left)

**MULTIPLY** numbers by **10** if you are getting smaller (same as moving decimal point one space to the right) →

# Types of Microscopes

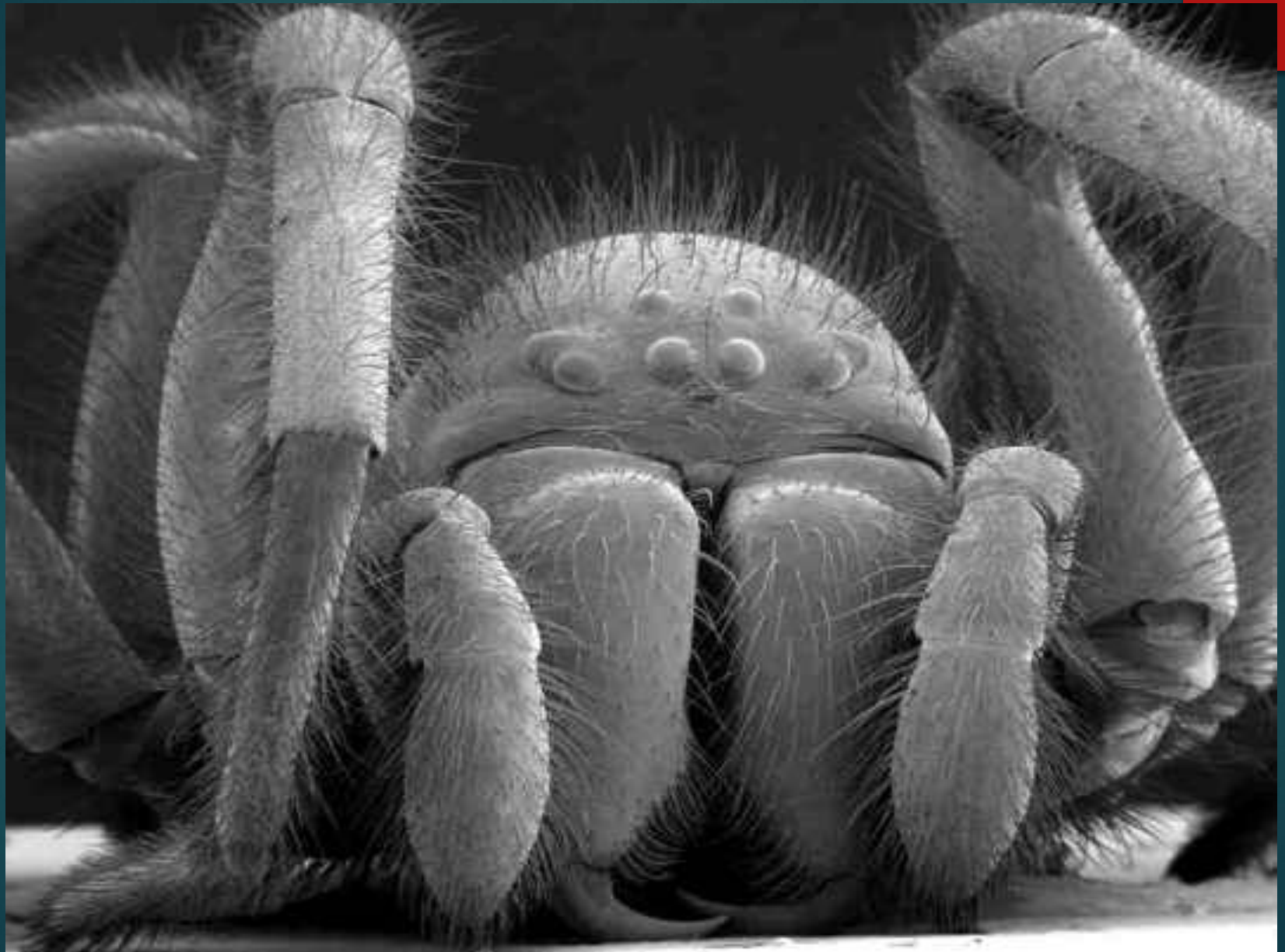
- ▶ Light microscope
  - ▶ Allow light to pass through specimen
  - ▶ Most today are compound
    - ▶ Two lenses
    - ▶ Total magnification
    - ▶ Resolution
    - ▶ Parts of the scope (Appendix D)



# Types of Microscopes

- ▶ Light microscope
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    - ▶ Parts of the scope (Appendix D)
- ▶ Electron microscope
  - ▶ Use beams of electrons instead of light
  - ▶ 1000X more detailed than light microscopes
  - ▶ Two types
    - ▶ TEM
      - ▶ Shine beam through
    - ▶ SEM
      - ▶ Bounce electrons off
      - ▶ 3-D





# Butterfly tongue under scanning electron microscope

