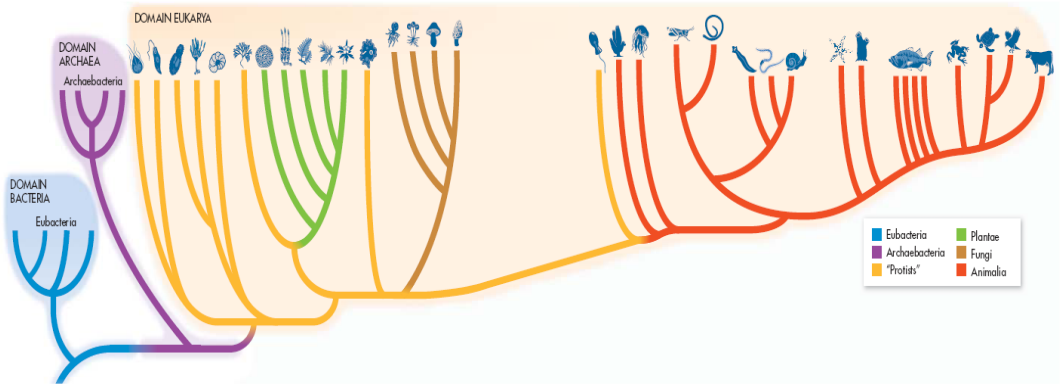
Name: Date

Characteristics of Life Packet

Another word for a living things is a(n) organism.

There are many different types of organisms, each of which is organized into one of 3 major domains, and 6 major kingdoms. Each kingdom is subdivided into phyla, which are subdivided into classes, which are subdivided into orders, which are subdivided into families, which are subdivided into genera, which are subdivided into species *(Remember, DKPCOFGS!)*



The scientific name of an organism is made up of its genus and species names. The first word (genus) is always capitalized; the second (species) is always lowercase. The scientific name is either *Italicized* or Underlined.

Here are some examples:

1. Human *Homo sapiens*
2. Cat *Felis domesticus*
3. Dog *Canis lupus familiaris*
4. Red Oak Tree *Quercus rubra*
5. White Maple Tree *Acer saccharinum*

Classification of Living Things

DOMAIN	Bacteria	Archaea	Eukarya			
KINGDOM	Eubacteria	Archaebacteria	"Protista"	Fungi	Plantae	Animalia
CELL TYPE	Prokaryote	Prokaryote	Eukaryote	Eukaryote	Eukaryote	Eukaryote
CELL STRUCTURES	Cell walls with peptidoglycan	Cell walls without peptidoglycan	Cell walls of cellulose in some; some have chloroplasts	Cell walls of chitin	Cell walls of cellulose; chloroplasts	No cell walls or chloroplasts
NUMBER OF CELLS	Unicellular	Unicellular	Most unicellular; some colonial; some multicellular	Most multicellular; some unicellular	Most multicellular: some green algae unicellular	Multicellular
MODE OF NUTRITION	Autotroph or heterotroph	Autotroph or heterotroph	Autotroph or heterotroph	Heterotroph	Autotroph	Heterotroph
EXAMPLES	*Streptococcus, Escherichia coli*	Methanogens, halophiles	*Amoeba, Paramecium,* slime molds, giant kelp	Mushrooms, yeasts	Mosses, ferns, flowering plants	Sponges, worms, insects, fishes, mammals

Characteristic of Living Things. *Although the many types of organisms may appear to be different from one another, they all share the following characteristics in common.*

1.Made of cells

2.Grow and Develop

3.Respond to environment (stimuli)

4. Based on universal genetic code

5.Evolve as a group

6.obtain & use materials and energy

a) require water to survive
b) produce waste

The sum of all chemical reactions in an organism (or cell) is known as metabolism.

7.maintain stable internal environment homeostasis

8.reproduce

9.have a life span (must die)

Optional: *Watch the Amoeba Sisters Video, "Characteristics of Life"* https://www.youtube.com/watch?v=cQPVXrV0GNA

1. **Living Things are Based on a Universal Genetic Code**

DNA deoxyribonucleic acid – the molecule which makes up the "genetic blueprint" of each organism

How does DNA work? DNA codes for RNA which codes for proteins which determine traits.

**All DNA uses the same type of coding system ('language') – thus the term "universal"*

Prokaryotic: Smaller, simpler, more primitive cells whose DNA is not enclosed in a nucleus.'

Example: bacteria

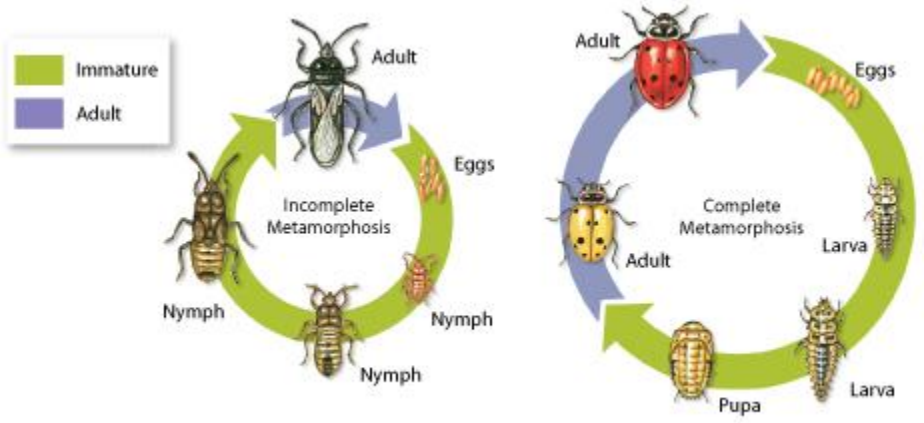
Eukaryotic: larger, more complex, more modern cells whose DNA is enclosed in a nucleus

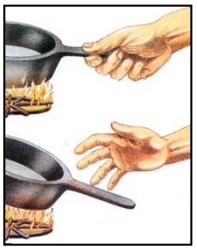
Examples: plants, animals, fungi, protists

2. **Living Things Grow and Develop**

Grow: To increase in size Examples: height, weight, size of cell

Develop: To change features as the organism proceeds through its life cycle Ex: puberty, metamorphosis





3**. Living Things Respond to their Environment**

(*A response is a reaction to a stimulus.*)

a. It's very hot out - You sweat

b. It's very cold out - You shiver

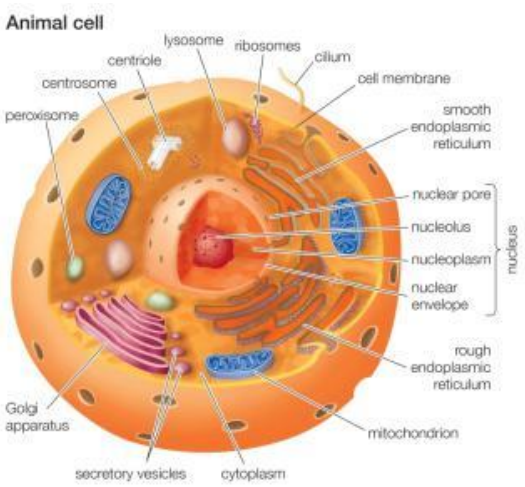
c. light - Plant bends towards the light

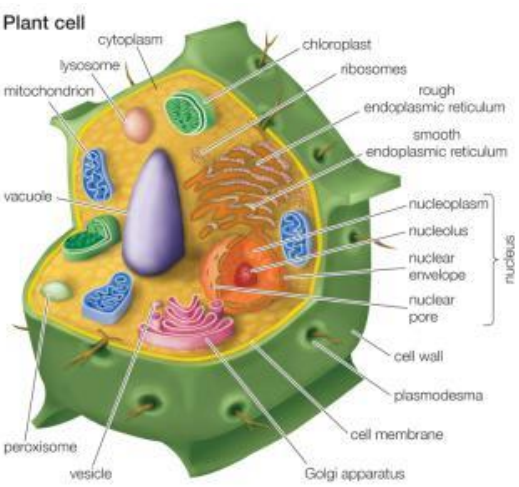
d. smell - Mating, seek out prey

e. sound - Move towards/away from stimulus

4. Living Things are made of one or more cells.

What is a cell? The smallest unit considered living; the building blocks giving structure and function to every living thing. Composed of chemicals (water, sugar, proteins, lipids, salts, etc.)





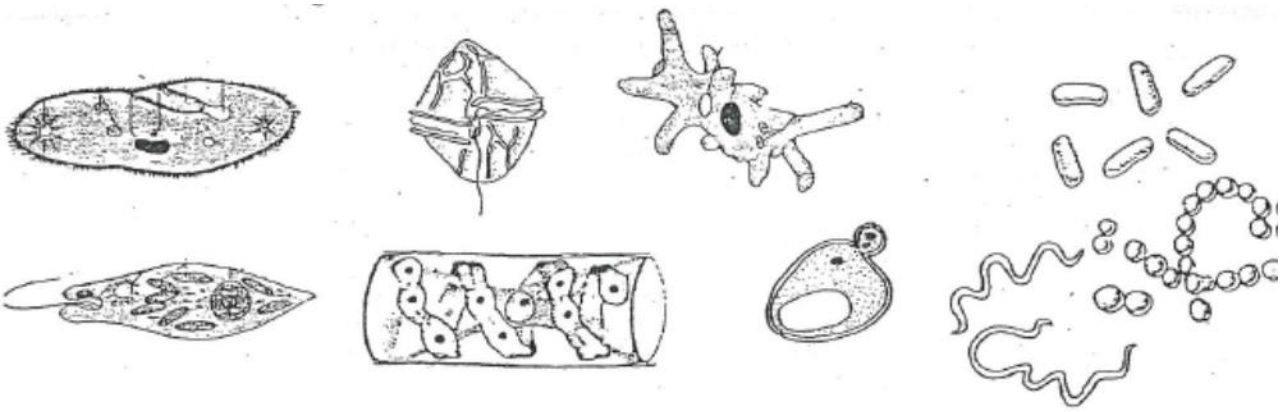
Organisms can be either unicellular or multicellular.

1. **Unicellular** organism composed of a single cell

a. organism exchanges materials directly with its environment through its cell membrane; no cellular specialization

b. all life functions for the organism are performed within one cell

examples: bacteria, yeast, amoeba, paramecium, some algae

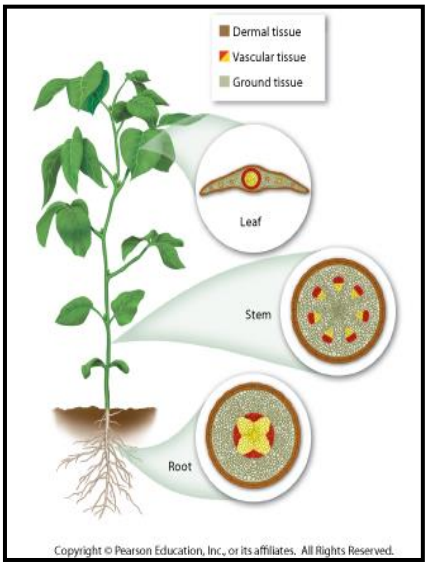


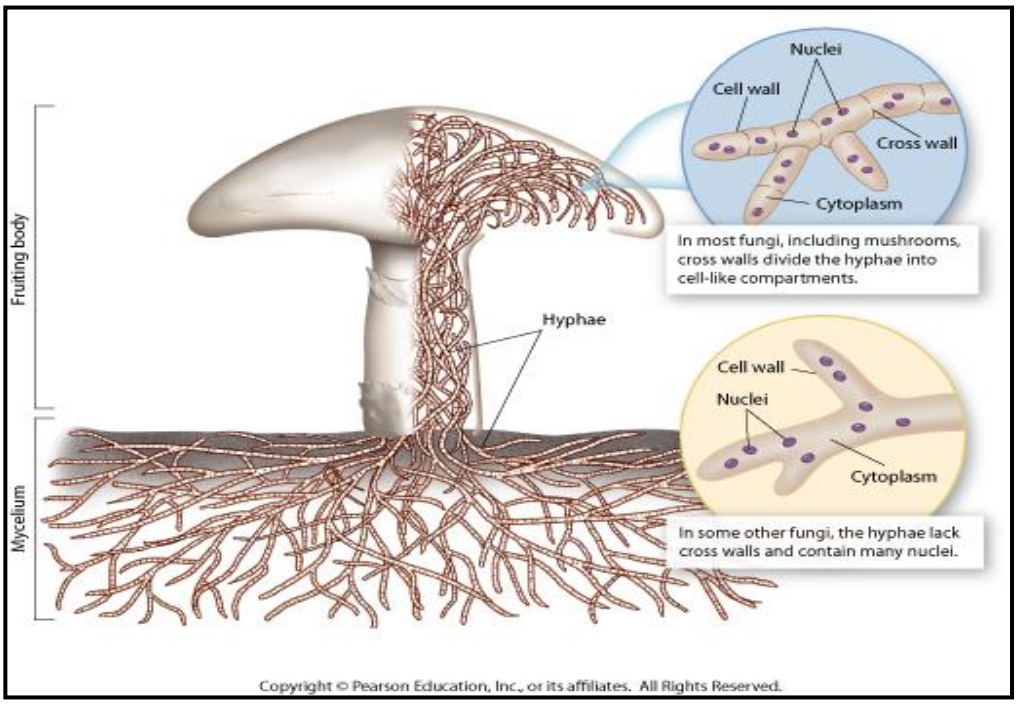
2. **Multicellular** organism composed of many cells (all have same genome)

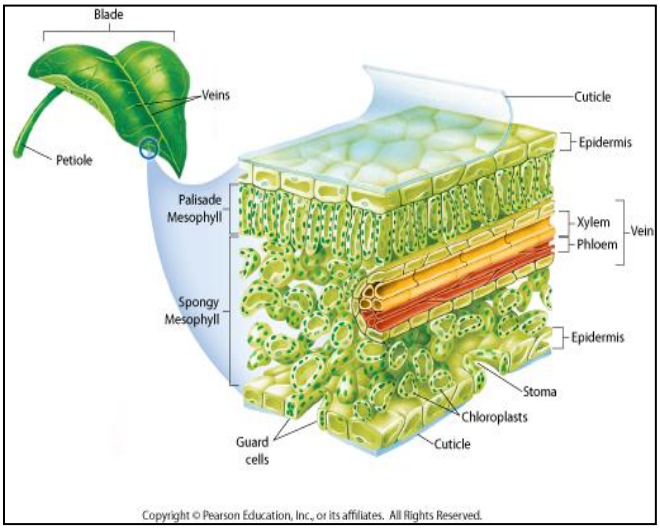
a. cells are specialized (turn genes on/off) to carry out specific functions for the organism

b. cells may group into tissues, organs, organ systems in more complex organisms

examples: plants, animals, most fungi, some protists.

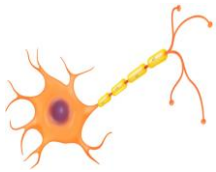
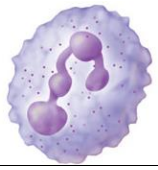
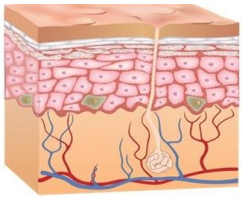
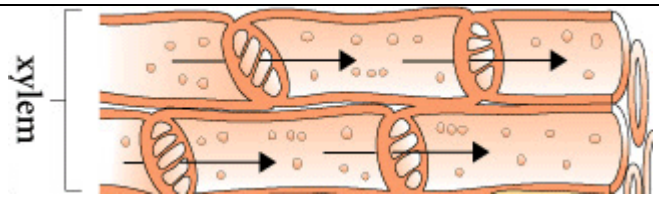






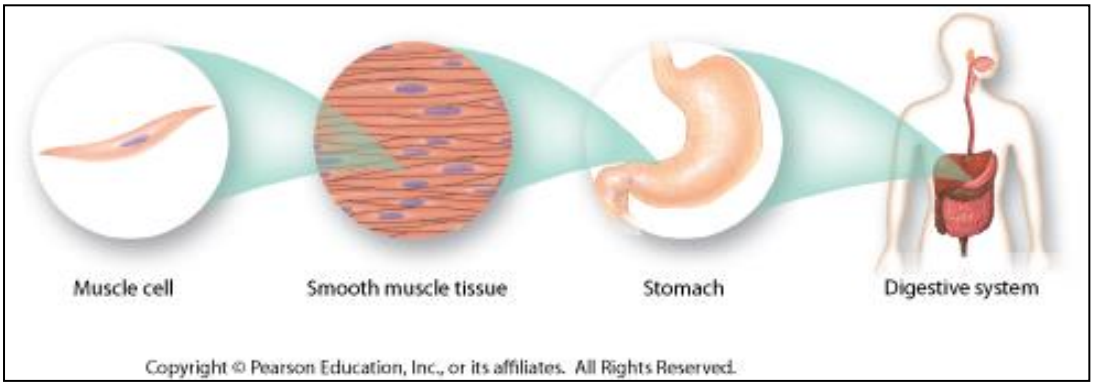
Multicellular Organization:

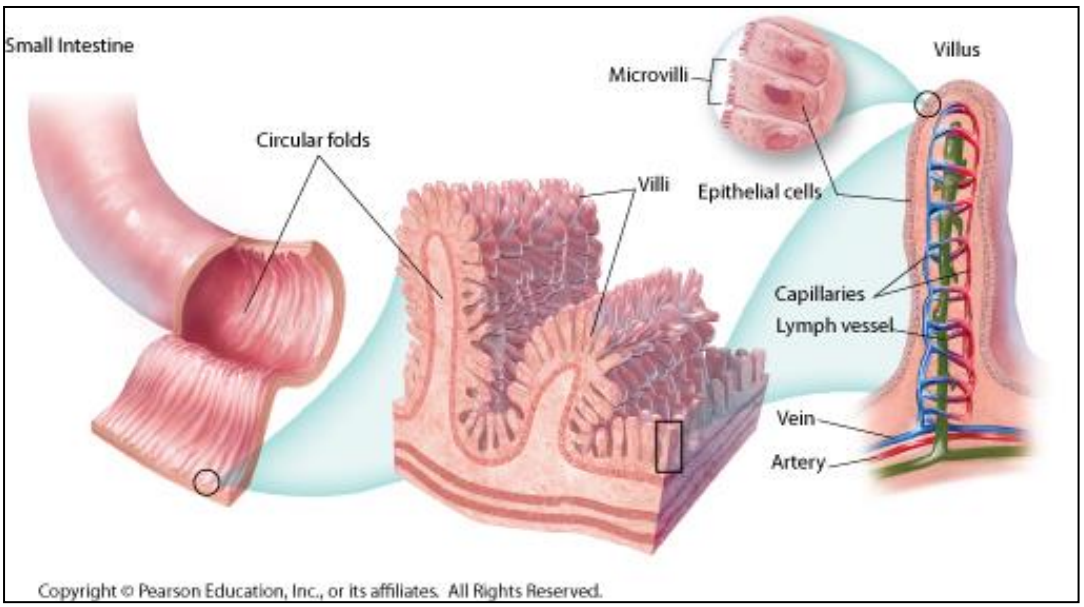
The STRUCTURE of a cell is related to its FUNCTION. What does this mean? A cell is formed/shaped in a particular way because of the job it must perform

Cell Type	Structure	Function
1. nerve cell (neuron)		Send messages from one place in body to another
2. red blood cell		Rolls thru small blood vessels to help deliver o2 to body cells
3. white blood cell		Can engulf foreign substances – helps protect against disease
4.skin cell (epithelial cell)		Forms barriers like the epidermis and protects and lines various parts of boy; cells are tightly packed together to form protective barriers
5. xylem cells in plants		Transport water and minerals throughout the plant

What is the cellular heirarchy of a human?

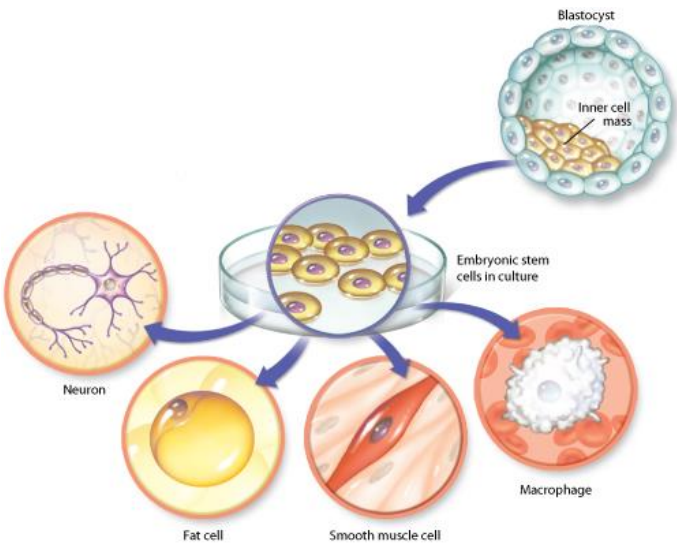
Atoms → Cells → Tissues → Organs → Organ Systems → Organism





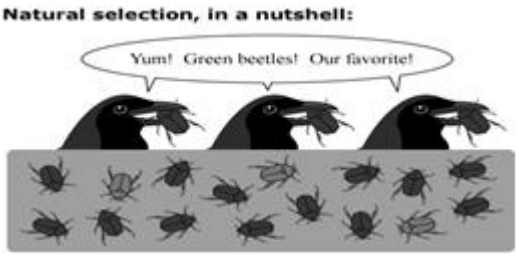
Cellular specialization takes place in complex, multicellular organisms.

Although they all have the same genome, different cell types will only express (transcribe & translate) the genes necessary for the particular structure/function of that cell type. Other genes are 'turned off' (ignored, in a molecular sense = not transcribed/translated).



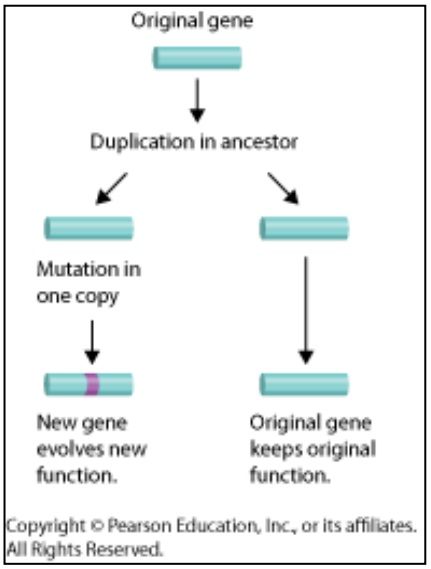
5. **Living Things evolve (as a group) over time.**

Adaptation: The process of change by which a species becomes better suited to its environment. Survival of the fittest – traits which allow the organism to most effectively survive and reproduce are "selected for" and therefore becoming more common in the population.



Adaptations can be **physical** (having to do with appearance), **behavioral**, or **physiological** (having to do with the way an organism's body functions.

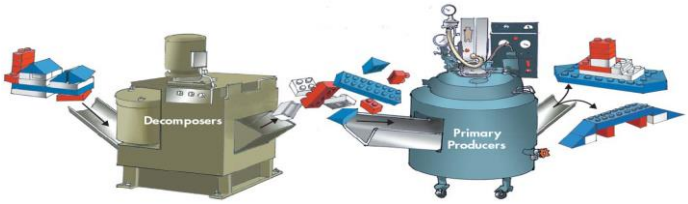
Organism	Environment	Adaptation
Polar Bear	Cold / Snow	White Fur
Cactus	Hot / Desert	Ability to store water



6. **Living Things Obtain and Use Materials and Energy**

Heterotroph: organisms that must obtain their food from their environment (consumers)

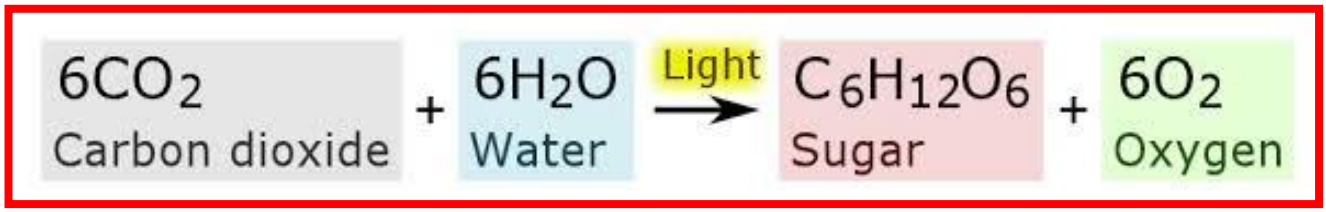
Autotroph: use light energy to produce their own food (photosynthesis) – also known as producers



Plants and other **producers** (aka autotrophs) Produce their own food in the process of photosynthesis. In this process, organisms convert energy from sunlight into food / chemical energy (typically – GLUCOSE unusable form).

EXAMPLES OF PHOTOSYNTHETIC ORGANISMS: Plants, algae & cyanobacteria

The overall (summary) chemical reaction for Photosynthesis:



Animals and other **consumers** (AKA heterotrophs) Obtain food from their environment because they are unable to produce their own food.

Cellular Respiration **bio**chemical reaction where food (usually glucose) is broken down inside cells in order to produce the energy needed by organisms for all life processes. Oxygen helps (IN THE PRESENCE OF ENZYMES) break down the glucose and eventually carbon dioxide and water are produced. The purpose of C/R is NOT to produce carbon dioxide and water (those are byproducts- or waste) but rather to produce ENERGY (ATP) the cells need!

EXAMPLES OF ORGANISMS WHICH PERFORM C/R: all organisms perform some type of C/R. (Aerobic most common)

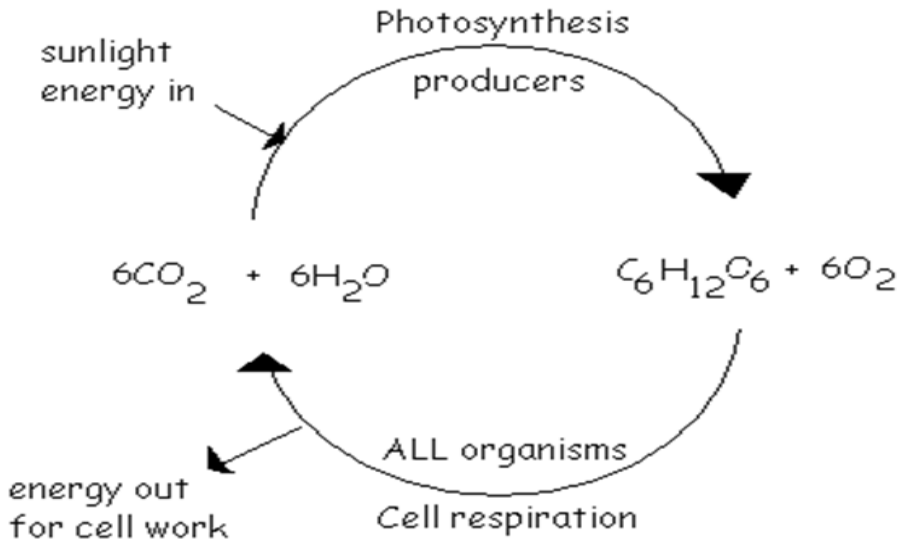
The overall (summary) chemical reaction for Cellular Respiration:

$$C_6H_{12}O_6 + 6\ O_2 \rightarrow 6\ CO_2 + 6\ H_2O + ATP$$

What do organisms need energy for? Building cells/ molecules (synthesis), Movement, Digestion of food, See/ think/ hear etc., LITERALLY EVERYTHING YOU CAN THINK OF!

How are the processes of Photosynthesis and Cellular Respiration interdependent?

The products of one reaction become the reactants of the other reaction. Photosynthesis is an energy-storing reactions; Cellular respiration is an energy-releasing reaction.

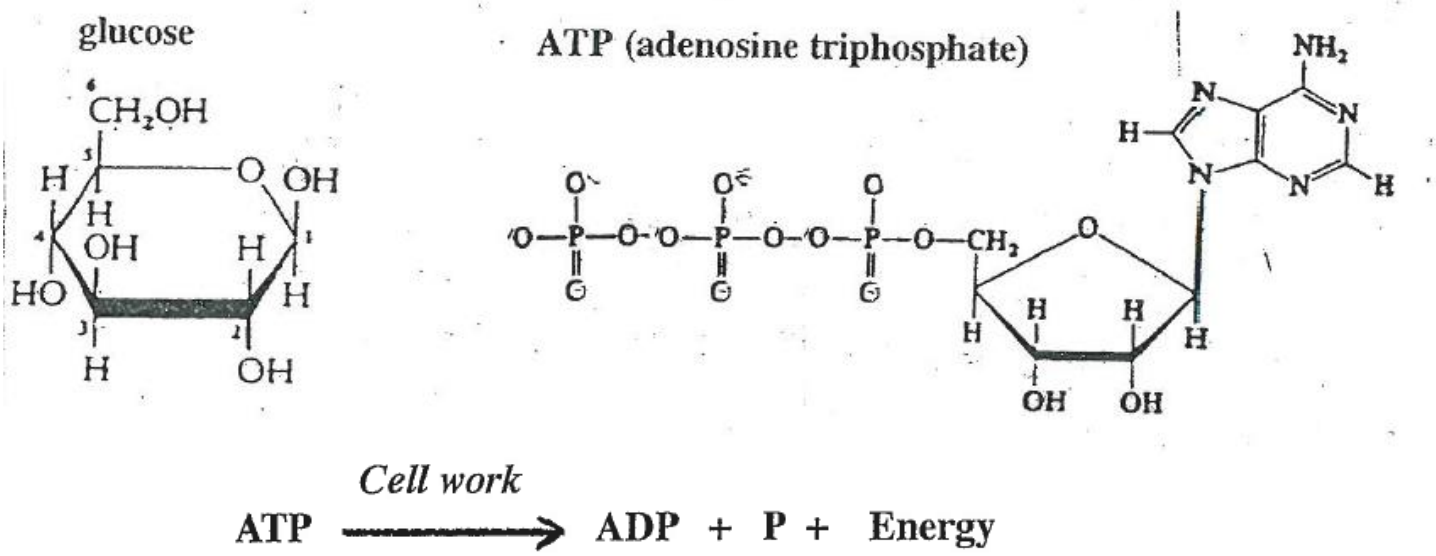


Why do organisms require water to survive? Dissolve solutes, temperature control, diffusion of materials across moist membranes; form cytosol (cytoplasm) and intercellular fluid; used in various chemical reactions (ex. Hydrolysis, carbonic acid buffer system, etc.), reactant of photosynthesis

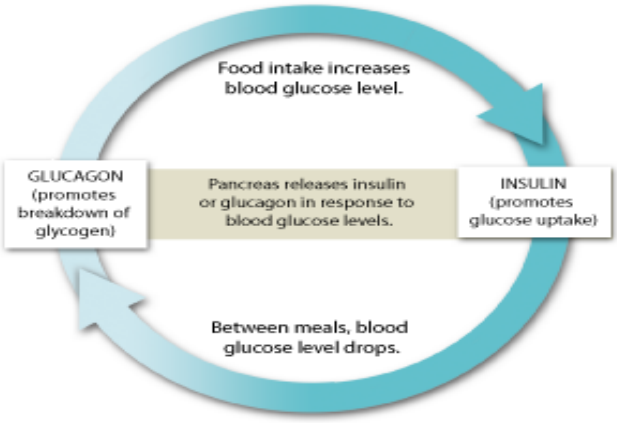
What are some wastes produced by organisms? Water, carbon dioxide, by-products of metabolism (urea), salts

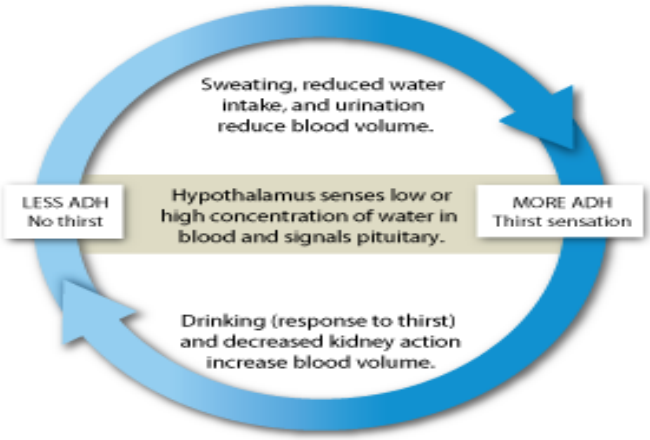
The importance of ATP

ATP Molecule which is used as the "energy currency" of the cell. As energy is released through C/R breaking down glucose, some of that energy is stored as potential energy in the bonds of ATP. ATP can later be broken down to release the stored energy to power life processes.



7. Living Things Maintain a Stable Internal Environment -HOMEOSTASIS





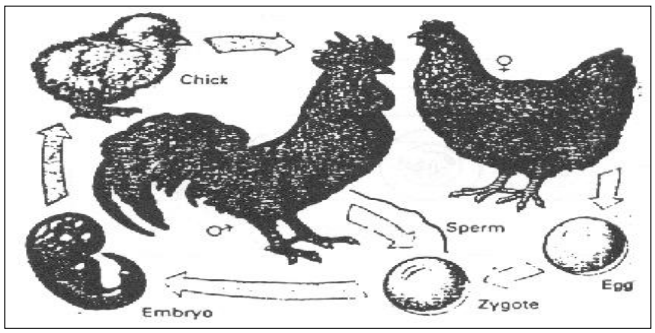
At every level of organization a regulated state is maintained. All the cells in your body communicate with each other in order to sustain this internal balance. When the internal operations of an organism are in balance regardless of any eternal changes that might occur, we call this condition homeostasis

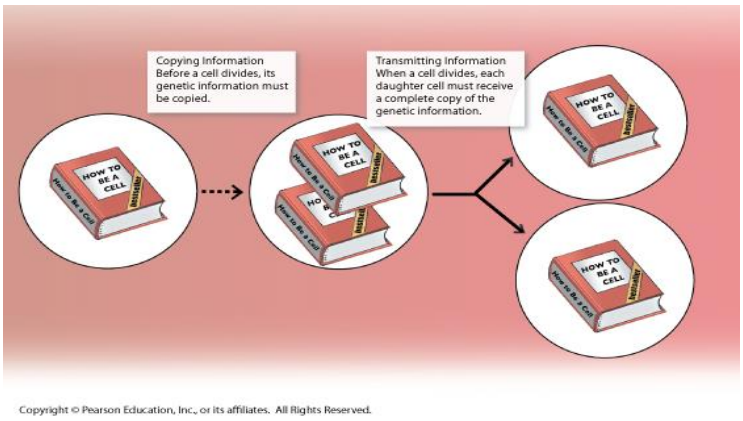
***Optional**: Watch Amoeba Sisters Biomolecules Video* https://www.youtube.com/watch?v=YO244P1e9QM

8. **Living Things Reproduce**

Organisms reproduce new organisms (offspring) by one of two methods:

1. Sexual Reproduction	2. Asexual Reproduction
• Usually requires 2 parents	• ONE parent
• Requires egg / sperm (gametes)	• NO Gametes involved
• Produces variation in offspring	• NO VARIATION produced
• Examples: plants, animals	• Examples: bacteria, yeast, amoeba





Cells reproduce themselves during **growth, development** and **maintenance** of a multicellular organism. **This is considered ASEXUAL process because there is one "parent" cell that divides into 2 identical "daughter" cells**

9. Living Things have a life span

Why can't organisms just live forever? Over time there is damage to the DNA and cells (things wear out despite constant maintenance and repair). Organisms cannot always maintain homeostasis in all environmental conditions. If an organism cannot continue its metabolism and maintain homeostasis – its life will cease! Earth has a limited supply of resources. When organisms die, the materials in their cells are recycled back into the environment for use by new generations of living things. Decomposers are essential to the recycling of materials between the living & nonliving portions of every ecosystem.

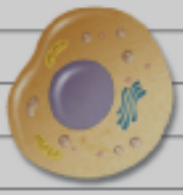
Viruses

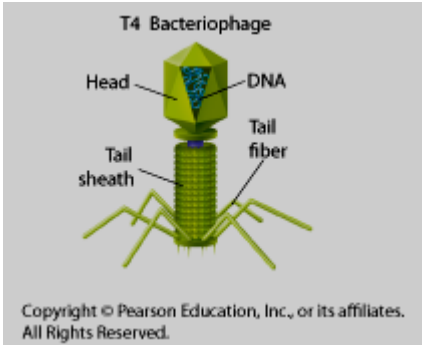
There is some debate over whether **viruses** are living or nonliving. Most agree that they are nonliving. Why?

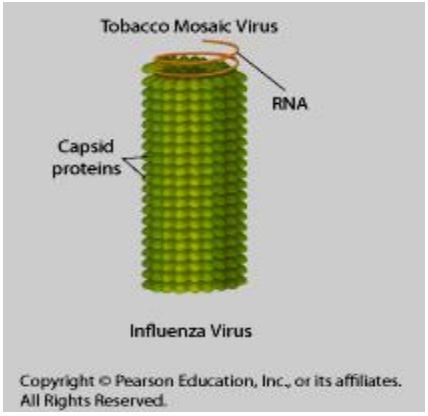
because they are unable to INDEPENDENTLY carry out all life processes – they are particles made of DNA and other organic chemicals that can replicate only by infecting living cells.

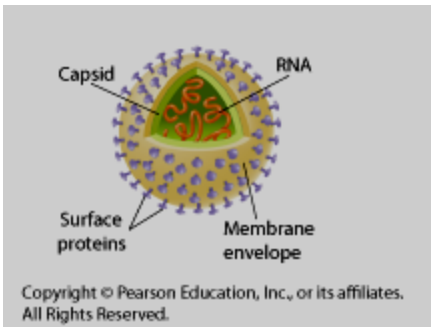
Viruses and Cells

Characteristic	Virus	Cell
Structure	DNA or RNA in capsid, some with envelope	Cell membrane, cytoplasm; eukaryotes also contain nucleus and many organelles
Reproduction	Only within a host cell	Independent cell division, either asexually or sexually
Genetic Code	DNA or RNA	DNA
Growth and Development	No	Yes; in multicellular organisms, cells increase in number and differentiate
Obtain and Use Energy	No	Yes
Response to Environment	No	Yes
Change Over Time	Yes	Yes









Optional: *Learn a little information regarding the scientific method:*

Video 1 – Independent and Dependent Variables from the MythBusters
https://www.youtube.com/watch?v=l0jTMDtX4WY

Video 2 - Crash Course Kids Video – The Engineering Process
https://www.youtube.com/watch?v=fxJWin195kU&list=PLhz12vamHOnZ4ZDC0dS6C9HRN5Qrm0jHO&index=1

VISUAL SUMMARY

THE CHARACTERISTICS OF LIVING THINGS

FIGURE 1–13 Apple trees share certain characteristics with other living things.
Compare and Contrast *How are the apple tree and the grass growing below similar? How are they different?*

Living things are based on a universal genetic code. All organisms store the complex information they need to live, grow, and reproduce in a genetic code written in a molecule called **DNA**. That information is copied and passed from parent to offspring. With a few minor variations, life's genetic code is almost identical in every organism on Earth.

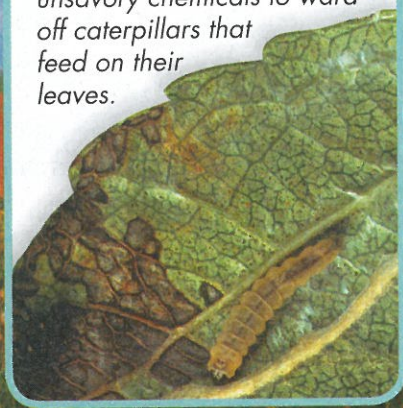
◀ *The growth, form, and structure of an apple tree are determined by information in its DNA.*

Living things grow and develop. Every organism has a particular pattern of growth and development. During development, a single fertilized egg divides again and again. As these cells divide, they differentiate, which means they begin to look different from one another and to perform different functions.

◀ *An apple tree develops from a tiny seed.*

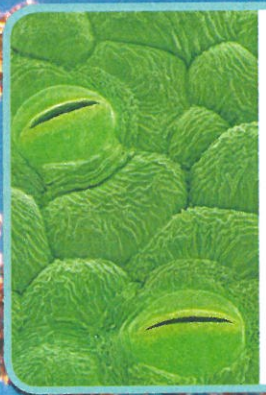
Living things respond to their environment. Organisms detect and respond to stimuli from their environment. A **stimulus** is a signal to which an organism responds.

▼ *Some plants can produce unsavory chemicals to ward off caterpillars that feed on their leaves.*



Living things reproduce. All organisms reproduce, which means that they produce new similar organisms. Most plants and animals engage in sexual reproduction. In **sexual reproduction,** cells from two parents unite to form the first cell of a new organism. Other organisms reproduce through **asexual reproduction,** in which a single organism produces offspring identical to itself.

▶ *Beautiful blossoms are part of the apple tree's cycle of sexual reproduction.*

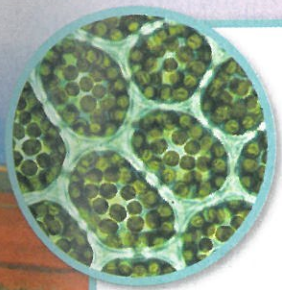


Living things maintain a stable internal environment. All organisms need to keep their internal environment relatively stable, even when external conditions change dramatically. This condition is called **homeostasis.**

◀ *These specialized cells help leaves regulate gases that enter and leave the plant.* SEM 1200×

Living things obtain and use material and energy. All organisms must take in materials and energy to grow, develop, and reproduce. The combination of chemical reactions through which an organism builds up or breaks down materials is called **metabolism.**

▶ *Various metabolic reactions occur in leaves.*



Living things are made up of cells. Organisms are composed of one or more cells—the smallest units considered fully alive. Cells can grow, respond to their surroundings, and reproduce. Despite their small size, cells are complex and highly organized.

▲ *A single branch of an apple tree contains millions of cells.* LM 800×

Taken as a group, living things evolve. Over generations, groups of organisms evolve, or change over time. Evolutionary change links all forms of life to a common origin more than 3.5 billion years ago. Evidence of this shared history is found in all aspects of living and fossil organisms, from physical features to structures of proteins to sequences of information in DNA.

▶ *Signs of one of the first land plants, Cooksonia, are preserved in rock over 400 million years old.*