Figure 1.1

Introduction to Biology

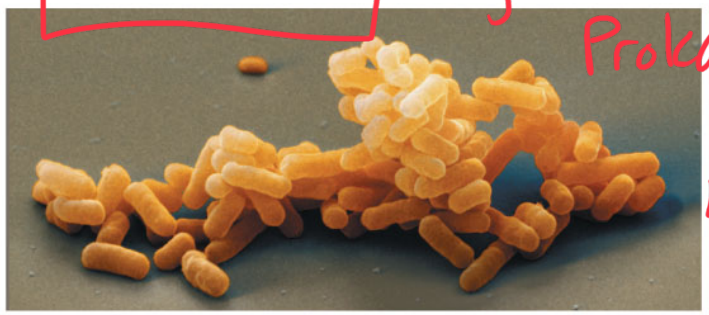
Biology is the study of LIFE!

Life is now organized by DNA

(a) Domain Bacteria

single-celled

Prokaryotic without nucleus

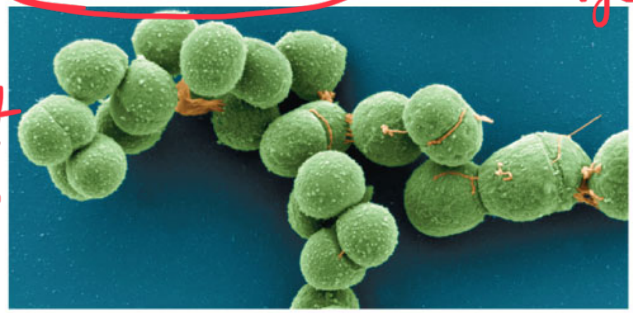


2 µm

"ancient"

(b) Domain Archaea

Bridge between Bacteria + Eukarya



2 µm

(c) Domain Eukarya

pro-karyotic before nut

Eukaryotic true nut

▲ Kingdom Plantae

Have a nucleus

▶ Kingdom Fungi

◀ Kingdom Animalia

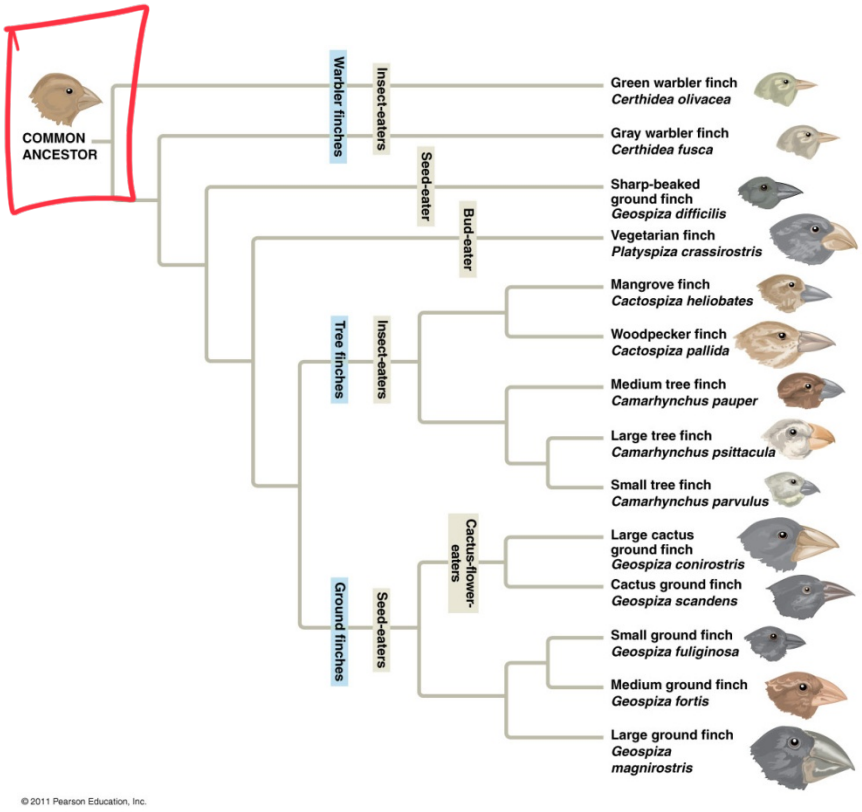
100 µm

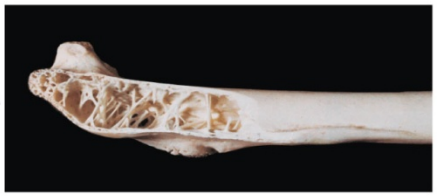
▶ Protists

Big Ideas in Biology

Big Idea 1: The process of evolution drives the diversity and unity of life.

Adaptation and environmental choice





Big Ideas in Biology

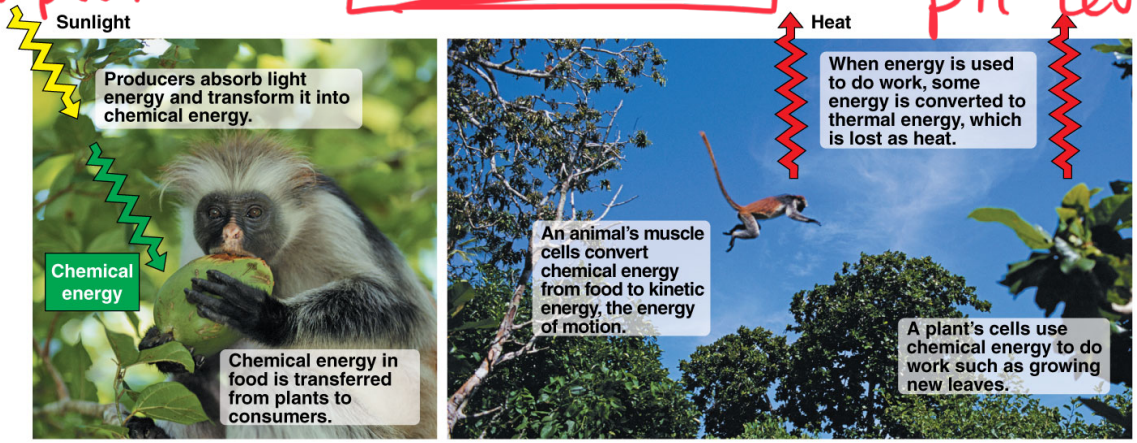
ability to do work

transmission of DNA

set points temperature 98.6°F

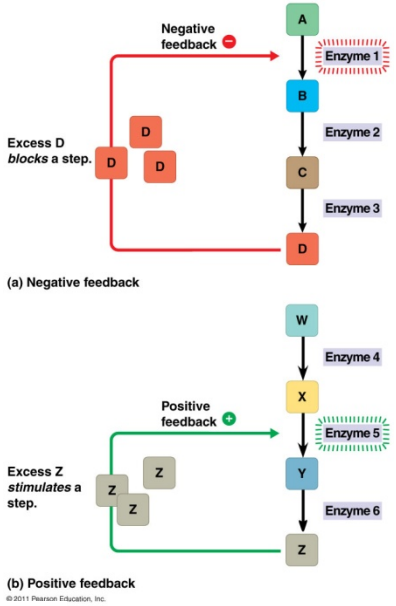
blood pressure pH level

Big Idea 2: Biological systems utilize free energy and molecular building blocks to grow, to reproduce and to maintain dynamic homeostasis.

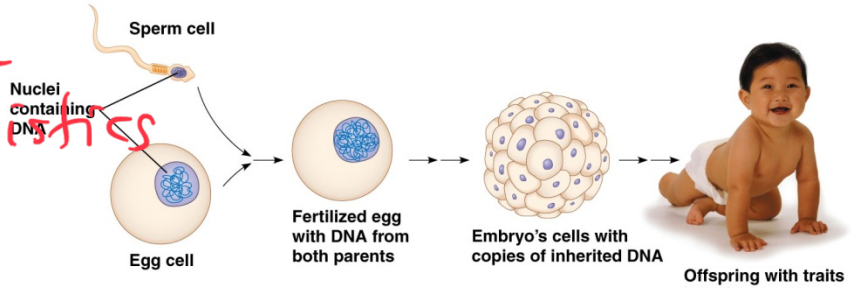


(a) Energy flow from sunlight to producers to consumers

(b) Using energy to do work



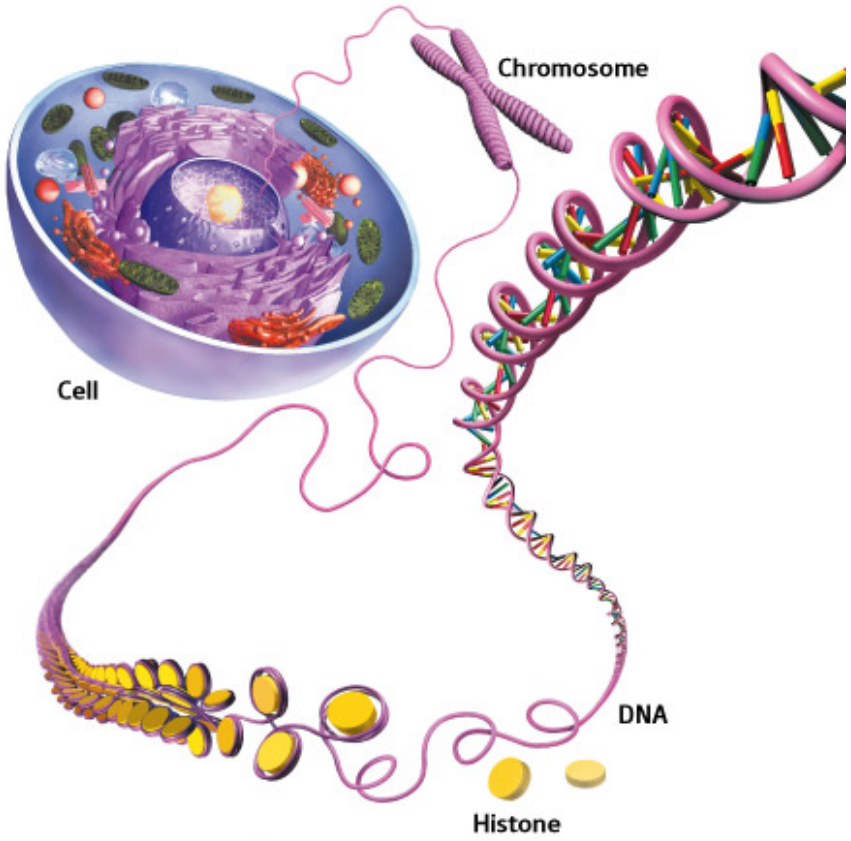
Living things have certain characteristics

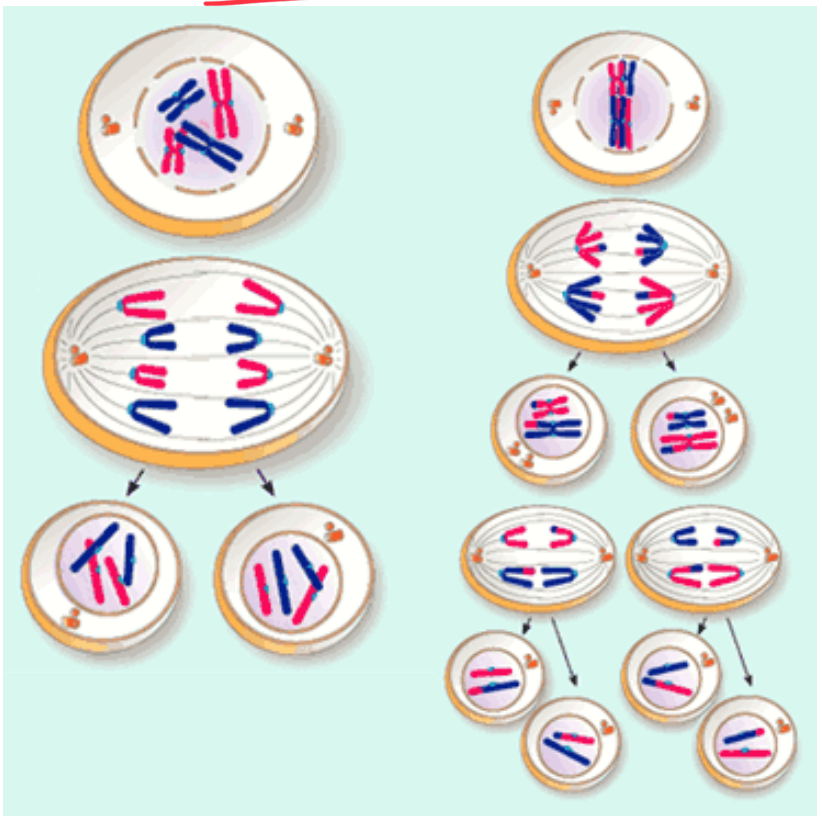


Big Ideas in Biology

Big Idea 3: Living systems store, retrieve, transmit and respond to information essential to life processes.

transmit DNA





What is Science?

- *Science* = Latin "to know"

Inquiry is at the heart of science.

- Inquiry: search for information and explanation

  Two main processes:

  1. Discovery science
  2. Hypothesis-based science

Discovery Science

- Describes nature through observation and analysis of data
- Data = recorded observations
  - Qualitative and quantitative
- Inductive reasoning: derive generalizations based on specific observations

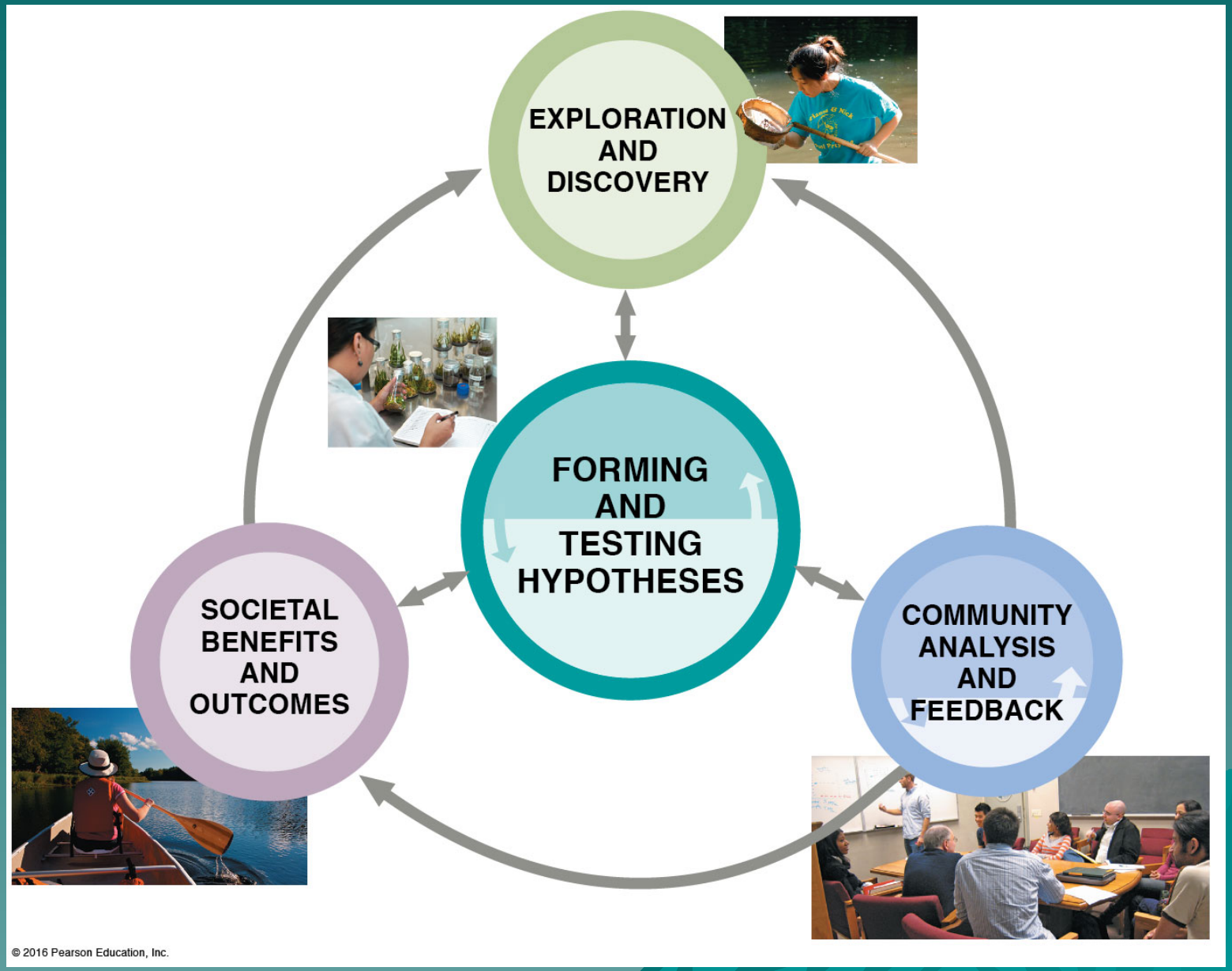
Hypothesis-Based Science

Educated guess – testable

- Hypothesis: makes predictions that can be tested by recording more observations or experiments

- AP Biology: "If … , then … because…"
- Results can either support or refute the hypothesis
  - Not "My hypothesis is correct"

Model of the Scientific Process



FORMING AND TESTING HYPOTHESES

Testing Ideas

- Forming hypotheses
- Predicting results
- Doing experiments and/or making observations
- Gathering data
- Analyzing results

Interpreting Results
Data may…

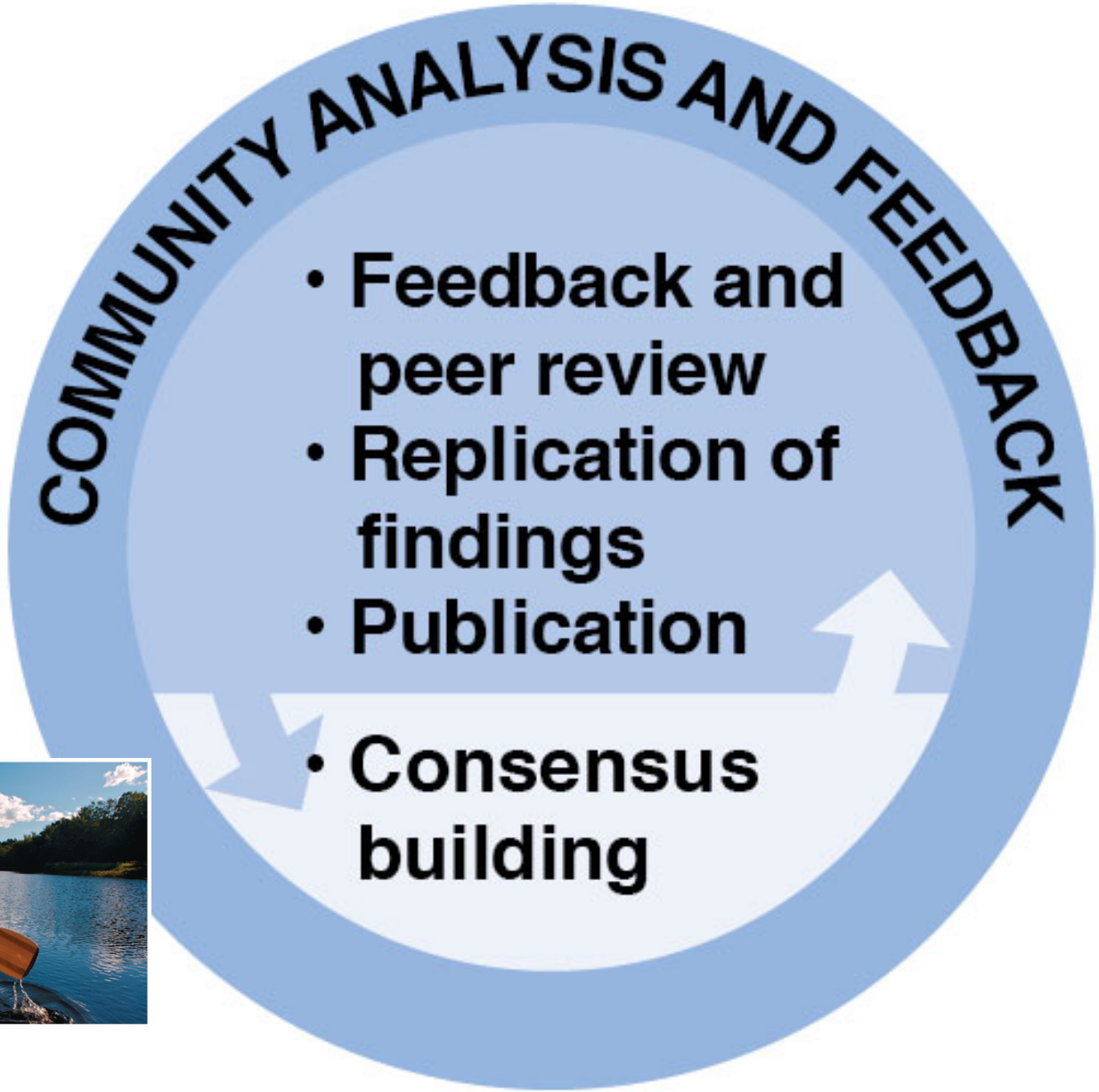
- Support a hypothesis
- Contradict a hypothesis
- Inspire a revised or new hypothesis

EXPLORATION AND DISCOVERY

- Observing nature
- Asking questions
- Reading the scientific literature

SOCIETAL BENEFITS AND OUTCOMES

- Developing technology
- Informing policy
- Solving problems
- Building knowledge



Theories in Science

Tested by generations of scientists

- Broader in scope than a hypothesis
- Generates new hypotheses
- Supported by a large body of evidence
- Can be modified or rejected with new research evidence

Law → mathematical relationship $E = mc^2$ $F_G = \frac{k M_1 M_2}{r^2}$

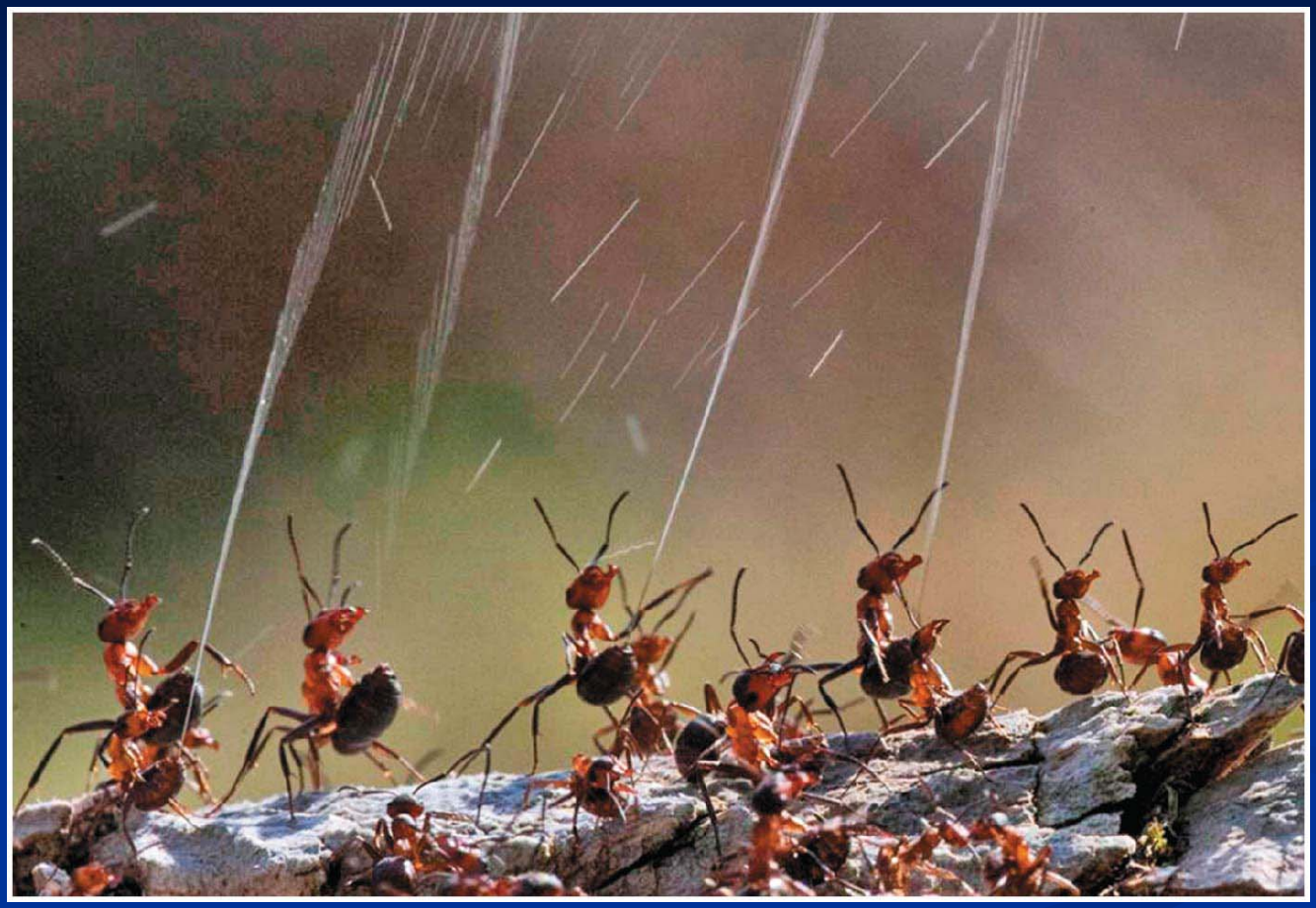
Examples:

- Theory of evolution by natural selection
- Theory of gravity
- Theory of plate tectonics

Chapter 2

The Chemical Context of Life

Wood Ants & Acid



Ants shoot formic acid to defend themselves from attacks from predators (birds).

You Must Know

- The three subatomic particles and their significance.
- The types of bonds and how they form.

I. Matter vs. Energy

$E = mc^2$

Energy = (mass)(speed of light)^2

$3.00 * 10^8$ m/s

Matter	Energy
▪ Has mass & takes up space	▪ Moves matter
▪ Affected by gravity	▪ Potential, kinetic
▪ Consists of elements and compounds	▪ Ability to do work
	▪ Conversions
	▪ Sound, light, heat

$W = Fd$

$PE = mgh$ $KE = \frac{1}{2}mv^2$

free energy

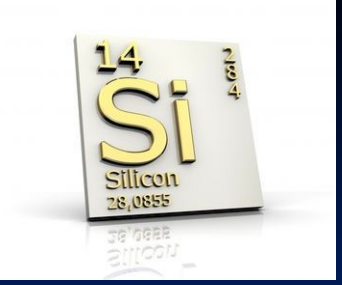
Black hole

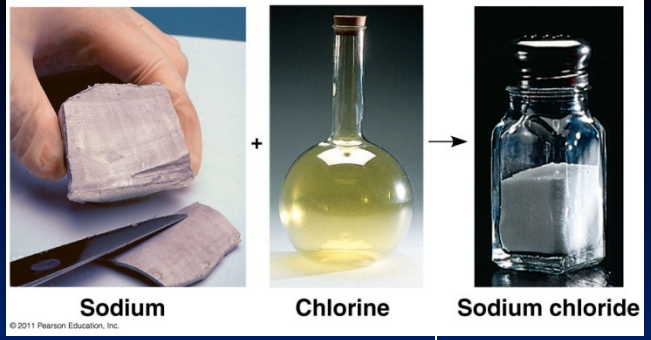
Light has mass!

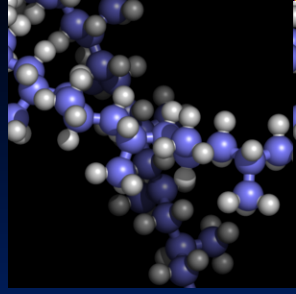
H_2O

H: element

O: element





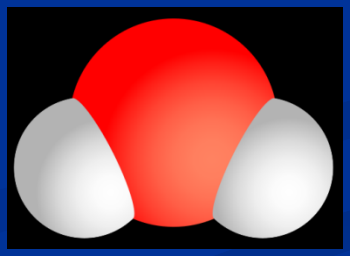


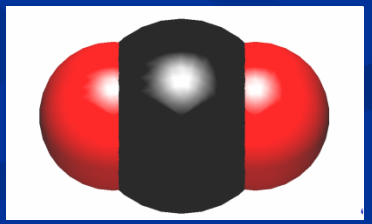
Element

- "pure" substance
- Can't be broken down by "ordinary" means to another substance
- Ex. hydrogen (H), nitrogen (N)

Compound

- 2 or more different elements combined in a fixed ratio
- Ex. H_2O, CO_2





Elements of Life

- 25 elements
  - 96% : O, C, H, N
  - ~ 4% : P, S, Ca, K & trace elements (ex: Fe, I)

O oxygen C carbon
H hydrogen N nitrogen

→ Has to do with macromolecules

Hint: Remember **CHNOPS**

Phosphorous

Sulfur