

# Bio100 midterm study guide

[Science](#), [Biology](#)



7 properties of Life | Description/Examples | | Order | All living things exhibit complex but ordered organization; structure of a pinecone | | Regulation | The environment outside of the organism may change drastically, but the organism can adjust its internal | | | environment keeping it within appropriate limits; temperature (shivering and sweating) | | Growth & Development | Information carried by genes controls the growth and development in all organisms | | Energy Utilization | Organisms take in energy and use it to perform all of life's activities; Puffin eating fish to have energy | | | to swim | | Response to the | All organisms respond to environmental stimuli; Venus fly trap shutting when a fly touches its hairs | | environment | | | Reproduction | Organisms reproduce their own kind; hippos only reproduce hippos | | Evolution | Reproduction underlies the capacity to evolve over time; a bug changes over time to camouflage to its | | | environment | Levels of organization in the living world: 1. Biosphere 2. Ecosystem 6. Organs-Organ Systems 3. Communities 7. Tissues 4. Population 8. Cells 5. Organism 9. Organelles 10. Molecules and Atoms

Homeostasis- The steady state of body functioning; the tendency to maintain relatively constant conditions in the internal environment even when the external environment changes. Homeostasis is dependent on negative feedback to give it signals to regulate; when a thermostat recognizes the temp has dropped it cues the heater to kick on.

In negative feedback, a change in a specific variable triggers a mechanism that will reverse the change. Ecosystem Nutrients are recycled; water, minerals, carbon dioxide and decomposed organisms are used and recycled back in to the ecosystem Energy flows through; sunlight is used for

photosynthesis which produces  $O_2$ . Producers are photosynthesizers. Producers convert the sun's energy to chemical energy of sugars and complex molecules. The sun enters as light and is converted to heat which is released back into the ecosystem. Taxonomy- the branch of biology that identifies names and classifies species. Names are 2 parts (binomial), genus and species. Closely related species are grouped into a genus.

Prokaryotic and Eukaryotic Cells | Characteristics | Prokaryotic Cells | Eukaryotic Cells | | Nucleus | No | Yes | | Cell Size | Very small | Larger | | Complexity (organelles) | Low complexity | Many | | Examples of organisms with these cells | Bacteria, archaea | Animals, humans, plants, fungus, protists | Domain Characteristics- 3 domains Domains | Archaea | Bacteria | Eukarya | | Distinguishing | Exist in extreme conditions | No nucleus | Nucleus | | characteristics | No nucleus | Cell walls contain | Unique rRNA to Eukarya | | | Single celled | peptidoglycan | | | Cell walls contain no peptidoglycan | Unique rRNA to Bacteria | | | Unique rRNA to Archaea | | | | Cell membrane is made of branched hydrocarbon chains | | | | attached to glycerol by ether links | | | | Examples of organisms | *Pyrolobus fumarii*, methanogens | e. coli | Protists, plants, | | found in this domain | | | fungi, animals | Plantae- plants are photosynthetic

Protist- unicellular organisms Cell structures common to both plant and animal cells: Ribosomes, golgi apparatus, plasma membrane, nucleus Unique to plants- chloroplasts, cell walls, central vacuole Unique to animals- centriole, lysosome, flagellum Evolution Evolution is the changing of organisms to produce the best offspring and have the best traits, leading to a better species of the organism; responsible for the unity and diversity in

life. Darwin's main point: Modern species descended from ancestral species, and organisms evolve by natural selection. Artificial selection accounts for the different breeds of domesticated dogs. (selective breeding)

Natural Selection (mechanism of Evolution) | Observation/deduction | What does it say? | | | What does it mean? | | Observation 1- Overproduction and competition | There are only so many resources available for species to live | | | on. When they over produce they will have to compete for the | | | resources; the strongest will survive | | Observation 2- Individual variation | Each individual within a species is different, with different | | | traits. Stronger, weaker, smarter, faster, slower. | | Conclusion- Unequal reproductive Success | The individuals with the best traits will be the ones to get the | | | resources and survive and be able to pass on these traits through | | | their offspring, leading to a species better adapted to their | | | environment. | Hypothesis driven science Scientific Process | Definition/Description | Example from rat experiment in Lab 1 lesson | | | page | | Observation | Observing something | Rats at local pet store seem to all run in | | | a clockwise direction on their wheels | | Questioning | Questioning that observation | Do all rats prefer to run in a clockwise | | | direction? | | Hypothesis | A proposed explanation for a set of | There is no difference in preference by | | | observations | rats as to which direction (clockwise or | | | counterclockwise) they run on an exercise | | | wheel. | Testing | Experiment | A sample of 100 rats (minimum sample size | | | is 30) were selected at random for the | | | experiment. They were split into different | | | groups (control and experimental). The | | | experiment was conducted multiple times by | | | several researchers to ensure that the | | | results were reproducible.

Every rat in both groups was observed to run in a clockwise direction and therefore, the null hypothesis was rejected. Explanation Conclusion to the experiment results-proven Rats do have a preference as to the direction in which they run on the exercise wheel; they prefer to run clockwise. Theory vs. Hypothesis- a theory must be supported by evidence. A good hypothesis must be falsifiable. Measurements

Prefix	Symbol	Relation to base unit
A. kilo	k	x 1,000 (1 k = 1,000 m)
B. centi	c	1/100 (1 cm = 0.01 m)
C. milli	m	1/1000 (1 ml = 0.001 l)
D. micro	$\mu$	1/1,000,000
E. nano	n	1/1,000,000,000

The following are thus equivalent: 575 nm, 0.575  $\mu$ m, 0.000575 mm, 0.0000575 cm, 0.000000575 m, and 0.000000000575 km. Likewise 4.63 kg is equal to 4,630 g and 463,000 cg. Temperature is usually recorded in degrees Celsius ( $^{\circ}$ C). On the Celsius scale, the boiling point of water is  $100^{\circ}$  and the freezing point of water is  $0^{\circ}$ .

The common temperature conversion formulae are:  $^{\circ}$ C =  $(^{\circ}$ F - 32) x 5/9 and  $^{\circ}$ F =  $(^{\circ}$ C x 9/5) + 32

Electrons- subatomic particles with a single unit of negative electric charge that play the greatest role in cellular chemical reactions and determine the chemical properties of an atom or molecule. Innermost shell can hold a maximum of 2 electrons. One or more electrons move around the nucleus of an atom. Source of energy that pumps hydrogen ions across the inner mitochondrial membrane

Atom- the structural unit that retains the properties of an element. Becomes an ion when it gains or loses electrons. Composed of protons, electrons and neutrons.

Proton- subatomic particle w/ a single unit of positive electrical charge.

Electron- subatomic particle w/ a single unit of negative electrical charge.

Neutron- Electrically neutral The number of electrons in the outermost shell determines the chemical properties of an atom. Atoms whose outer shells are not full tend to interact with other atoms- that is, to participate in chemical reactions. The innermost shells is full with only 2 electrons, while the second and third shells can each hold up to 8 electrons. Molecule- A group of two or more atoms held together by covalent bonds. Isotopes differ in their mass number  $3\text{CO}_2$  is three molecules of carbon dioxide.

Carbon is organic | Type of Bond | How they form | Examples | | Ionic | Transfer of electrons that happen through | Table salt | | | the attraction of oppositely charges ions | | | | such as positive calcium and negative | | | | fluoride. | | | Covalent | When one atom shares its electrons with | Methane | | | another atom. | | | Hydrogen | Occurs in water between a hydrogen and | Water | | | oxygen atom in a different molecule.

A type| | | of weak chemical bond formed when a | | | | partially positive hydrogen atom from one | | | | polar molecule is attracted to the | | | | partially negative atom in another molecule| | | |(or in another part of the same molecule). | | Water- 2 hydrogen atoms, 1 oxygen atom- is an important solvent in life because it forms hydrogen bonds. pH 7 because it is neither acidic or basic. Cohesion- The tendency of water molecules of the same kind to stick together.

The strength of hydrogen bonds between water molecules allows for surface tension (spider walking on water) pH- 0 is acidic- greater  $\text{H}^+$  concentration, water is 7- equal  $\text{H}^+$  and  $\text{OH}^-$  concentration (neutral) and 14 is Basic- lower  $\text{H}^+$  concentration.. Carbon is an important molecule for life because it can form chemical bonds with a maximum of 4 other atoms. 4 electrons in its

outermost shell (can hold 8), needs 8 to be stable and it gets the electrons by covalent bond Centrioles - Every animal-like cell has two small organelles. They are there to help the cell when it comes time to divide. They are put to work in both the process of mitosis and the process of meiosis.

You will usually find them near the nucleus but they cannot be seen when the cell is not dividing. Made of Microtubules. Hydrocarbon- the simplest organic compounds which contain only carbon and hydrogen atoms. Hydrolysis- breaking of a long chain compound into its subunits by adding water to the structure between its subunits. Adding a water molecule to split two sugars apart. Consumes water. Changes polymer to monomer Dehydration reaction- A chemical process in which a polymer forms when monomers are linked by the removal of water molecules. One molecule of water is removed for each pair of monomers linked. A dehydration reaction is the opposite of a hydrolysis reaction.

Carbohydrate monomers are united into a polymer by means of dehydration synthesis Carbohydrate- A biological molecule consisting of simple single-monomer sugars (monosaccharide), two-monomer sugars (disaccharides), and other multi-unit sugars (polysaccharides). Proteins- made of amino acids. Hair and muscle. Act as enzymes. Proteins function depends on its shape Lipids-fats (oils) and steroids (cholesterols. Stores energy and produces other steroids. Fat is made of glycerol with 3 fatty acid molecules (triglycerides). Mitochondria are known as the powerhouses of the cell. They are organelles that act like a digestive system that takes in nutrients, breaks them down, and creates energy for the cell. Nucleic acids- DNA and RNA, provides the directions for building proteins. Made of nucleotides.

A> T and G> C Polysaccharides- sugars Soften a fat- create more double bonds with carbon atoms in the fatty acid chains. More hydrogen atoms in saturated fats make them remain solid at room temp. Enzyme- may contain the organic molecule -NH<sub>2</sub>. Special type of protein that causes metabolic reactions to proceed at a much greater rate than they normally would. Their function depends upon their three-dimensional shape. Three factors that can affect the observance of enzymes is temperature, pH and the presence of catalase. A protein that serves as a biological catalyst, changing the rate of a chemical reaction without itself being changed in the process. DNA- made up of nucleotides.

Nuclear membrane- the “ envelope” there is pores and spaces for RNA and proteins to pass through while the nuclear envelope keeps all of the chromatin and nucleolus inside. Cytoskeleton- maintains cell shape, anchors organelles, and moves parts of the cell. A meshwork of fine fibers in the cytoplasm of a eukaryotic cell; includes microfilaments, intermediate filaments, and microtubules. Cell walls; plant cell walls are composed of cellulose. A protective layer external to the plasma membrane in plant cells, bacteria, fungi, and some protists; protects the cell and helps maintain its shape. Cell membranes are composed of lipids and proteins; it separates the cell from its surroundings.

Called the Fluid Mosaic” because molecules can move freely past one another and mosaic because of the diversity of proteins that float like icebergs in a phospholipids sea. Cytoplasm- Everything inside a eukaryotic cell between the plasma membrane and the nucleus; consists of a semi fluid medium and organelles; can also refer to the interior of a prokaryotic cell.



Chloroplasts- the organelles that perform photosynthesis in plant cells and some protists. Located in the cytoplasm within the plasma membrane. Enclosed by two concentric membranes, a chloroplast absorbs sunlight and uses it to power the synthesis of organic food molecules (sugars).

Chlorophyll- A green pigment in chloroplasts that participates directly in the light reactions. Chlorophyll a- the chlorophyll that is used during light reaction and is in the reaction center of the photosystem Chlorophyll b- broadens the range of light a plant can use Carotenoids- absorbs extra light that could damage the chlorophyll Anthocyanin- protects the plant from UV damage Genes- Chromosomes are made up of DNA. Segments of DNA in specific patterns are called genes. Your genes make you who you are. You will find the chromosomes and genetic material in the nucleus of a cell. In prokaryotes, DNA floats in the cytoplasm in an area called the nucleoid. Lysosome- aids in digestion Plasma membrane- major lipids are phospholipids.

The thin layer of lipids and proteins that sets a cell off from its surroundings and acts as a selective barrier to the passage of ions and molecules into and out of the cell; consists of a phospholipid bilayer in which proteins are embedded. Golgi apparatus- protein modification. An organelle in eukaryotic cells consisting of stacks of membranous sacs that modify, store, and ship products of the endoplasmic reticulum. Central vacuole- A membrane-enclosed sac occupying most of the interior of a mature plant cell, having diverse roles in reproduction, growth, and development. Aids in storage Microtubules- cell shape Nucleolus- The nucleolus is a non-membrane bound structure [composed of proteins and nucleic acids found within the nucleus. Ribosomal RNA (rRNA) is transcribed and assembled within the nucleolus.

Cilia- hair-like structures on the outside of a cell that create movement through a back and forth motion Flagella- tail-like structure on the outside of the cell that helps move the cell along Food vacuole- sac that buds from the plasma membrane to help the lysosome release enzymes that digest the food molecules that provides energy to the cell. Cellular respiration- conversion of the energy stored in food molecules to energy stored in ATP. Glucose is used as food and carbon dioxide is produced as waste. Formula is  $6\text{CO}_2 + 6\text{H}_2\text{O} = \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$  (6 molecules carbon dioxide + 6 molecules water = 1 molecule sugar + 6 molecules oxygen). Cellular respiration varies from breathing because it is required to share 2 gases with its surroundings and breathing shares 2 gases between blood and surroundings. Stages are Glycolysis, Citric Acid Cycle and Electron Transport Aerobic= 4, anerobic= 34 Cellular responses involve transduction of an external signal Paramecium- single celled organism (Protist) with a nucleus (eukaryotic cell) and small hair-like structures (cilia) Osmosis- water moves from the lower solute concentration to the higher solute concentration. A type of passive diffusion where water moves down the concentration gradient through a semi-permeable membrane. Hypertonic- In comparing two solutions, referring to the one with the greater concentration of solutes. Hypotonic- In comparing two solutions, referring to the one with the lower concentration of solutes. If a cell is placed in it, water will move into the cell from the surrounding solution. Energy- capacity to perform work

Kinetic energy- energy of motion (muscle moving) potential energy- Energy that something has because of its location. A rock on the top of the mountain contains potential energy entropy- the measure of the amount of disorder or

randomness in a situation Principles of conservation of energy- it is not possible to create or destroy energy. Can only be converted from one form to another. ATP molecules- main energy carriers in cells. ATP synthesis occurs in the mitochondrion Active transport requires ATP, passive does not. Facilitated transport occurs by means of transport proteins Diffusing molecules move down their concentration gradients until they are evenly distributed.

If a human cell were placed in water, it swells because water is diffusing across the plasma membrane from a region of high concentration outside the cell to a region of low concentration inside the cell. Endocytosis- The movement of materials in to the cell Exocytosis- The movement of materials out of the cytoplasm of a cell via membranous vesicles or vacuoles Phagocytosis is a type of endocytosis in which a cell engulfs another cell. A cell engulfs a particle by wrapping pseudopodia around it and packaging it within the vacuole Pinocytosis- cellular drinking Receptor-Mediated Endocytosis - the movement of specific molecules into the cell by inward budding vesicles. The vesicles contain proteins with receptor sites specific to the molecules being taken in.

Polypeptide- a chain of amino acids that have been linked together by dehydration synthesis Light reactions take place in the thylakoid membrane. Source of electrons is H<sub>2</sub>O. The first of two stages in photosynthesis, the steps in which solar energy is absorbed and converted to chemical energy in the form of ATP and NADPH. The light reactions power the sugar-producing Calvin cycle but produce no sugar themselves. Photosynthesis- light excites the electrons in chlorophyll to a higher energy state. Energy is released and

used to create ATP when electrons are passed down the energy hill during the light dependant reactions. The process by which plants, algae, and some bacteria transform light energy to chemical energy stored in the bonds of sugars made from carbon dioxide and water.  $CO_2 + 6H_2O = C_6H_{12}O_6 + 6O_2$  (6 molecules carbon dioxide + 6 molecules water = 1 molecule sugar + 6 molecules oxygen) Calvin Cycle- makes sugars during photosynthesis in the Stroma. The Calvin Cycle uses the products of the light reactions (which are ATP and NADPH) to power the production of sugar from carbon dioxide. The enzymes in the Calvin cycle are dissolved in the Stroma, the thick fluid within the chloroplast. ATP generated by the light reactions provides the energy for sugar synthesis. And the NADPH produced by the light reactions provides the high-energy electrons for the reduction of carbon dioxide to Glucose. Thus, the Calvin cycle indirectly depends on light produce sugar because it requires the supply of ATP and NADPH produced by the light reactions.

It also stores ions in solution that the cell may need at a later time. vesicle is a bubble of liquid within another liquid, a supramolecular assembly made up of many different molecules. More technically, a vesicle is a small membrane-enclosed sack that can store or transport substances. Vesicles can form naturally because of the properties of lipid membranes (see micelle), or they may be prepared. Artificially prepared vesicles are known as liposomes. Most vesicles have specialized functions depending on what materials they contain. Water-splitting photosystem when oxygen is produced Osmoregulation- animal's ability to survive if its cells are exposed to hypertonic or hypotonic environment