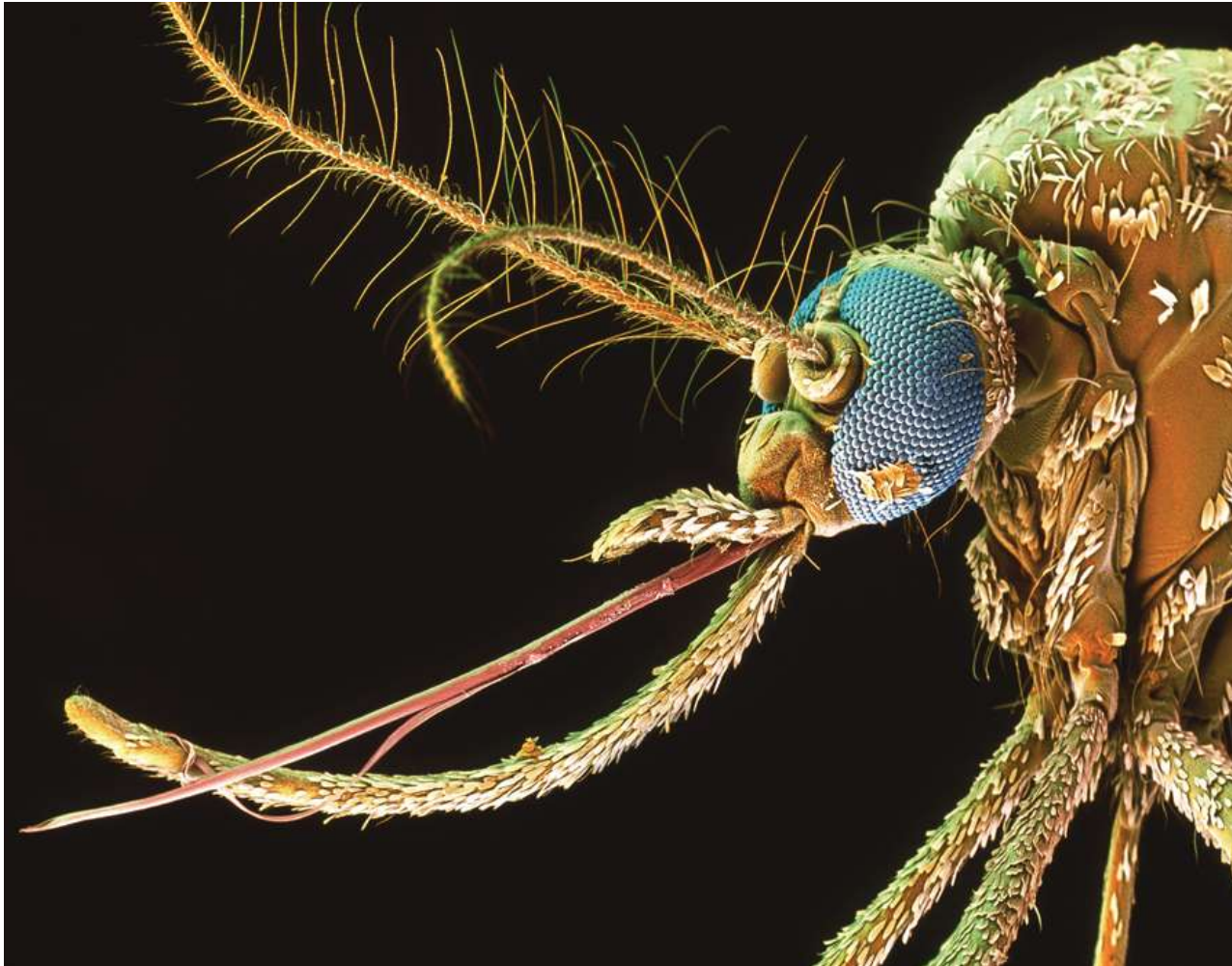


Chapter 1

Biology in the 21st Century

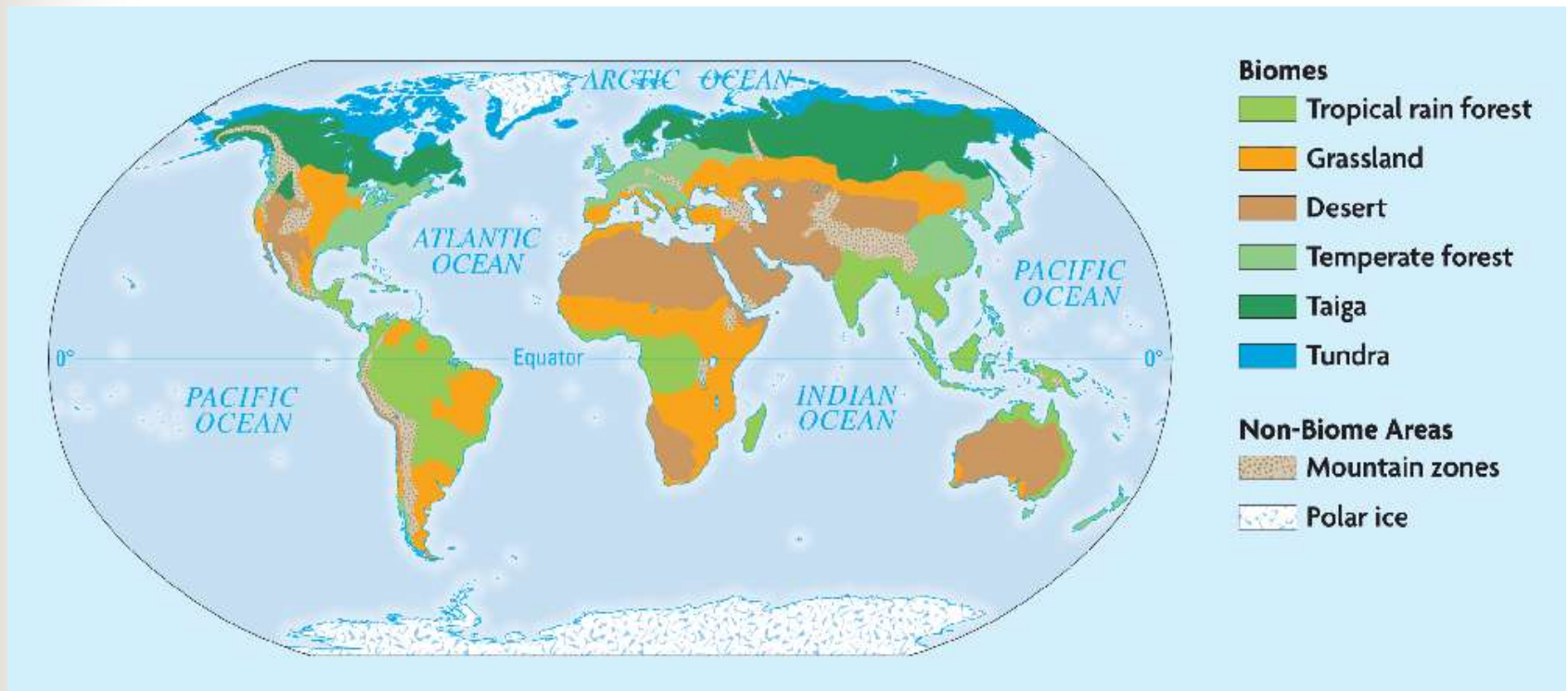


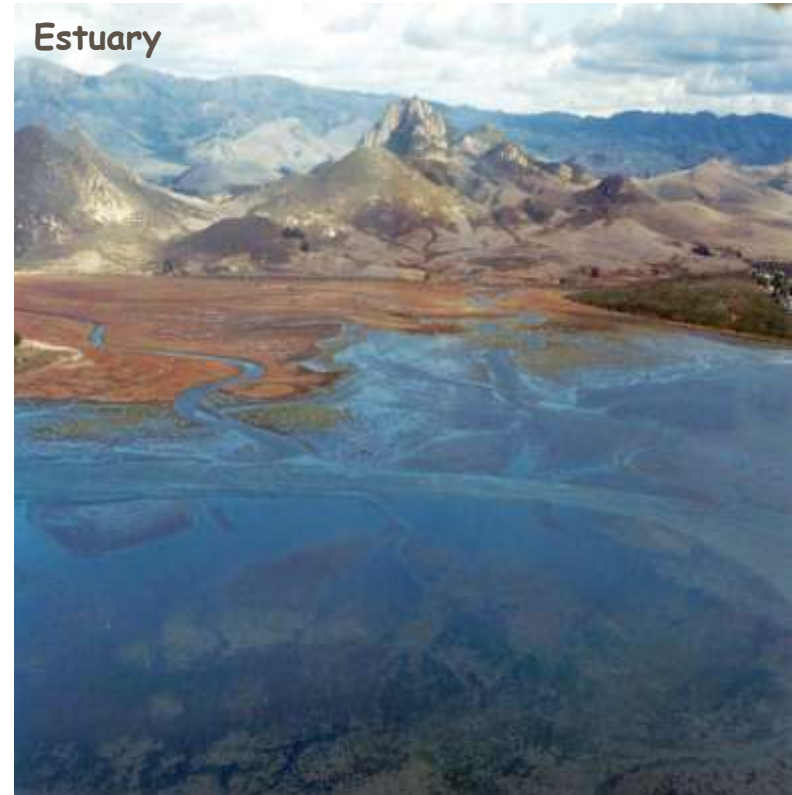


- **Biology- study of life**
 - **3.5 billion years ago**



- biosphere = where life exists





- Biodiversity = variety of life.
 - More at equator.



Biodiversity is **greater** closer to the equator.

■ Species

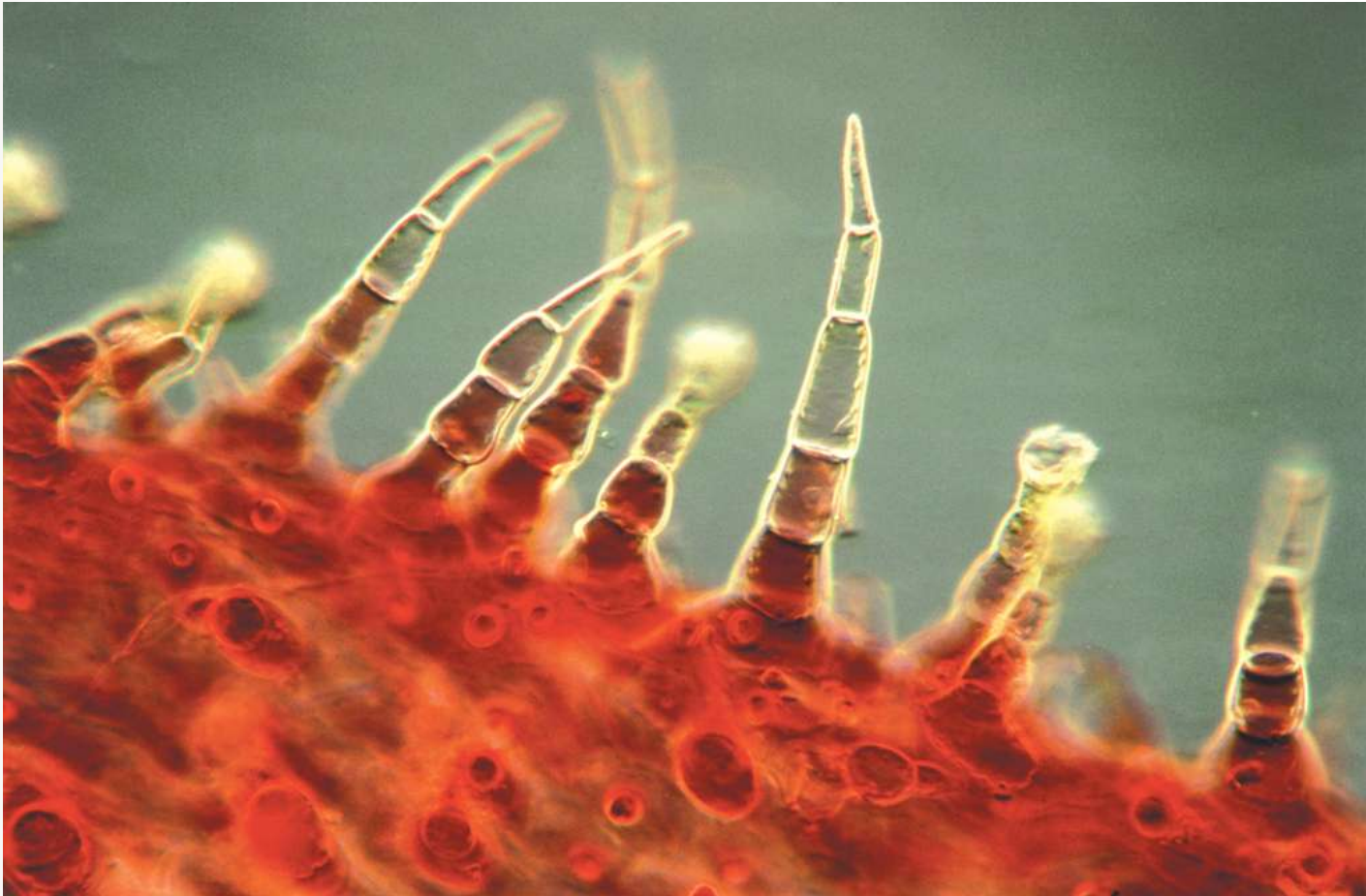
- interbreed to reproduce.
- *2 million identified.
- *Discover 10,000 each year while 50,000 die out



■ New species

- Rainforests
- Deep oceans
- *2.5 billion organisms in gram of soil

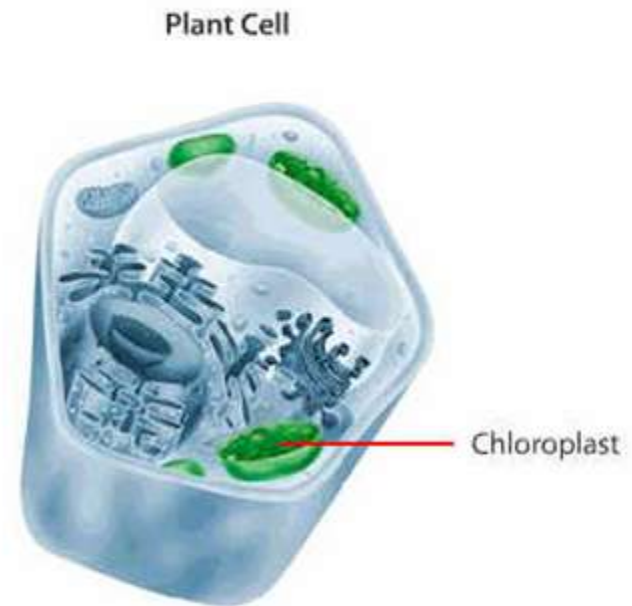




6 characteristics of life

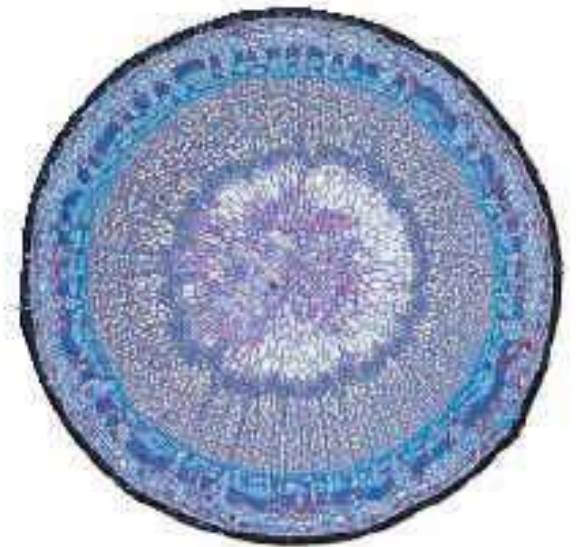
1. Cells

- Basic unit of life
- Unicellular (1)
multicellular (many)











2. Organization

- cell structures
(**organelles**) carry
out functions

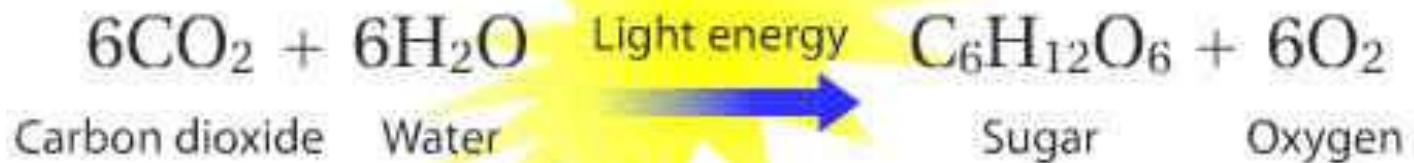


- Multicellular organization
 - Cells →
 - Tissues →
 - Organs →
 - **systems** →
 - **organism**

Levels of Organization		
Biosphere	The part of Earth that contains all organisms	
Ecosystem	Community and its nonliving surroundings	
Community	Populations that live together in a defined area	
Population	Group of organisms of one type that live in the same area	
Organism	Individual living being	
Groups of Cells	Three organs, and organ systems	
Cells	Smallest functional unit of life	
Molecules	Group of atoms arranged in a fixed chemical compound	

3. Energy Use

- **metabolism**
 - Sum of all chemical processes
- growth, maintenance and reproduction



4. Respond to environment

- Homeostasis-stable internal conditions
- Adaptations
- Reflexes



6. Reproduction

- Offspring= species survival
- Pass DNA (genetic material)
- repair/replacement



Themes of Biology 1.2





1. systems of related parts

- System = organized group of interacting parts
 - Cell
 - body system
 - Ecosystem



2. Structure and function are related

- Teeth

- ?

- Lungs

- ?

- Feet

- ?



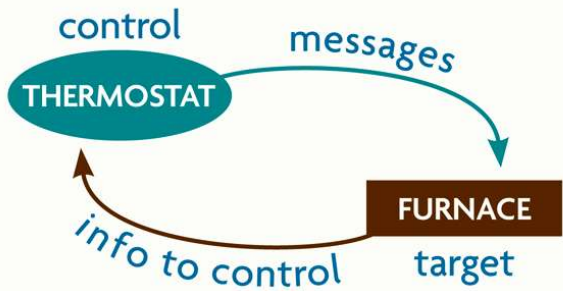


3. maintain homeostasis

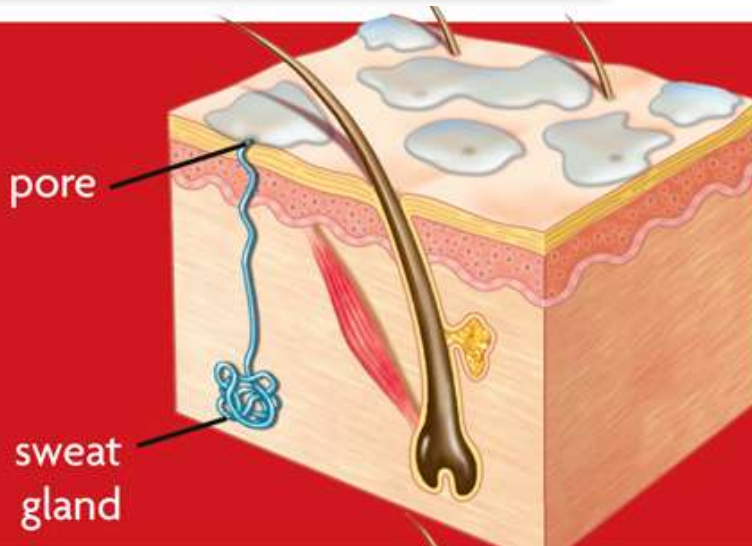
- constant internal conditions.
 - negative feedback.
 - Sweat/shiver

VISUAL VOCAB

Thermoregulation maintains a stable body temperature under a variety of conditions, just as a thermostat regulates a furnace. Both mechanisms use feedback to keep temperatures within set ranges.



hot temperature



Blood flow to the skin increases. Tiny muscles expand the pores. Sweat glands release water to cool the body.





4. Evolution

- Change over time. *genetics
- Adaptations = beneficial traits passed to future generations.
 - Mimicry : orchid and thorn bug





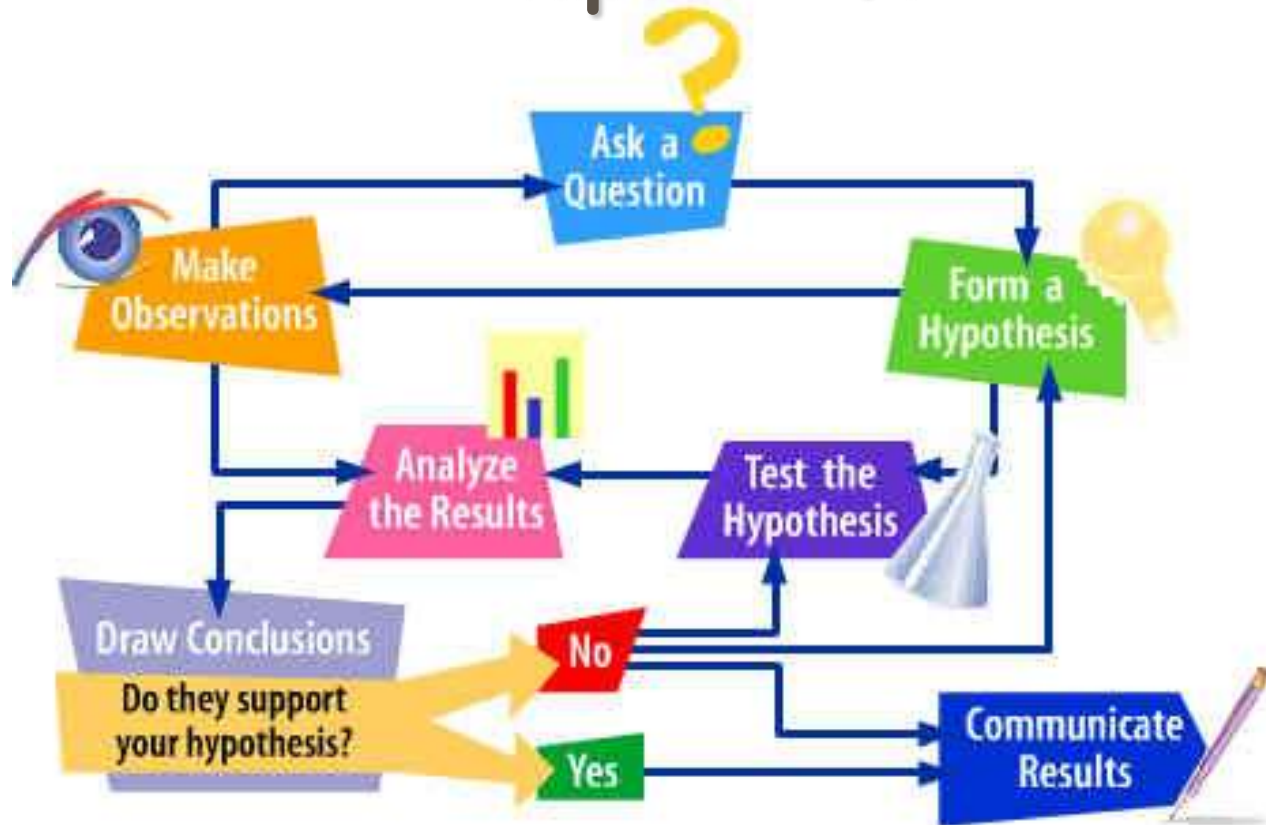
■ Natural selection- Survival of the fittest

- Charles Darwin
- Evolutions driving
force



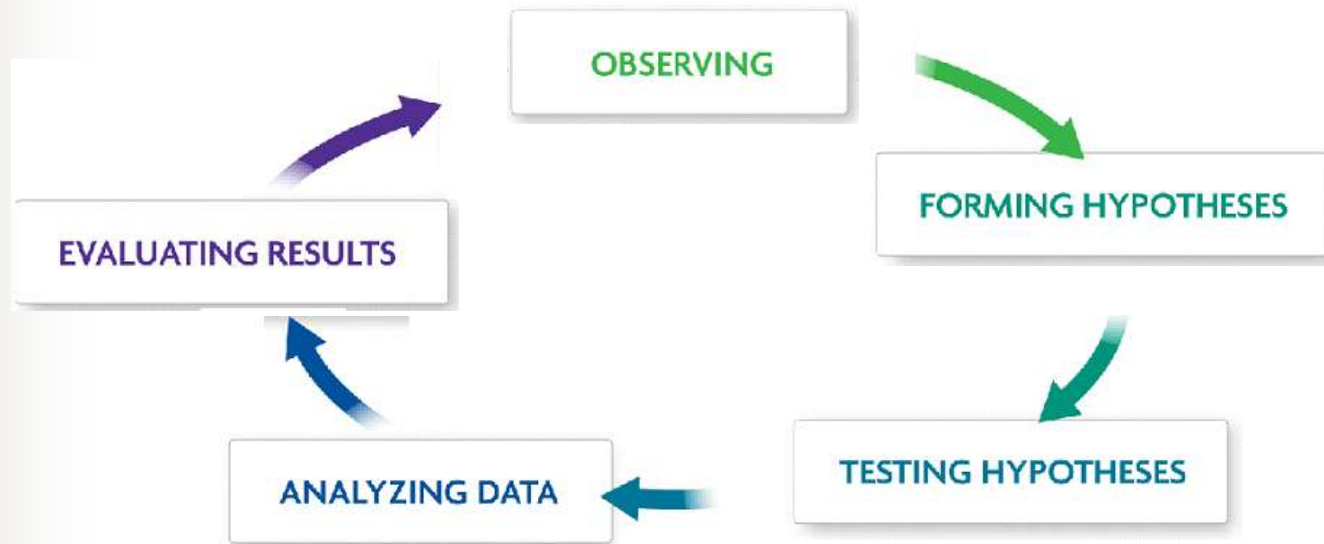
Scientific thinking and processes

Chapter 1.3



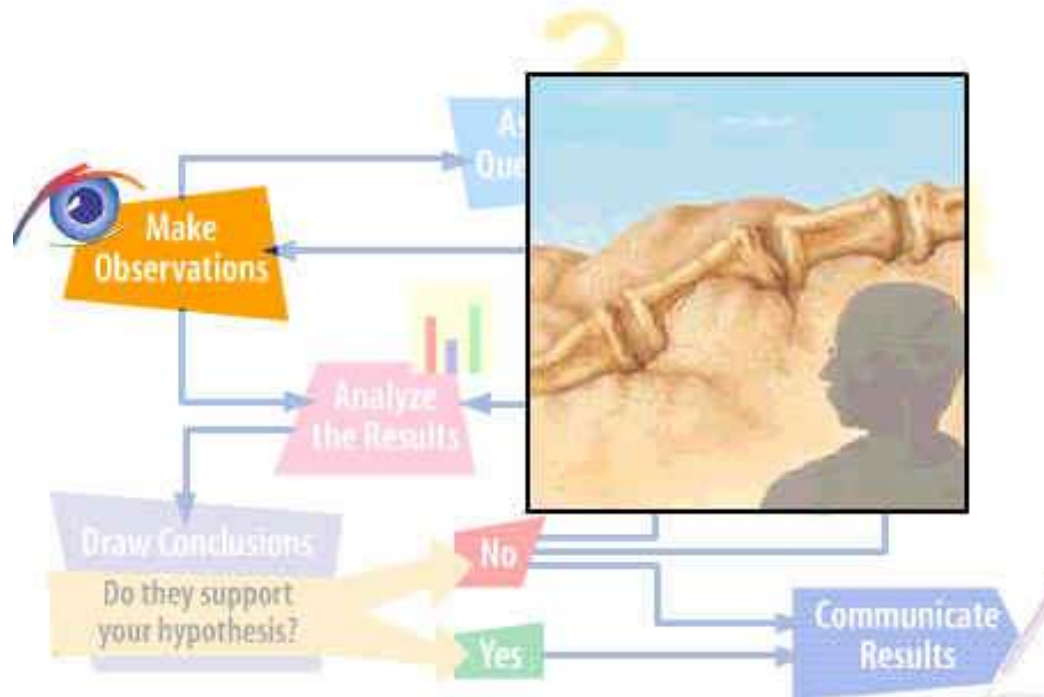
Scientific method

- Steps to solve a problem



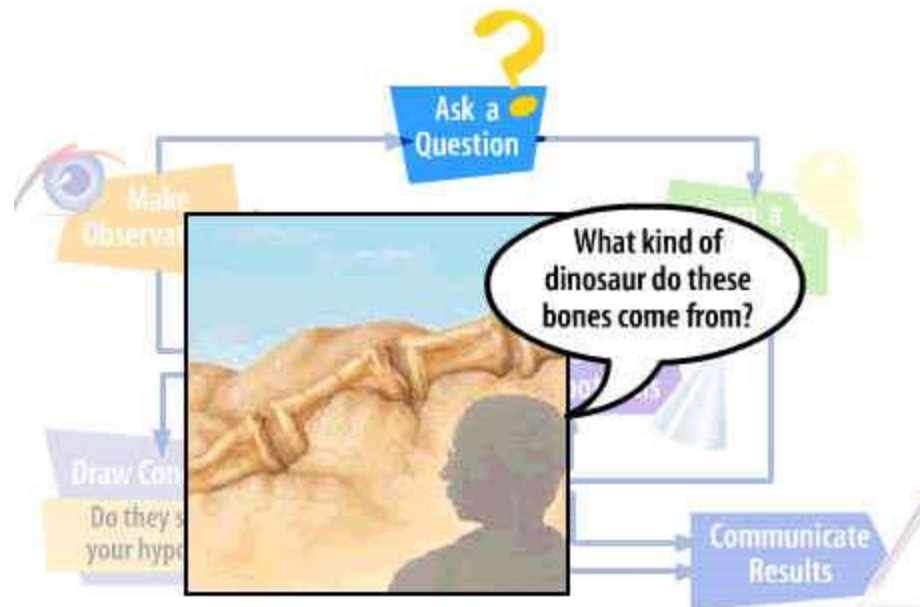
1. Observation

- five senses
- Instruments ex: seismograph



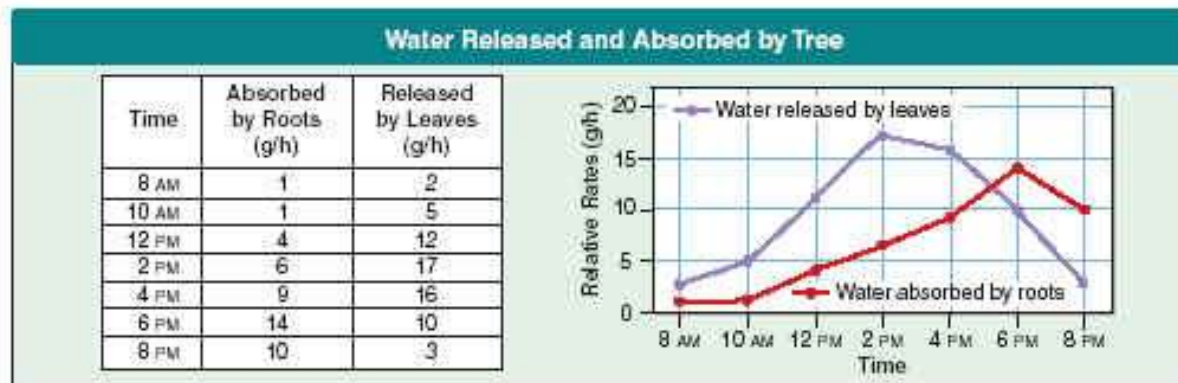
2. Ask Questions

- Based on observations
- simple



3. Collect data

- Qualitative :
 - Descriptions: sights, sounds, smells
- Quantitative:
 - Measured or counted
 - Sampling: small part represents entire population



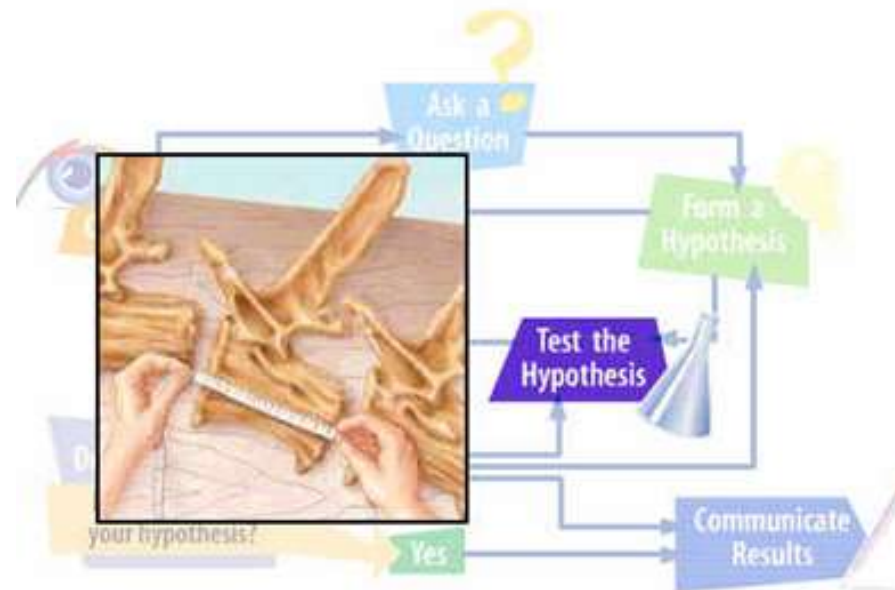



4. Hypothesizing

- An educated guess
- Specific & testable
- Predicting: "if-then" statement

5. Experimenting

- controlled experiment
 - Compare 2 groups



- 
- 1. Control group: treated normal
 - 2. Experimental group: altered
 - Independent variable (tested)
 - Dependent variable : observed or measured (size, color, health)
 - Constants: no change



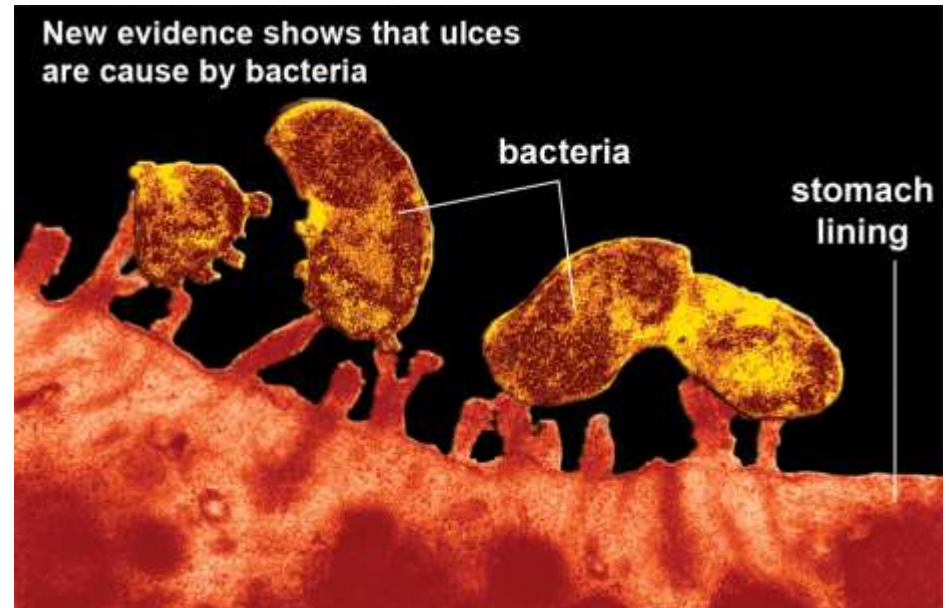
independent variable



dependent variable

6. Draw conclusions

- Models
- Inference-
 - smoke= fire
- Theory
- Scientific Law





Communication

- Journals
- Meetings



implementing

- What works best
 - Field work vs lab work

1-4

Technology



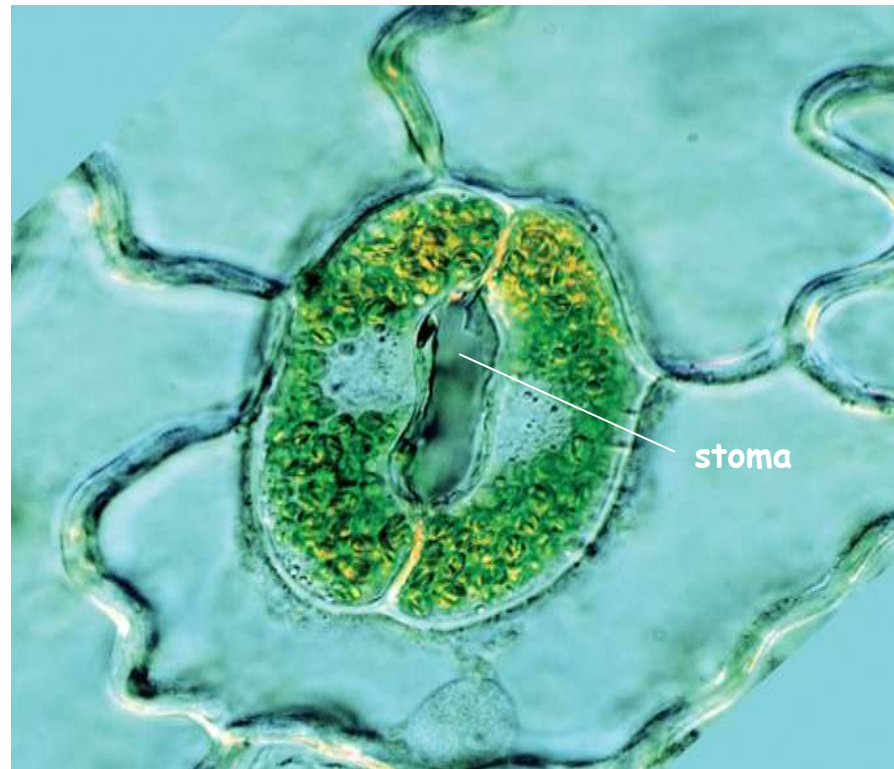


Simple microscope

- 1 lens
- Magnifying glass

Compound (light) microscope

- More than 1 lens



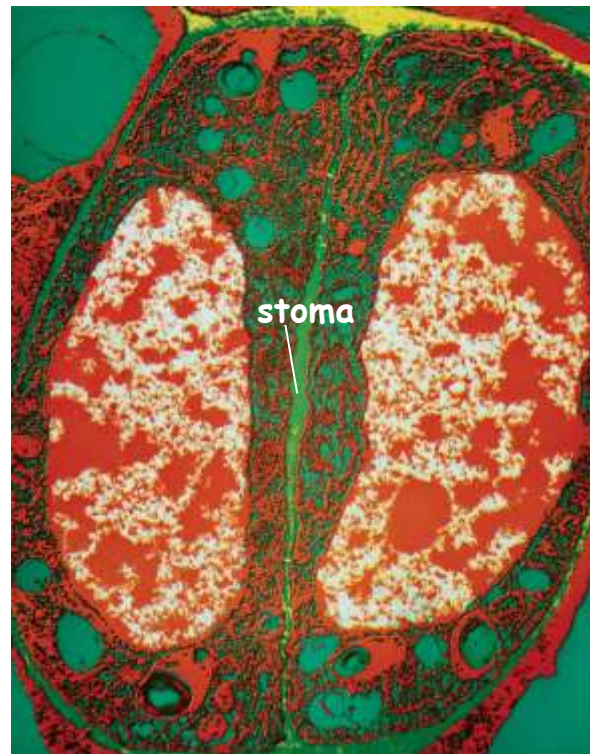
Dissecting microscope

- Aid in observation

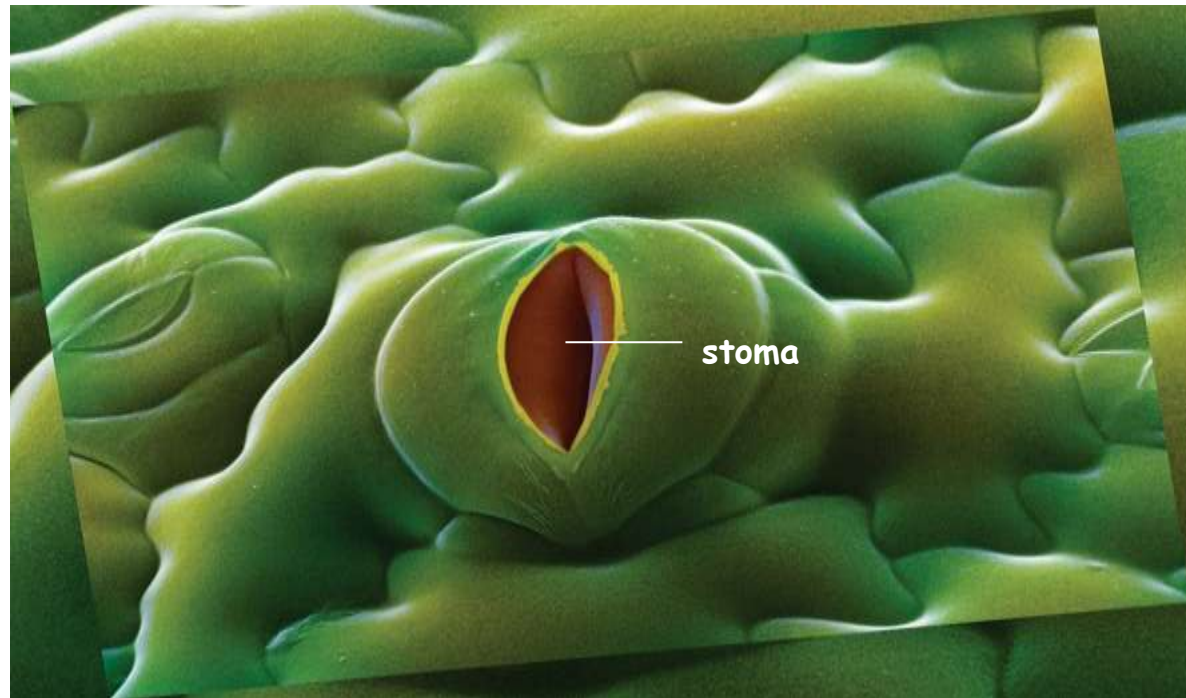
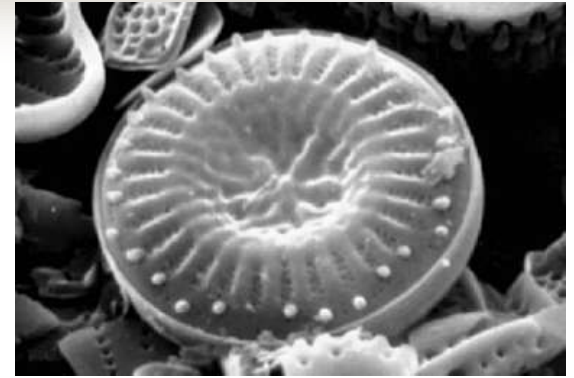


Electron Microscope

- beam of electrons
- **Transmission EM**
- **200,000X**



- Scanning EM
- 3D - metal coating
- 100,000X

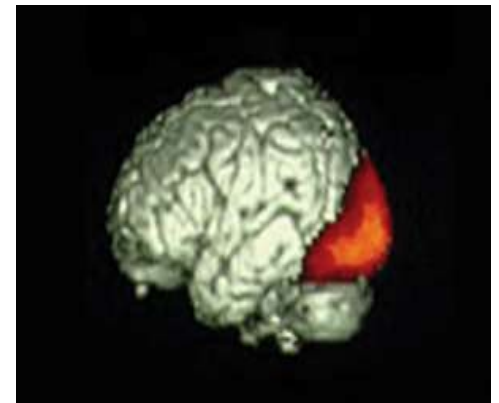
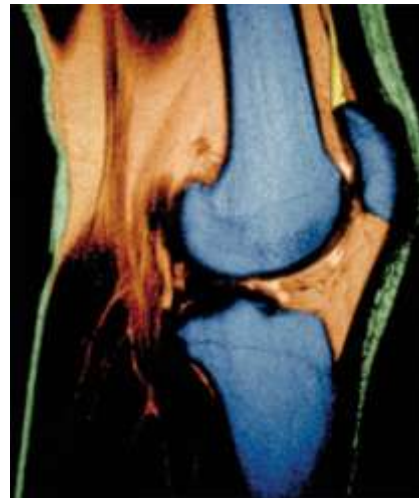


Medical imaging

- X-ray
 - Bone/teeth

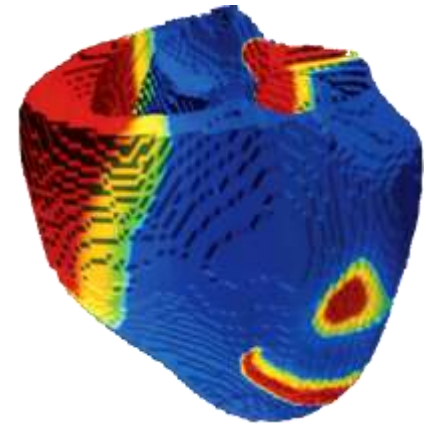
❖ magnetic resonance imaging (MRI)

❖ fMRI (functional)

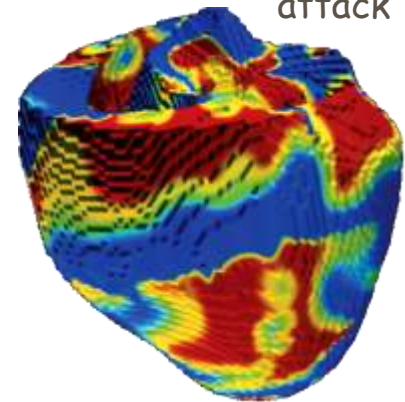


- Computer models
 - heart attacks
 - Spread of disease

Normal heartbeat

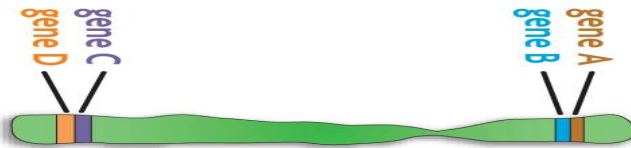


Heart attack



molecular genetics = new studies.

- gene = stores genetic information.
- Genomics
 - comparison of genomes (all DNA)



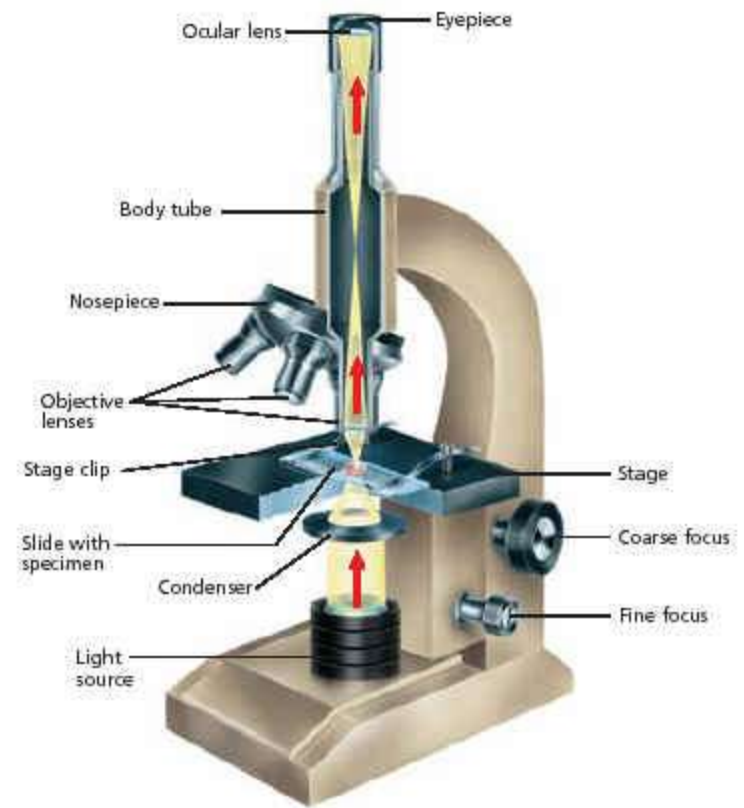



Microscopes


- Magnification
- Details = resolution
- Total magnification = eyepiece X objective


Light Microscopes (compound)


- eye piece
 - 10X
- Arm
 - Supports body
- Body
 - Set distance b/w eyepiece and objectives




- 
- Nose piece
 - Holds objectives and rotates
 - Low power objective
 - Magnifies 4x
 - Medium & or high power objectives
 - 10x-40 (43)x

- 
- Stage
 - Supports slide
 - Opening for light
 - Stage clips
 - Secures slide

- 
- Diaphragm
 - Controls amount of light
 - Base
 - Supports scope
 - Light source
 - Provides light

- 
- Course adjustment knob
 - Moves objectives/stage
 - Focus
 - Never use on high power

- 
- Fine adjustment knob
 - Sharp focus
 - Slightly moves objectives/stage
 - Use with all objectives

Focusing a Microscope

- On **low power**, use the **Coarse** adjustment knob to focus
- On **high power**, use the **fine adjustment** knob to focus





Carrying and Storage

- Carry a microscope with one hand **on the arm** & the other hand **under the base**
- Store microscopes on **low power**, **light off**, **slide removed**, and **covered**

Section 1.5

Biology and your future

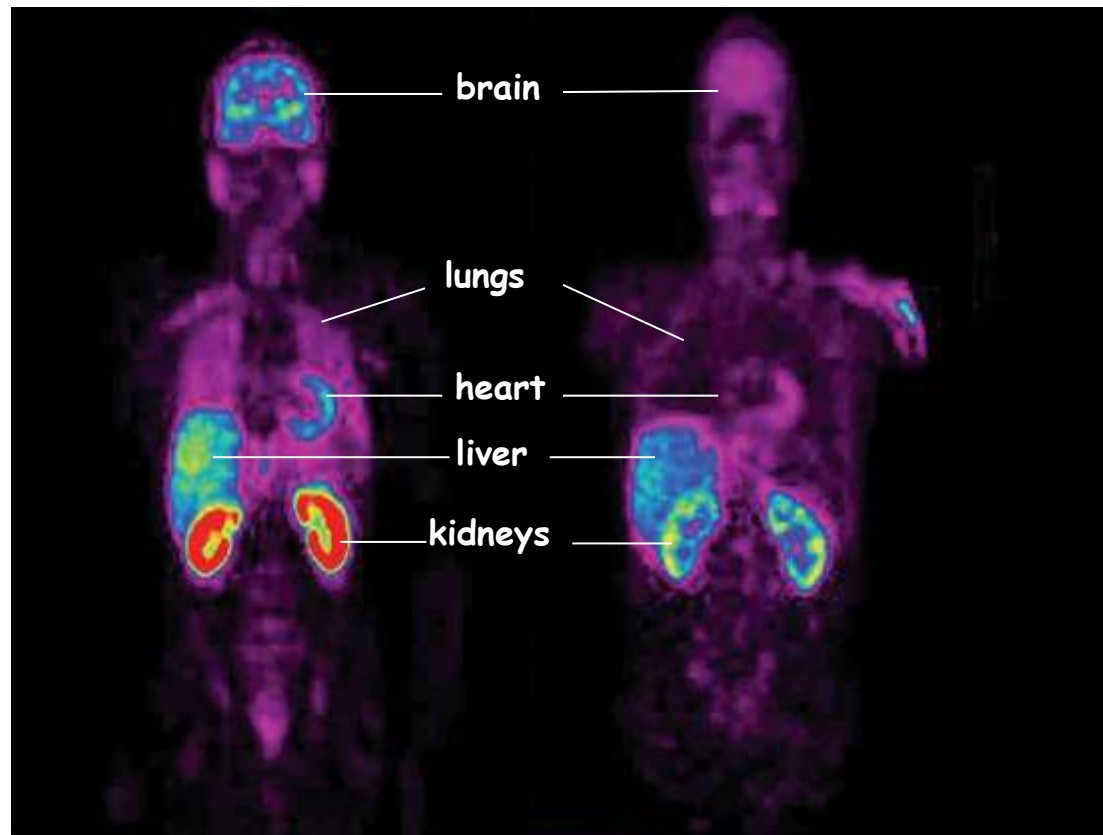
Understanding biology can help you make informed decisions.



- Understanding your health.
 - food allergies
 - potential effects of obesity



- Cancer
- Effects of alcohol/tobacco



- understand environmental issues.
 - Interactions in ecosystems
 - Pollution
 - biodiversity

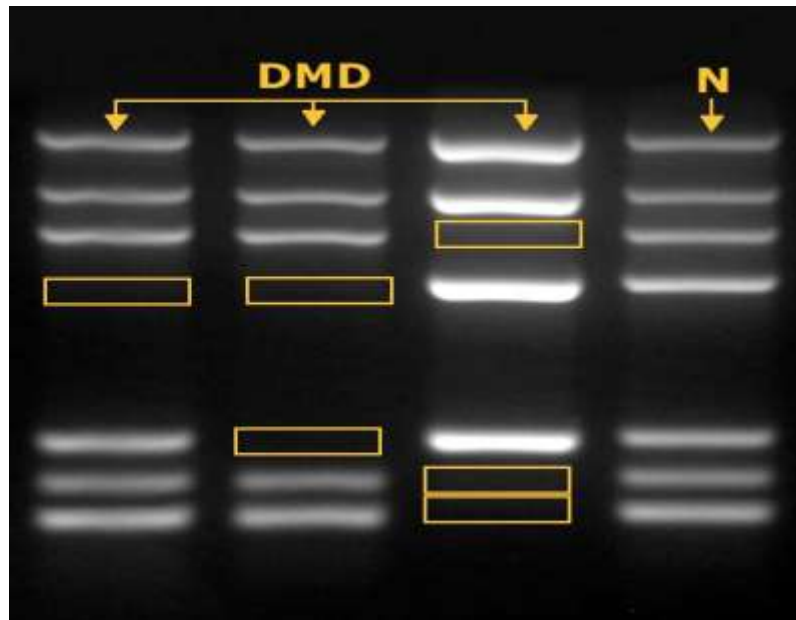


Biotechnology

- use and application of living things and biological processes.



■ DNA testing in medicine and forensics



- transgenic (genetically modified) crops
- transgenic bacteria

■ Concerns of biotechnology.

- safety of gm crops



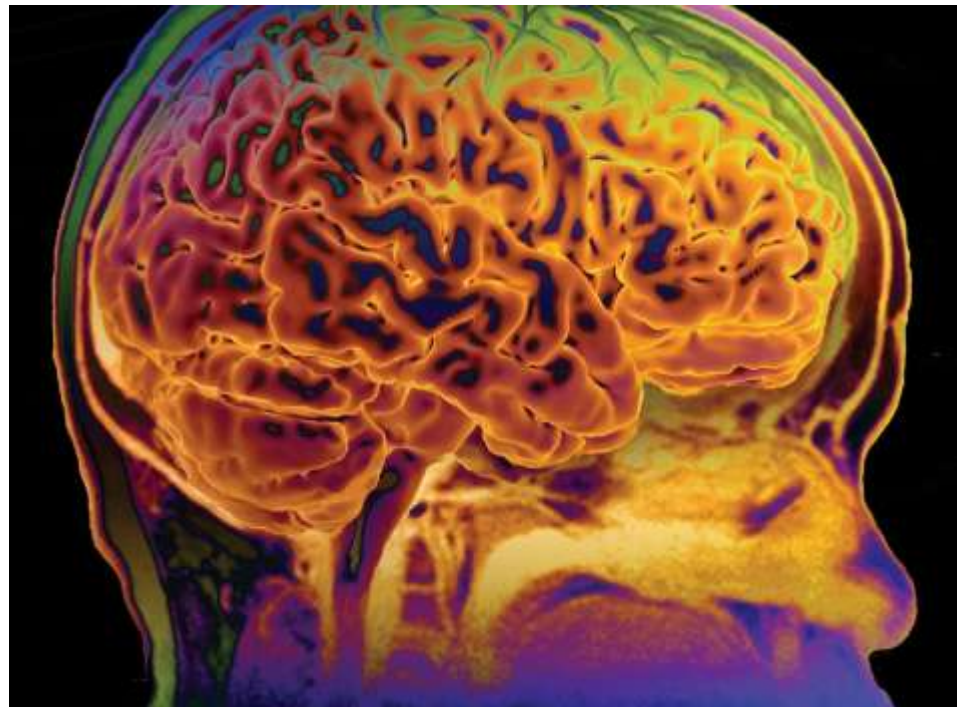
- spread of undesirable genes
- decrease in biodiversity
- ethical considerations



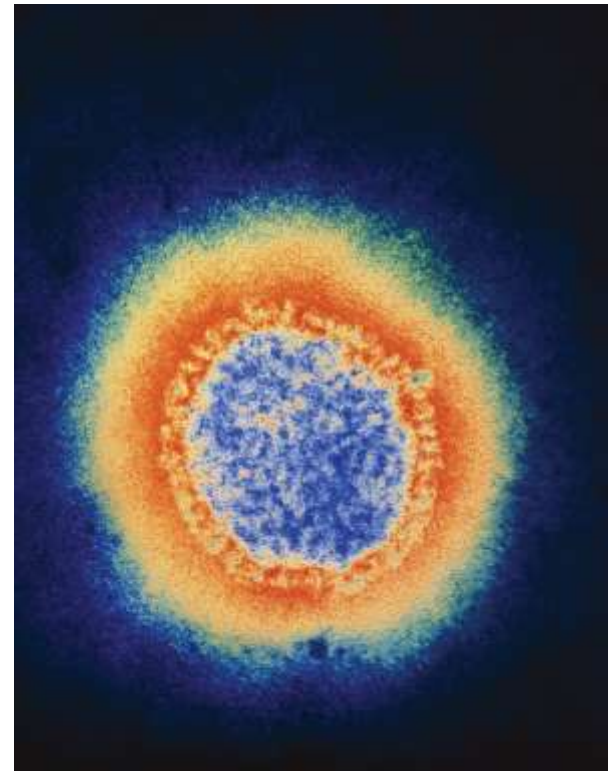
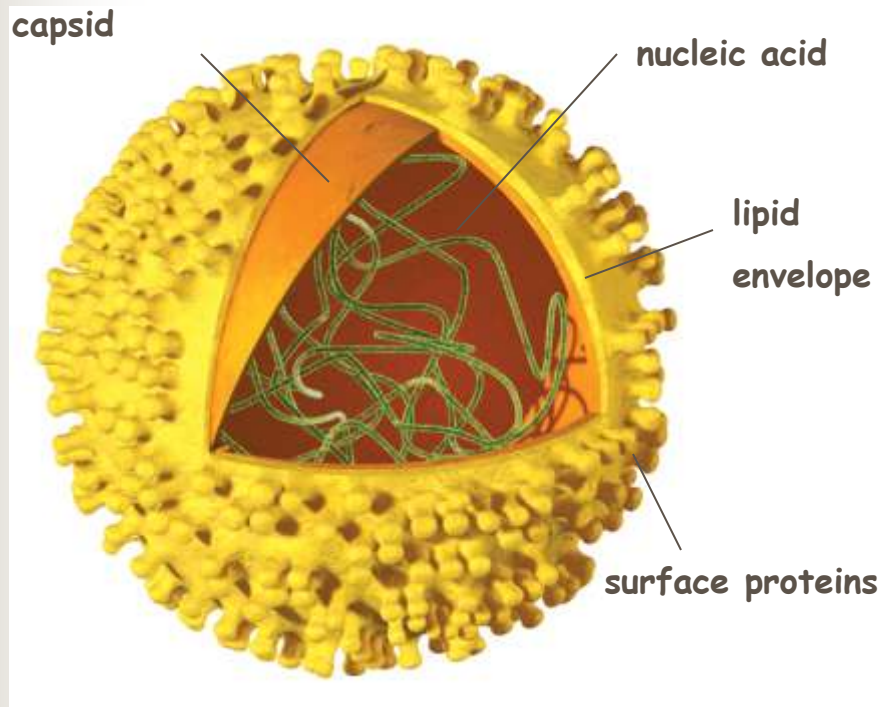


- many questions to answer in biology.

- How are memories stored in the brain?



- How do viruses mutate?



- Does life exist on planets other than Earth?

Scientific Measurements



Measurements

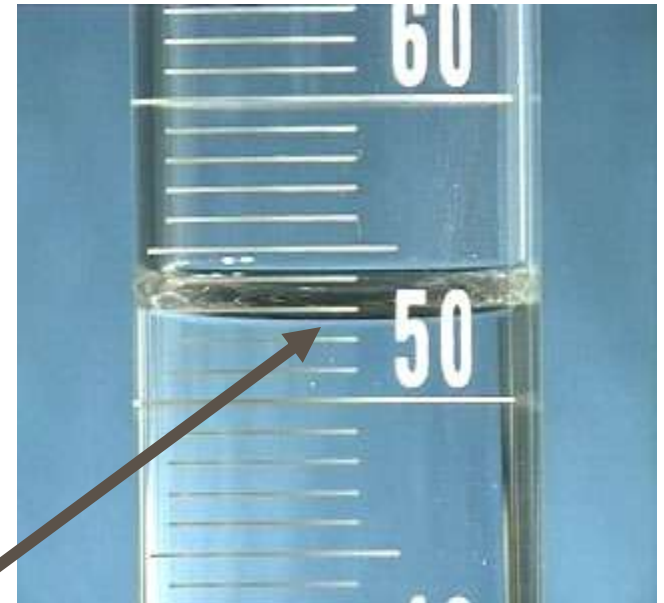
- Scientists use **SI units or metric system**
- Based on units of ten

TABLE 1-4 Other Units Acceptable for Use with SI

Name	Abbreviation	Value in SI units
Minute	min	1 min = 60 s
Hour	h	1 h = 60 min = 3,600 s
Day	d	1 d = 24 h = 86,400 s
Liter	L	1 L = 1 dm ³ = 0.001 m ³
Metric ton	t	1 t = 1,000 kg

Base Units of Measurement

- Length - **Meter**
- Volume - **Liter**
- Mass - **Gram**
- Time - **Second**
- Temperature - **°C**



Always read the **Meniscus** (bottom of the curve)



Common Metric Prefixes used in Biology

- **Kilo-** means 1000
- **Centi-** means $1/100^{\text{th}}$
- **Milli-** means $1/1000^{\text{th}}$
- **Micro** - means $1/100,000^{\text{th}}$
- **Nano-** means $1/1000000000^{\text{th}}$

Other Metric Prefixes

TABLE 1-2 *Some SI Prefixes*

<u>Prefix</u>	<u>Abbreviation</u>	<u>Factor of base unit</u>
giga	G	1,000,000,000
mega	M	1,000,000
kilo	k	1,000
hecto	h	100
deka	da	10
deci	d	0.1
centi	c	0.01
milli	m	0.001
micro	μ	0.000001
nano	n	0.000000001
pico	p	0.000000000001

TABLE 1-3 *SI Derived Units Often Used in Biology*

<u>Derived quantity</u>	<u>Name</u>	<u>Abbreviation</u>
Area	square meter	m ²
Volume	cubic meter	m ³
Mass density	kilogram per cubic meter	kg/m ³
Specific volume	cubic meter per kilogram	m ³ /kg
Celsius temperature	degree Celsius	°C

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