DAYTONA STATE COLLEGE

GENERAL BIOLOGY I FINAL EXAM

REVIEW

BE ABLE TO DEFINE

- Biology
  - The study of life
- Hypothesis
  - A proposed explanation of a natural phenomenon, must be testable and falsifiable
- Alternative Hypothesis
  - The opposite of the hypothesis
- Theory
  - A hypothesis that has stood the test of time, and has a large amount of supporting evidence
- Testable
  - Quantifiable, measurable
- Falsifiable
  - Can be disproven
- Eukaryote
  - Has cells with a nucleus and membrane-bound organelles
- Prokaryote
  - Cells have no nucleus or membrane bound organelles

BE ABLE TO DEFINE

- Proton
  - Positively charged particle in the nucleus of an atom. (Mass = 1 amu)
- Neutron
  - Non charged particle in the nucleus of an atom. (Mass = 1 amu)
- Electron
  - Negatively charged particle that orbits the nucleus of an atom.
- Electron Orbital
  - The area where an electron may be found
- Hydrophilic
  - Will mix with water (polar)
- Hydrophobic
  - Repels water (non-polar)
- DNA
  - Deoxyribonucleic Acid, used for storing information in a cell
- RNA
  - Ribonucleic Acid, used to carry information to be processed and turned into protein

BE ABLE TO DEFINE

- Nucleotide
  - A nitrogenous base acid + A 5-carbon sugar (deoxyribose or ribose) + a phosphate group, building blocks of DNA and RNA
- Positive Feedback
  - A cycle in which one signal triggers increase in another, which increases the original signal. System output increases until system crashes. i.e. childbirth
- Negative Feedback
  - One signal triggers increase of another, which decreases the original signal, Maintains balance. i.e. insulin and glucagon
- Artificial Selection
  - Selection by humans for specific traits in animals or plants
- Natural Selection
  - Selection by the environment for certain traits in animals or plants
- Common Descent
  - All things are descended from a common ancestor, i.e. all species evolved from one organism
- Solvent
  - What a chemical is dissolved in, usually water
- Solute
  - What is being dissolved

BE ABLE TO DEFINE

- Photosynthetic
  - Uses photons (sunlight) to make food, i.e. makes glucose via photosynthesis
- Heterotrophic
  - Uses existing sources of food, i.e. eats other things
- Isotope
  - An atom of a given element with extra neutrons (extra mass) in its nucleus
- Trace Element
  - Elements that make up less than .01% of human body weight
- Atomic Number
  - The number of protons in an atom's nucleus, defines the element
- Atomic Mass
  - The mass of protons and neutrons in an atom
- Calorie
  - The heat required to raise one gram of water one degree centigrade.
    - Metric unit of Energy.
- Kilocalorie
  - 1000 Calories

TERMS TO KNOW

- Polar
  - A covalently bonded molecule where one atom has the electrons most of the time, leading to partial positive and negative charges
- Nonpolar
  - A covalently bonded molecule where all the electrons are shared equally, and no charge is created
- Hydrophilic
  - A molecule that is attracted to water, typically polar
- Hydrophobic
  - A molecule that repels water, typically nonpolar
- Valence
  - The outermost shell of electrons in an atom, the valence shell is what allows bonding between atoms
- Structural Isomer
  - when molecules with the same molecular formula have bonded together in different orders.
  - Any of two or more chemical compounds, having the same molecular formula but different structural formulas.
- Geometric Isomer
  - A chemical compound having the same molecular formula as another but a different geometric configuration, as when atoms or groups of atoms are attached in different spatial arrangements on either side of a double bond or a ring.
- Enantiomer
  - Differs in spatial orientation around an asymmetrical carbon atom
  - Stereoisomers that are mirror images of one another but cannot be superimposed on each other.

TERMS TO KNOW

- Monosaccharide
  - A single simple sugar, i.e. glucose, fructose, galactose, ribose
- Disaccharide
  - Two simple sugars bonded together, i.e. glucose-glucose: maltose
- Polysaccharide
  - A long chain of simple sugars, i.e. starch, cellulose, and glycogen
- Peptide
  - A short chain of amino acids
- Polypeptide
  - A long chain made up of many amino acids
- Nucleotide
  - A nitrogenous base + a 5-carbon sugar + a phosphate group
- Dehydration Synthesis of Polymers
  - The process of binding two monomers by creating a water molecule
- Hydrolysis of Polymers
  - Breaking apart two bonded monomers by adding water

TERMS TO KNOW

- Primary Structure of Proteins
  - The actual amino acid sequence of a polypeptide
- Secondary Structure of Proteins
  - The alpha helixes and beta pleated sheets formed by the initial folding of the primary structure
- Tertiary Structure of Proteins
  - Further folding of the polypeptide
- Quaternary Structure of Proteins
  - The final structure of the protein, often involves multiple polypeptide chains folding together
- Phospholipid
  - An amphiphilic molecule with a polar head and a nonpolar tail, makes up cell membranes
- Fluid Mosaic Model
  - Proteins and phospholipids in the cell membrane are mobile (fluid), and the proteins are embedded in the membrane(mosaic)
- Phagocytosis
  - Literally "cell-eating", phagocytosis is the process by which large molecules are brought into a cell
- Peptide Bond
  - The bond between two amino acids made when the carboxyl group of one molecule reacts with the amino group of another molecule, causing the release of H_20

TERMS TO KNOW

- Saturated Fatty Acid
  - A fatty acid with all single bonds, fully hydrogenated
- Unsaturated Fatty Acid
  - A fatty acid with one or more double bonds, not fully hydrogenated
- RNA world
  - The theory that states that RNA came before either DNA or Proteins as both the genetic material of a cell and as an Rnzyme functioning as a protein
- Gap Junctions
  - Holes between cells, allows diffusion between cells
- Tight Junctions
  - Hold cells tight together to prevent leakage
- Desmosomes
  - Connects cells together
- Microbial Mats
  - Growths of bacteria
- Stromatolite
  - A fossilized microbial mat, with cells similar to current microbial mats found in lagoons
- Cyanobacteria
  - Blue-green algae, photosynthetic prokaryotes that created oxygen in the early atmosphere

TERMS TO KNOW

- Anabolism
  - Building molecules for storing energy
- Catabolism
  - Breaking down molecules for usable energy
- Metabolism
  - The combined processes of catabolism and anabolism
- Entropy
  - A measure of disorder in a system
- Kinetic Energy
  - Energy of movement
- Potential Energy
  - Stored Energy
- ATP
  - Adenosine Triphosphate, energy currency used by the body
- Energy coupling
  - A process by which an exergonic reaction provides energy to be used in an endergonic reaction, i.e. electron transport and oxidative phosphorylation

TERMS TO KNOW

- NADH
  - Electron carrier used in cellular metabolism
- NADPH
  - Electron carrier used by chloroplasts in photosynthesis
- Hydrolysis
  - Breaking down a polymer by inserting a water molecule
- Active Site
  - The portion of an enzyme to which a substrate binds and where reactions take place.
- Substrate
  - What is acted on by an enzyme
- Product
  - What is produced by an enzyme from a substrate
- Coenzyme
  - A non-protein organic substance that combines with a protein to form an active enzyme.
- Cofactor
  - Non-protein molecules required for enzymes to function
  - Typically refers to a non-organic molecule

TERMS TO KNOW

- Energy of Activation
  - The energy required to initiate a reaction
- Competitive Inhibitor
  - An inhibitor that competes for the active site on an enzyme
- Noncompetitive Inhibitor
  - An inhibitor that does not compete for the active site of an enzyme
- Allosteric Inhibitor
  - An inhibitor that binds to the allosteric site of an enzyme. Results in change of shape to the active site.
- Feedback Inhibition
  - The product of an enzymatic reaction is an allosteric inhibitor of the enzyme that creates it
- Exergonic Reactions
  - Release heat
- Endergonic Reactions
  - Absorb heat

TERMS TO KNOW

- Diffusion
  - Movement of a solute from high concentration to low concentration
- Osmosis
  - Diffusion of water
- Hypertonic
  - More solute outside than inside
- Hypotonic
  - Less solute outside than inside
- Isotonic
  - Same amount of solute outside as inside
- Freeze Fracture
  - Technique used to prove the fluid mosaic model of cell membranes
- Induced Fit
  - When a substrate binds to an enzyme, the enzyme's shape is slightly altered.

TERMS TO KNOW

- Plasmolysis
  - The removal of water from plant cells, caused by being in a hypertonic solution
  - Shrinkage or contraction of the protoplasm away from the wall of a living plant or bacterial cell.
- Hemolysis
  - The lysis of red blood cells, caused by placing them into a hypotonic solution
- Crenation
  - The shrinkage of red blood cells when placed in a hypertonic solution
- Turgor Pressure
  - The pressure created when the central vacuole in a plant cell fills with water, allows plants to stand upright. Form of hydrostatic pressure.
- Symport
  - The active transport of substance A drives the active transport of substance B in the same direction
- Antiport
  - The active transport of substance A drives the active transport of substance B in the opposite direction
- Passive Transport
  - The movement of substances that does not require energy
- Active Transport
  - The movement of substances requiring energy (ATP)

TERMS TO KNOW

- Receptor Mediated Endocytosis
  - Endocytosis triggered by the activation of a receptor on the cell surface
- Exocytosis
  - Ejecting something from the cell
- Phagocytosis
  - "Cell Eating" used to bring in large molecules, usually other cells
- Pinocytosis
  - "Cell Drinking" used to bring in smaller, non-visible, water-soluble molecules
- Cyclic Phosphorylation
  - More ATP than NADPH are needed to fix carbon in Calvin cycle
- Non-cyclic phosphorylation
  - Electron Transport Chain used in photosynthesis to make ATP
- Anaerobic
  - Does not use oxygen
- Aerobic
  - Uses Oxygen

TERMS TO KNOW

- Stroma
  - The space inside the chloroplast
- Thylakoid
  - Small, stacked, round discs inside the chloroplast
- Photosystem II
  - First light gathering system in non-cyclic phosphorylation
- Photosystem I
  - Second light gathering system in non-cyclic phosphorylation, after electron transport chain
- First Law of Thermodynamics
  - ☞ **Energy** in the universe is constant or **total quantity** of energy before equals **total quantity** after each energy conversion.
  - ☞ **ENERGY** can be transferred and transformed but energy cannot be created or destroyed.
- Second Law of Thermodynamics
  - Every **energy** transfer makes the universe more disordered, or increases entropy

TERMS TO KNOW

- Cell Cycle
  - Interphase (G0, G1, S, G2) and mitosis
- Prophase
  - Chromatin condenses into chromosomes, nuclear membrane dissolves
- Metaphase
  - Chromosomes line up along the center of the cell
- Anaphase
  - Chromatids begin pulling apart
- Telophase
  - Chromosomes move to opposite ends of the cell, nuclear membranes reform
- Cytokinesis
  - Cleavage of the cell, involves cleavage furrow in animal cells and cell plate formation in plant cells
- Chromosome
  - Tightly bundled DNA
- Chromatid
  - One of a pair of duplicated chromosomes
- Chromatin
  - Loose DNA

TERMS TO KNOW

- Karyotype
  - The number and appearance of chromosomes in the nucleus of a eurkaryotic cell.
  - Karogram - A graph depicting all 23 pairs of chromosomes lined up in order from largest to smallest
- Haploid
  - One complete set of chromosomes, i.e. 23 chromosomes in haploid human gametes
- Diploid
  - Two complete sets of chromosomes, i.e. 23 pairs of chromosomes in somatic human cells
- Gamete
  - Haploid reproductive cells
- Centromere
  - Center of a chromosome
- Kinetochore
  - Protein in the center of a chromosome where spindle fibers attach
- Homologous Chromosomes
  - A pair of the same chromosomes, one from each parent, may have different versions of the same alleles
- Fission of Bacteria
  - The method by which bacteria reproduce, doubling of chromosomes and splitting of one cell into two with no mitosis occurring. This takes place with out the formation of spindles.

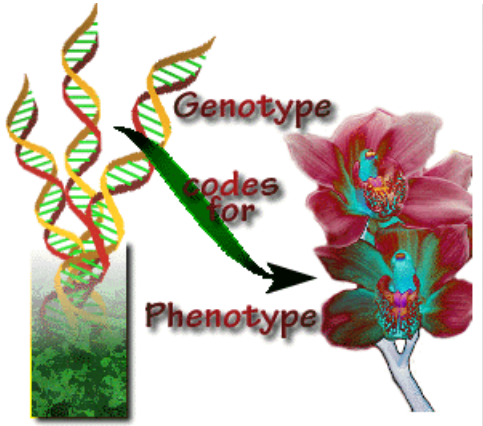
TERMS TO KNOW

- Autosomes
  - A chromosome that is not a sex chromosome.
  - Chromosomes responsible for normal body function and body parts
- Sex Chromosomes
  - Chromosomes that determine sex and male/female body parts
- Gametophyte
  - Haploid organism that makes gametes via mitosis
- Sporophyte
  - Diploid organism that makes spores via meiosis
- Recombination
  - Crossing over of chromosomes during meiosis 1
- Gregor Mendel
  - First to prove inheritance using discrete units or particulate units and not due to inheritance blending
- Allele
  - Alternative forms of the same gene
  - A single type of a gene, i.e. brown eye vs blue eye genes
- Genotype
  - The genetic makeup of a cell, organism or individual.
- Phenotype
  - Composite of an organism's observable characteristics
  - Expression of genes + environmental factors

Genotype vs Phenotype

Phenotype This is the "outward, physical manifestation" of the organism. These are the physical parts, the sum of the atoms, molecules, macromolecules, cells, structures, metabolism, energy utilization, tissues, organs, reflexes and behaviors; anything that is part of the observable structure, function or behavior of a living organism.

Genotype This is the "internally coded, inheritable information" carried by all living organisms. This stored information is used as a "blueprint" or set of instructions for building and maintaining a living creature. These instructions are found within almost all cells (the "internal" part), they are written in a coded language (the genetic code), they are copied at the time of cell division or reproduction and are passed from one generation to the next ("inheritable"). These instructions are intimately involved with all aspects of the life of a cell or an organism. They control everything from the formation of protein macromolecules, to the regulation of metabolism and synthesis.



The relationship between the genotype and phenotype is a simple one ...

The **Genotype** codes for the **Phenotype**

The "internally coded, inheritable information", or **Genotype**, carried by all living organisms, holds the critical instructions that are used and interpreted by the cellular machinary of the cells to produce the "outward, physical manifestation", or **Phenotype** of the organism.

TERMS TO KNOW

- Homozygous
  - Having two of the same alleles for a specific trait (true breeding)
- Heterozygous
  - Having two different alleles for a specific trait
- Parental Generation
  - The first set of parents crossed in which their genotype is the basis for predicting the genotype of their offspring, which in turn may be crossed.
- F1 and F2 Generations
  - F1 is the first cross of the parental generation, F2 is a cross of the F1 generation
- Dominant
  - Allele that is always expressed if present
- Recessive
  - Allele that is only expressed if homozygous for that allele
- Test Cross
  - Dominant phenotype of unknown genotype being crossed with recessive phenotype to determine genotype
- Haploid
  - Having a single set of chromosomes (n)
- Diploid
  - Having two sets of chromosomes (2n)

TERMS TO KNOW

- Complete dominance
  - One allele is completely dominant over the other, and is always expressed if present
- Co-dominance
  - Both alleles are completely expressed, i.e. AB blood type
- Incomplete dominance
  - Both alleles are expressed, i.e. pink flowers being a cross of red and white
- Multiple alleles
  - More than one allele exists, i.e. ABO blood types
- Monohybrid cross and dihybrid cross
  - Monohybrid cross: Crossing of alleles for one trait
  - Dihybrid cross: Crossing of alleles for two traits
- Dependent assortment (like linked genes) vs. independent assortment
  - Dependent assortment: Theory that alleles on the same chromosome are crossed together
  - Independent assortment: Theory that alleles on the same chromosome are crossed separately
- Pleiotropy
  - More than two alleles develop as a result of mutation
- Polygenic
  - Phenotype is determined by multiple genes

TERMS TO KNOW

- Sex linked trait
  - Any gene or allele carried only on the X or Y chromosome
- Monohybrid cross
  - A one gene cross, i.e. flower color
- Dihybrid cross
  - A two gene cross, i.e. eye color
- Dependent assortment (linked genes) vs. independent assortment
  - Genes that are closer on the same chromosome will often cross together in dependent assortment, whereas those farther apart are subject to independent assortment and cross separately
- Barr Bodies (in somatic cells)
  - Inactive X chromosome, more than one x chromosome results in a barr body
- Monosomy
  - Having only one chromosome where normally there are two
- Trisomy
  - Having 3 of the same chromosome i.e. trisomy X (XXX female genotype) and down's syndrome (3 chromosome 21s)

TERMS TO KNOW

- Euploidy
  - Having a normal number of chromosomes
- Aneuploidy
  - Having an abnormal number of chromosomes
- Deletion
  - Removal of a section of a chromosome
- Duplication
  - Repeating a section of a chromosome
- Translocation
  - Moving a segment from one chromosome to a non-homologous one
- Inversion
  - Reversing a section of a chromosome
- Crossing Over
  - In meiosis, the cutting and swapping of genes between homologous chromosomes

TERMS TO KNOW

- Genetic/Linkage Map
  - Constructed using recombination frequencies to demonstrate distance between two genes on a chromosome, recombination frequency is directly proportional to the distance between genes
- Sex-Determining system in humans, grasshoppers, ants/bees, birds
  - Humans: XX(female), XY(male)
  - Grasshoppers: XX(female), X0(male)
  - Ants/bees: Haploid(male), Diploid(female)
  - Birds: ZW(female), ZZ(male)

TERMS TO KNOW

- Anti-parallel (in reference to strands of DNA)
  - The two strands of DNA face opposite directions, one strand is facing the 3' to 5' direction and the other is facing the 5' to 3' direction
- Leading and lagging strand of DNA synthesis
  - Leading Strand: the strand of DNA that copies continuously,
  - Lagging Strand: the strand of DNA that is copied discontinuously, resulting in Okasaki fragments
- What does 5' and 3' mean?
  - 5' is the end of DNA with a phosphate, and 3' is the end with a deoxyribose sugar
- Why is DNA copied in the 5' to 3' direction?
  - New nucleotides can only be added to the 3' end of DNA
- Okasaki fragment
  - Short, newly synthesized DNA fragments
  - Found on the lagging template strand of DNA,
- Primase and primer
  - Primase is the enzyme that creates a primer, which is a short piece of RNA that is used to begin copying DNA
- Transcription
  - Copying of DNA to RNA
- Translation
  - The process by which a ribosome uses an mRNA template and makes a protein

TERMS TO KNOW

- DNA replication
  - The process of duplicating DNA to make two complete copies from a single copy of DNA
- mRNA
  - Messenger RNA, used as a template for protein synthesis
- tRNA
  - Transfer RNA, ferries amino acids to ribosomes
- Initiator tRNA
  - Has an anticodon for the "start" codon of mRNA
- rRNA
  - Ribosomal RNA, ribosomes are made of rRNA and some proteins
- snRNA
  - Small Nuclear RNA, snRNA is often combines with proteins to produce snRNPs "snurps" which assist in the processing of pre-mRNA
- Amino-Acid tRNA Synthase
  - Aminoacyl tRNA synthetase attaches amino acids to tRNA
- The Genetic Code is:
  - Universal: All domains and kingdoms use DNA as the genetic material
  - Degenerate: There are 64 different codons for only 20 amino acids
  - Non-overlapping: Each nucleotide is used only once
  - Comma-less: There are no "spaces" or unused nucleotides between codons

TERMS TO KNOW

- Codon
  - 3 nucleotides together make up a codon which codes or a single amino acid
- Termination codon
  - The "stop" codon, signals the end of translation
- Anticodon
  - On tRNA, this is a sequence of 3 nucleotides that matches up with a codon, i.e. if the codon is ACG, the anticodon would be UGC
- Promoter
  - Where transcription begins on a strand of DNA
  - A site in a DNA molecule at which RNA polymerase and transcription factors bind to initiate transcription of mRNA.
- RNA polymerase
  - Enzyme that makes RNA
- 5' cap (with G)
  - Modified guanine added to 5' end of mRNA
- Poly A tail
  - 50-250 Adenines added to 3' end of mRNA
- Introns
  - Non-coding parts of mRNA
- Exons
  - Coding parts of mRNA
- Spliceosome
  - snRNA and proteins that splice out introns, also called snRNPs or "snurps"

TERMS TO KNOW

- A site, P site, E site of a Ribosome
  - A Site: Aminoacyl tRNA binding site, where tRNA molecules bind to mRNA
  - P Site: Peptidyl tRNA binding site, where the peptide bond forms between the two amino acids carried by the tRNA molecules
  - E Site: Exit site, where the tRNA exits the ribosome after detaching from its amino acid
- Point mutation
  - Change in one base of DNA (silent mutation changes DNA but not amino acid sequence)
- Frame shift mutation
  - Insertion or deletion of 1 or 2 nucleotides, changes multiple amino acids
- Missense mutation
  - One DNA base change changes only one amino acid
- Nonsense mutation
  - Makes a premature stop codon

CONCEPT QUESTIONS

- What are the characteristics that distinguish a living organism from a non-living substance?
  - Order, Evolutionary adaptation, Response to environment, Regulation (or homeostasis), Energy processing, Growth, Development, Reproduction
- Know the scientific method.
  - Observation, Question, Hypothesis, Prediction, Experiment
- What did the Pasteur experiment prove?
  - No spontaneous generation
- Know the order of the hierarchy of life
  - Atom, molecule, organelle, cell, tissue, organ, organism, population, community, ecosystem, and biosphere.
    - Be able to define each term and give examples

CONCEPT QUESTIONS

- How does energy flow through an ecosystem?
  - One way
- What is the ultimate source of energy for almost all ecosystems?
  - The sun
- What are an ion, element, and a molecule?
  - Ion: an atom with a different number of electrons, a charged atom
  - Element: A pure substance, made of only one type of atom
  - Molecule: Two or more atoms bound together
- What part of the atom defines an element?
  - The number of protons
- Which four elements comprise 96% of the human body?
  - Carbon, Hydrogen, Oxygen, Nitrogen
- What is a hydrogen bond?
  - A dipole-dipole interaction between Hydrogen and either Oxygen, Nitrogen, or Fluorine.
- What is an ionic bond?
  - A bond between two atoms, where electrons are transferred from one atom to the other
- What is a covalent bond?
  - A bond between two atoms, where electrons are shared between both atoms

CONCEPT QUESTIONS

- What is a polar covalent and nonpolar covalent bond?
  - Polar covalent bonds are bonds between two non-metals of different electronegativities.
  - Nonpolar covalent bonds are bonds between two non-metals of the same electronegativities.
    - When differences in electronegativities is very small the bond is considered to be nonpolar.
- Which carries the partial negative and which carries the partial positive charge in water?
  - Oxygen carries the partial negative,
    Hydrogen carries the partial positive
- In addition to oxygen-hydrogen bond, nitrogen-hydrogen bond is
  - polar
- The carbon-hydrogen bond is
  - *non-polar*

CONCEPT QUESTIONS

- What is the pH scale?
  - A measure of the concentration of hydrogen ions present in a substance, it represents the acidity of the solution.
- What magnitude of [H] or [OH] does each number represent?
  - pH = -log[H]
  - Therefore each number is a magnitude of ten.
- How much more acidic is pH 6 than pH 7?
  - **10 times more acidic**
- How much more acidic is pH 4 than pH 7?
  - **1000 times more acidic**

CONCEPT QUESTIONS

- Be able to identify whether a molecule is positive or negative based on whether oxygen or hydrogen is attracted to it.
  - If Oxygen is attracted to a molecule then the molecule is positive
  - If Hydrogen is attracted to a molecule then the molecule is negative.
- What is the order of taxonomy from kingdom to species?
  - Domain, **K**ingdom, **P**hylum, **C**lass, **O**rder, **F**amily, **G**enus, **S**pecies
    - **k**eep **p**iling **c**hocolate **o**n **f**or **g**oodness **s**ake
- What are the characteristics of the three domains and the characteristics of kingdoms of Eukarya?

FILL IN THE BLANKS

	Example organism	Characteristics of Domain (and then kingdom of Eukarya)
Domain = Archaea		
Domain = Bacteria		
Domain Eukarya		
Domain Eukarya Kingdom = Protista		
Domain Eukarya Kingdom =Animalia		
Domain Eukarya Kingdom =Plantae		
Domain Eukarya Kingdom =Fungi		

FILL IN THE BLANKS

	Example organism	Characteristics of Domain (and then kingdom of Eukarya)
Domain = Archaea	Thermophile or Halophile	Live in extreme environments (Salt and Heat for example)
Domain = Bacteria	E. Coli	Prokaryotes, meaning they do not have membrane bound organelles. Also true bacteria have a peptidoglycan cell wall.
Domain Eukarya	Paramecium, Human, Sunflower, Mushrooms	multicellular organisms
Domain Eukarya Kingdom = Protista	Paramecium	single celled organisms
Domain Eukarya Kingdom =Animalia	Cheetah, Whale, Human	multicellular eukaryotic heterotrophic organisms that ingest organic materials.
Domain Eukarya Kingdom =Plantae	Oak Tree, Sunflower	multicellular eukaryotic photosynthetic organisms
Domain Eukarya Kingdom =Fungi	Mushrooms	multicellular heterotroph that digests externally

CONCEPT QUESTIONS

- What element defines organic chemicals vs. inorganic?
  - Carbon
- What are the elements found in the four major organic compounds?
  - Carbon, Oxygen, Hydrogen, Nitrogen, Phosphorus, and Sulfur
- What element is unique to proteins?
  - Sulfur
- What element is unique to nucleic acids?
  - Phosphorus

CONCEPT QUESTIONS

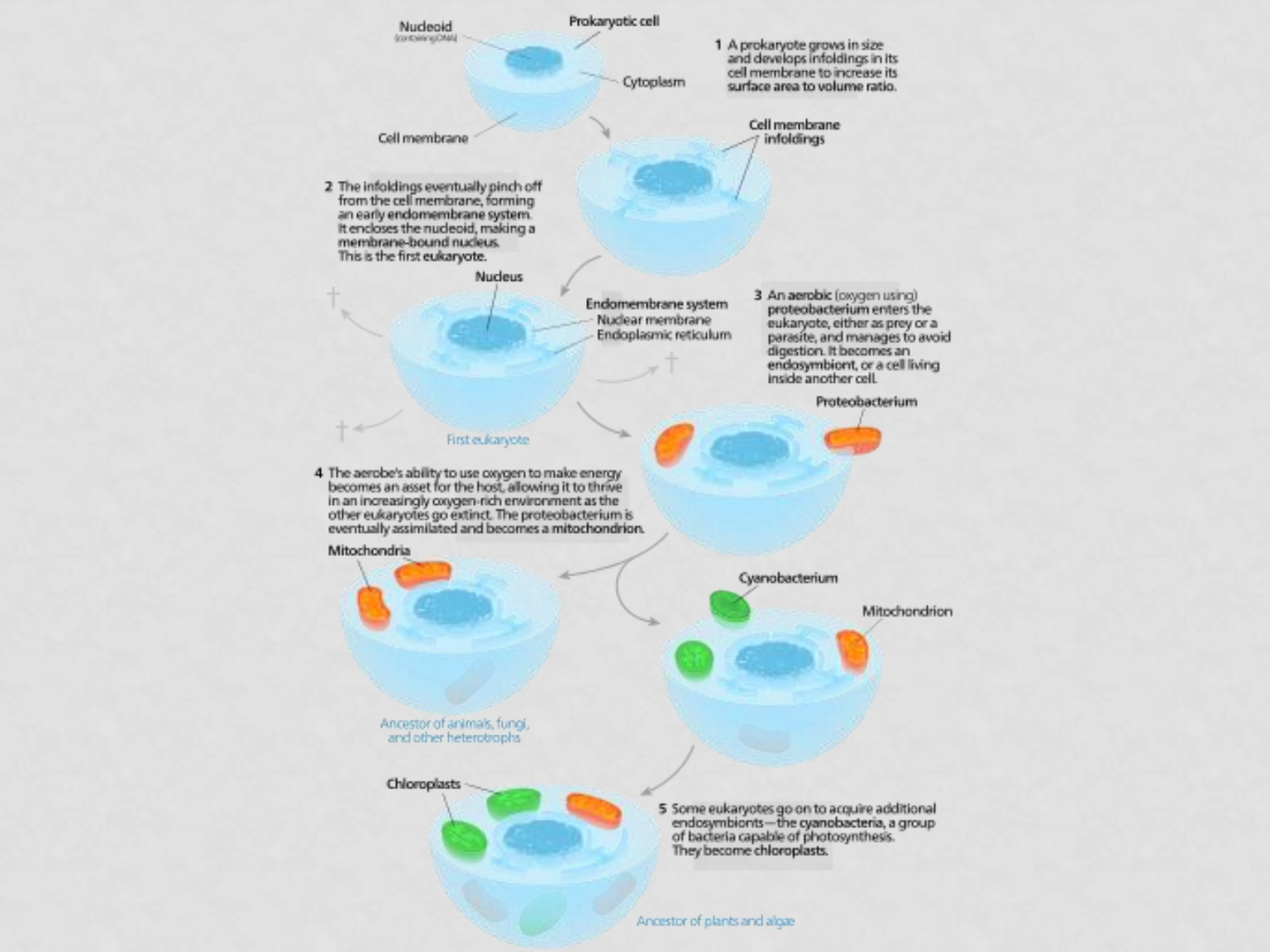
- What are the functions of the four major organic compounds?
  - Proteins: Structure, support, movement, enzymatic activity
  - Lipids: Energy storage, cell membranes
  - Nucleic Acids: Information storage
  - Carbohydrates: Energy

CONCEPT QUESTIONS

- How many different amino acids are in the genetic code to make up a polypeptide?
  - There are 20 amino acids
- What bond holds alpha helix and beta pleated sheet in that secondary shape?
  - Hydrogen bonds
- Would a change in amino acid sequence change the shape of the primary, secondary, tertiary or quaternary protein structure?
  - It would change the primary structure, which could result in changes to the other three structures which build upon it
- What bases pair with which bases in DNA and RNA?
  - A pairs with T or U, and C pairs with G
- Which bases are pyrimidines or purines?
  - Pyrimidine: cytosine, thymine, uracil
  - Purine: adenine, guanine
- What would be the RNA sequence that hybridizes to the DNA sequence AAAGGCT?
  - UUUCCGA
- What was Stanley Miller's experiment and what did it show?
  - He recreated Earth's early atmosphere, which showed that organic molecules, such as amino acids and lipids, could form on their own over time

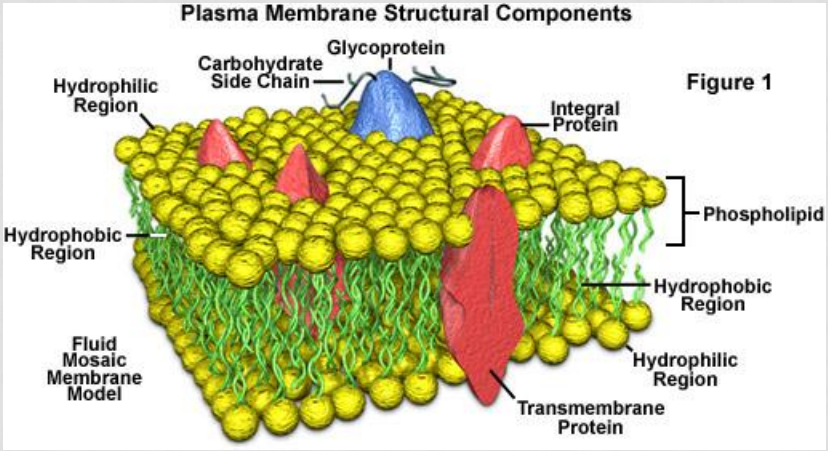
CONCEPT QUESTIONS

- What is the endomembrane system?
  - A system of organelles in eukaryotic cells that make products for use outside the cell
- What happens to a food vacuole as it enters a cell?
  - It meets with a lysosome and its contents are broken down
- What is the flow of information in a cell (hint: start is DNA)?
  - DNA → RNA → Protein
- What are the functions of the parts of the nucleus (nuclear membrane, nuclear pores, and nucleolus)?
  - Nuclear membrane – keeps the nucleus separate from the rest of the cell
  - Nuclear pores – Allow ribosomes and mRNA to enter and exit the nucleus
  - Nucleolus – where ribosomes are made
- What is the endosymbiotic theory for the origin of mitochondria and chloroplasts and what is the evidence for the symbiotic theory of the origin of mitochondria and chloroplasts?
  - Chloroplasts and Mitochondria were once free-living bacteria that were phagocytized and not destroyed, and eventually became part of the cell.
  - Mitochondria and Chloroplast have a two membranes and DNA different than the cell nucleus.


Nucleoid
(containing DNA)
Prokaryotic cell
Cytoplasm
Cell membrane
1 A prokaryote grows in size and develops infoldings in its cell membrane to increase its surface area to volume ratio.
Cell membrane infoldings
2 The infoldings eventually pinch off from the cell membrane, forming an early endomembrane system. It encloses the nucleoid, making a membrane-bound nucleus. This is the first eukaryote.
Nucleus
Endomembrane system
Nuclear membrane
Endoplasmic reticulum
3 An aerobic (oxygen using) proteobacterium enters the eukaryote, either as prey or a parasite, and manages to avoid digestion. It becomes an endosymbiont, or a cell living inside another cell.
Proteobacterium
First eukaryote
4 The aerobe's ability to use oxygen to make energy becomes an asset for the host, allowing it to thrive in an increasingly oxygen-rich environment as the other eukaryotes go extinct. The proteobacterium is eventually assimilated and becomes a mitochondrion.
Mitochondria
Cyanobacterium
Mitochondrion
Ancestor of animals, fungi, and other heterotrophs
Chloroplasts
5 Some eukaryotes go on to acquire additional endosymbionts—the cyanobacteria, a group of bacteria capable of photosynthesis. They become chloroplasts.
Ancestor of plants and algae

CONCEPT QUESTIONS

- What is the fluid mosaic model for cell membranes?
  - Phospholipids and membrane proteins flow (fluid) and membrane proteins are embedded in the membrane (mosaic)
- What is the structure of a membrane (describe and draw it and include hydrophilic and hydrophobic labels, plus phospholipids, integral proteins, peripheral proteins and glycoproteins)?



CONCEPT QUESTIONS

- What are some of the functions of plasma membrane integral proteins?
  - Transport, Recognition, Intercellular Joining, Attachment
- What molecules can pass through a cell membrane without the aid of a protein? What molecules require the aid of a protein?
  - Without Protein: Small nonpolar molecules - lipids
  - With Protein: Small charged particles, polar substances, larger molecules – ions, proteins

CONCEPT QUESTIONS

- How do enzymes lower the energy of activation (or speed up a chemical reaction)?
  - They allow substrates to react with each other faster by straining the reactant's bonds and bringing the reactants closer together.
- Why do enzymes have an optimal pH? Why does pepsin from the stomach act at a lower pH than proteases from the small intestine?
  - pH effects the structure of a protein. Proteins will denature outside the range in which they are designed to work.
- Why do enzymes have an optimal temperature? Why do bacteria from hot springs have a higher optimal temperature than human enzymes?
  - Proteins denature at temperatures outside their optimal range.

CONCEPT QUESTIONS

- How many ATP are made through cellular respiration (from one glucose to CO_2 and H_2O)?
  - 36-38
- How many ATP are made from one NADH?
  - 3
- How many ATP are made from one FADH?
  - 2
- Where is ATP synthase located?
  - In the inner mitochondrial membrane
- Compare where mitochondria and chloroplasts put the H+ ions.
  - They both put them into a small space to better form a concentration gradient (intermembrane space in mitochondria and thylakoid space in chloroplasts)

CONCEPT QUESTIONS

- Why are plants green?
  - The chlorophyll in plants absorbs all spectra of light except green
- Where does oxygen come from in photosynthesis?
  - Water
- Which pigments are responsible for absorbing light energy for the light dependent reactions?
  - Chlorophylls
- Where are the photosynthetic pigments located within the chloroplast?
  - In the thylakoid membrane

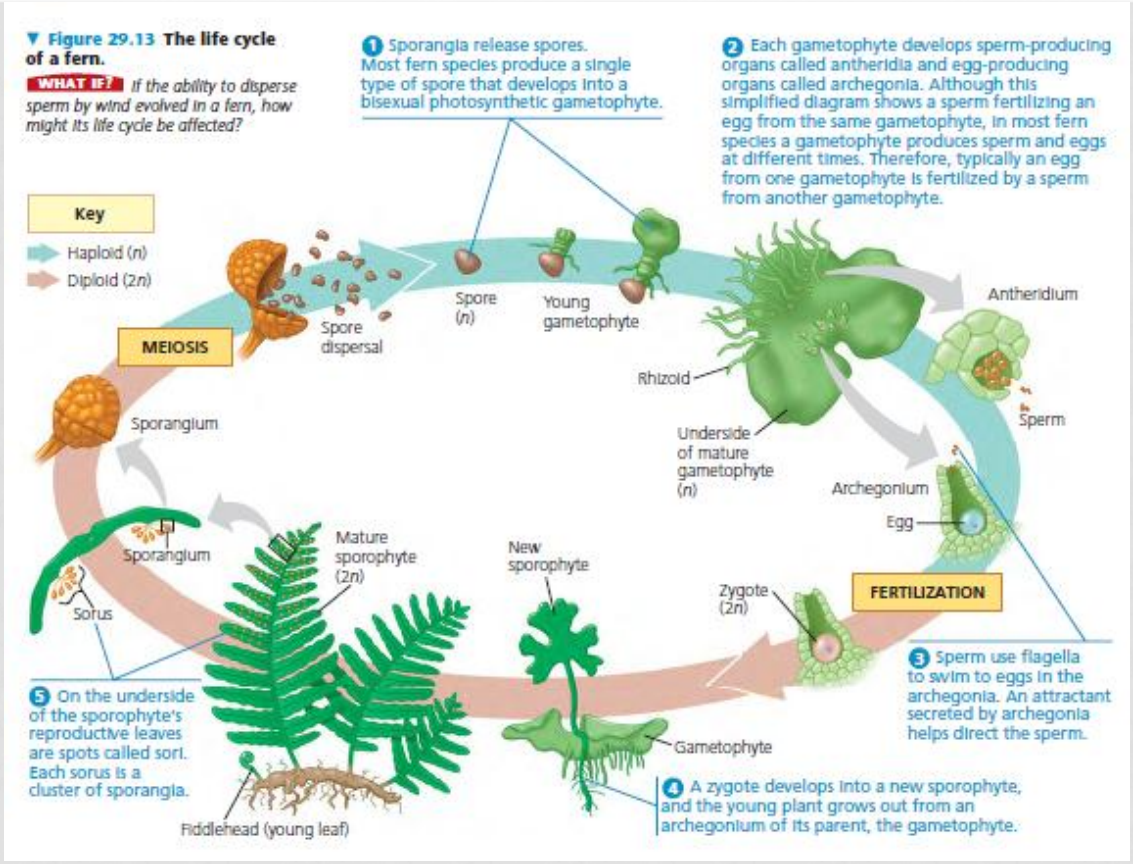
CONCEPT QUESTIONS

- MITOSIS: Be able to identify pictorial/symbolic representations of mitosis.
  - Chromosomes condense during _____Pro_____ phase; chromosomes are located in the equator during _____Meta_____ phase, chromatids separate during _____Ana_____ phase, chromosomes relax during _____Telo_____ phase?
  - Centrioles move to the poles during _____Pro_____ phase of mitosis?
  - The nuclear membrane disassembles during _____Pro_____ phase, and reassembles during _____Telo_____ phase and is absent in-between phases.
  - How do spindle fibers move chromosomes during anaphase?
    - In anaphase, spindle fibers pull sister chromatids toward the spindle poles. Spindle fibers not connected to chromatids lengthen and elongate the cell.
  - Cytokinesis in plants is by _____Forming a cell plate_____ and cytokinesis in animals is by _____Forming a cleavage furrow_____. Centrioles are found in _____Animals_____ but not _____higher level Plants_____?
  - If a cell had 10 chromatids in metaphase of mitosis, how many chromosomes are in each resulting nucleus?
    - 5

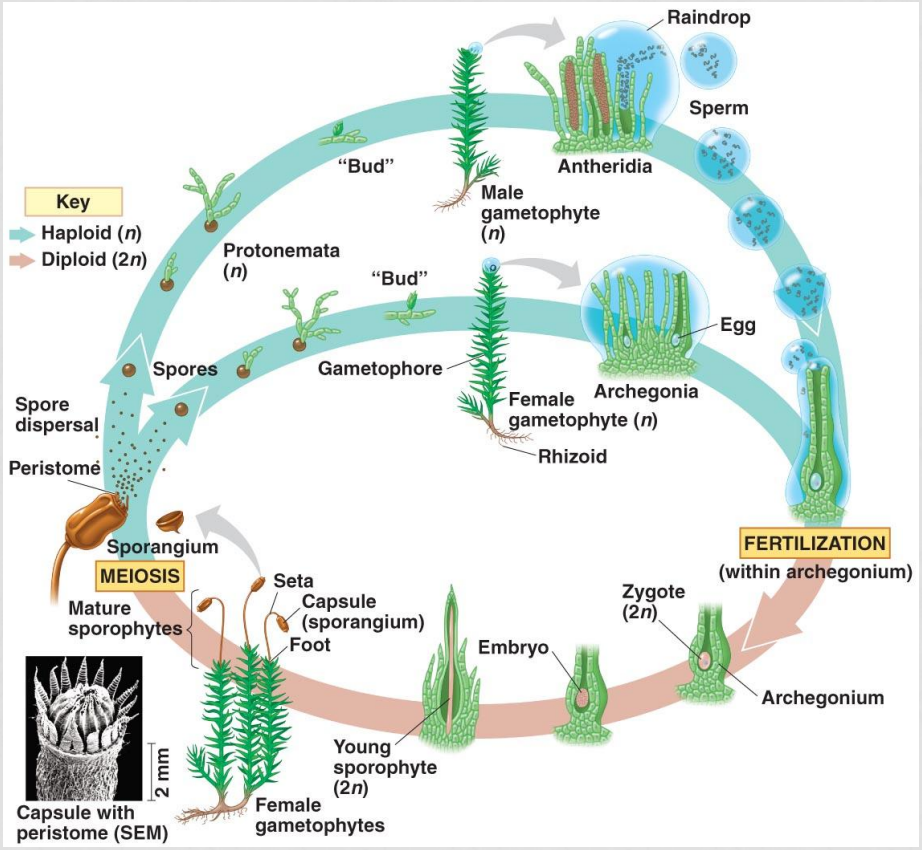
CONCEPT QUESTIONS

- What is the life cycle of animals?
  - Diploid with an extremely reduced haploid stage
- What is the life cycle (alternation of generation) of plants?
  - Alternating haploid and diploid generations, sporophyte and gametophyte
- What are the differences between meiosis and mitosis?
  - Meiosis forms haploid cells, Mitosis forms diploid cells
  - Meiosis involves crossing over and shuffling of genes, mitosis makes two exact replicas
  - Meiosis is a two stage process Meiosis 1 and Meiosis 2.
- What are the similarities between meiosis and mitosis?
  - Both Meiosis and Mitosis go through the four phases; prophase, metaphase, anaphase, and telophase.

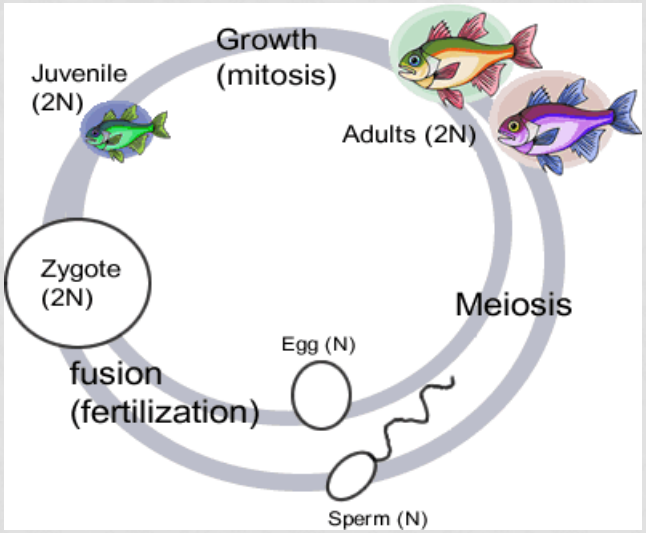
LIFE CYCLE OF A FERN EXAMPLE OF ALTERNATION OF GENERATIONS



LIFE CYCLE OF A MOSS EXAMPLE OF ALTERNATION OF GENERATIONS



LIFE CYCLE OF AN ANIMAL



CONCEPT QUESTIONS

- If there are 100 chromosomes before meiosis, how many are there after meiosis?
  - 50
- If there are 100 chromosomes before mitosis, how many are there after mitosis?
  - 100
- If a cell has two pair of homologous chromosomes before mitosis (after S phase), then how many chromatids does it have?
  - 4
- If a cell has two pair of homologous chromosomes before meiosis (after S phase), then how many chromatids does it have?
  - 4

CONCEPT QUESTIONS

- If two genes have a 5% recombination frequency and another two genes have a 10% frequency, which genes are closer: the 5% or 10%?
  - 5%
- Is protein or DNA the hereditary material?
  - DNA
- What was the Beadle and Tatum definition of a gene?
  - A sequence of DNA that codes for an enzyme
- What is a more comprehensive definition of a gene?
  - A sequence of DNA that codes for any protein or functional RNA (like tRNA or rRNA)

CONCEPT QUESTIONS

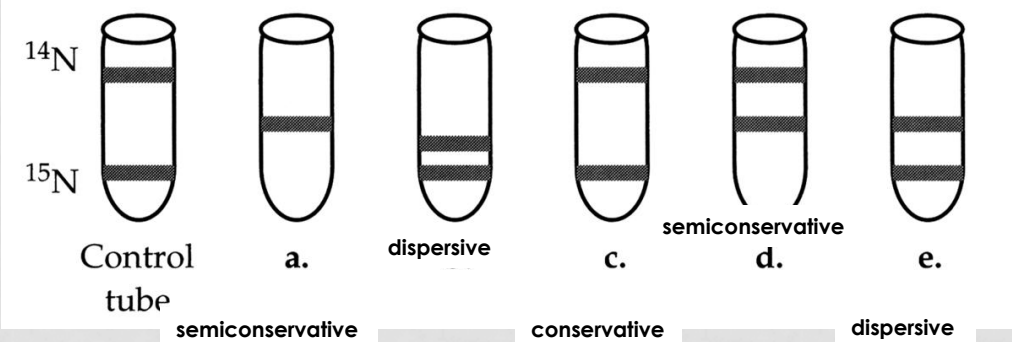
- What was the Avery, McCleod, and McCarty experiment and what did it show?
  - It expanded upon the Griffith experiment by heat-killing the transforming S material and treating it with protease, but it still transformed R cells into S cells, proving that protein was NOT the hereditary material
- What was the Hershey-Chase experiment, what did it show, and what was labeled P^{32} and S^{35}?
  - The Hershey-Chase experiment took a T2 bacteriophage which was composed only of DNA and protein, separately labeled the DNA with P^{32} and the proteins with S^{35} to see which was passed on to bacteria in infection. The radioactive phages were mixed with bacteria and then centrifuged to see where the radioactive particles ended up. In the phages with radioactive proteins, the liquid was radioactive, indication that protein had not passed into the cell. In phages with radioactive DNA, the pellet was radioactive, indicating that the DNA was passed on, and proving that DNA was the hereditary material.

CONCEPT QUESTIONS

- DNA and RNA base pairs
  - Which bases of DNA hydrogen bond to which bases of DNA?
- A pairs with __T__ with __2__ hydrogen bonds.
- G pairs with __C__ with __3__ hydrogen bonds
  - Which bases of DNA hydrogen bond to which bases of RNA?
- A with __U__; T with __A__; G with __C__; C with __G__
  - Which bases of RNA hydrogen bond to which bases of RNA?
- A pairs with __U__ with __2__ hydrogen bonds.
- G pairs with __C__ with __3__ hydrogen bonds
  - If adenine is 40% of the DNA, then what is the percentage of T, C and G?
    - T: 40%
    - C: 10%
    - G: 10%

CONCEPT QUESTIONS

- How did the Messelson-Stahl experiment with N_{14} and N_{15} prove that **DNA replicates semi-conservatively** and **not** conservatively or dispersively?
  - Bacteria that were cultivated in N_{15} and then transferred to N_{14} culture and had their DNA centrifuged after 20 minutes and then 40 minutes to allow one and then two replications. The heavier N_{15} was mixed with the lighter N_{14} instead of separating after the first replication, and after the second, it was separated, showing that neither conservative or dispersive replication occurred.
- What are the expected results from semi-conservative replication, conservative replication and dispersive replication? Be able to identify figures representing semi-conservative, conservative and dispersive replication.



CONCEPT QUESTIONS

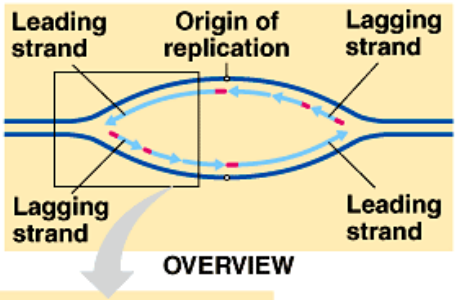
- What are the functions of:
  - Helicase
    - Unzips the double helix
  - Ligase
    - Binds the Okazaki fragments together
  - DNA polymerase
    - Makes new DNA
  - Primase
    - Makes an RNA primer
  - Single Stranded DNA Binding Protein
    - Keeps DNA strands separated until DNA polymerase synthesizes a new strand
  - Gyrase
    - Keeps the DNA form getting too tightly wound

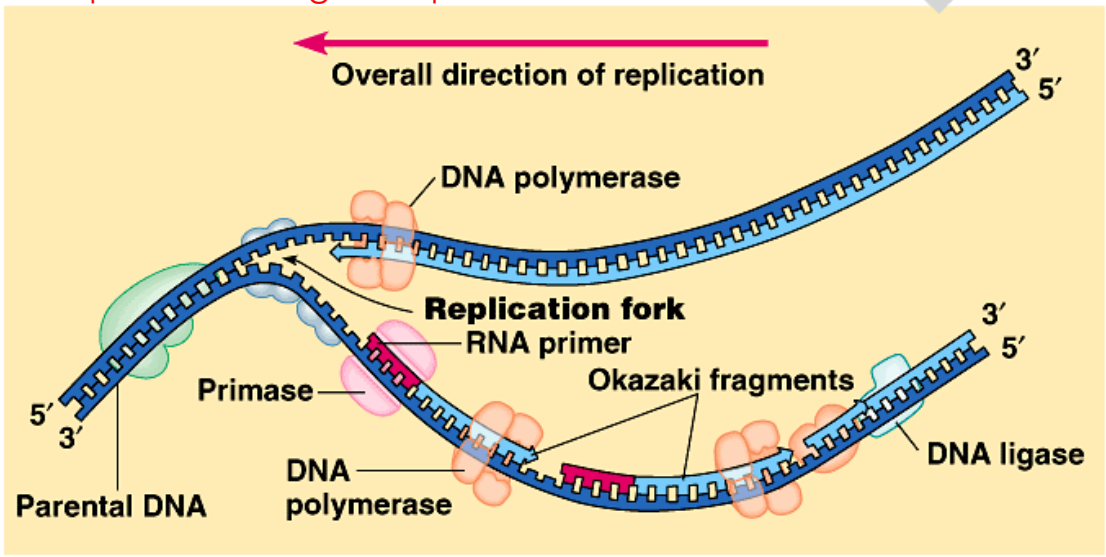
CONCEPT QUESTION

Summarize DNA replication for the leading and lagging strands

Leading Strand: helicase unwinds DNA, primase creates and RNA primer, and DNA polymerase synthesizes continuously

Lagging Strand: helicase unwinds DNA, primase creates an RNA primer, DNA polymerase is synthesized discontinuously, with RNA polymerase making new primers. DNA polymerase removes the RNA primers and ligase replaces them with DNA





CONCEPT QUESTIONS

- How does the telomerase solve the problem of replicating linear DNA?
  - It elongates the ends of DNA with "junk" nucleotides in order to not lose information when DNA is copied
- What would happen to DNA if the DNA telomerase did not function?
  - DNA would continue to get shorter and shorter and would lose genes from the ends, leading to mutations
- What are the main steps of initiation, elongation, and termination of protein synthesis (translation)? Where does the release factor bind?
  - Anticodon on tRNA binds to codon on mRNA
  - Ribosome forms a covalent (peptide) bond between amino acids in P site and A site
  - Ribosome moves down the mRNA 3 codons, continues until it reaches stop codon, release factor binds to A site and stop codon
- What are the main steps of initiation, elongation, and termination of RNA synthesis (transcription)?
  - At the promoter sequence, transcription factors help RNA polymerase bind to DNA
  - RNA polymerase unwinds DNA and copies as it moves along the strand
  - At the terminator, RNA polymerase detaches from DNA and the new mRNA detaches from it
- What are the three steps of processing eukaryotic mRNA to the mature form (any order)?
  - Introns are removed and exons are spliced together, 5' cap and poly A tail are added,

CONCEPT QUESTIONS

- How many nucleotides would be necessary to code for one amino acid?
  - 3
- How many nucleotides would be necessary to code for a polypeptide that is 500 amino acids long?
  - 1500
- If the genetic code were only two nucleotides long and comprised four different nucleotides (A, G, C, U) how many amino acids could be coded for precisely?
  - 16
- How does the signal peptide and signal recognition particle help target proteins to the RER?
  - Signal peptide at the end of mRNA binds to signal recognition particle, which binds to ribosome on the RER

FILL IN THE BLANKS

	Examples (where relevant use plant and animal examples)	Define
Atom		
Molecule		
Organelle		
Cell		
Tissue		
Organ		
Organism		
Population		
Community		
Ecosystem		
Biosphere		

FILL IN THE BLANKS

	Examples (where relevant use plant and animal examples)	Define
Atom	Oxygen, Hydrogen, Nitrogen	Smallest unit of matter
Molecule	Water (H_20) Carbon Dioxide ($C0_2$)	Two or more atoms held together by covalent bond(s)
Organelle	Mitochondria, chloroplast	a membrane bound structure; like nucleus, mitochondria, or chloroplast
Cell	animal cell, plant cell	Basic or smallest unit of life
Tissue	skin or heart muscle tissue	A group of cells with one function
Organ	heart	A group of tissues with one function.
Organism	a single person, a single Zebra	a single organism
Population	number of Zebras in a certain area	Organisms of one species in an area.
Community	All the animals and plants in a forest	all populations of all species in one particular area
Ecosystem	The Ocean, Artic, or Desert Ecosystem	all biotic (living) and abiotic (non-living) factors that interact with the biotic in an area.
Biosphere	The Earth or maybe northern and southern hemisphere	all ecosystems on earth or global ecosystem

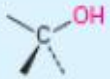
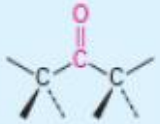
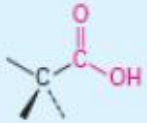
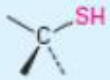
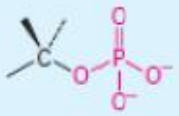
FUNCTIONAL GROUPS

	Formula	Example(s)
Hydroxyl		
Carbonyl - aldehyde		
Carbonyl - ketone		
Carboxyl		
Amino		
Sulfhydryl		
Phosphate		

FUNCTIONAL GROUPS

	Formula	Example(s)
Hydroxyl	**OH**	**Alcohols**
Carbonyl	**C=O (at the end of a molecule)**	**Aldehyde**
Carbonyl	**C=O (in the middle of a molecule)**	**Ketone**
Carboxyl	**COOH**	**Carboxylic Acids**
Amino	**NH2**	**Amines**
Sulfhydryl	**SH**	**Thiols**
Phosphate	**PO4**	**Organic Phosphates**

FUNCTIONAL GROUPS

Name	Structure*	Name ending	Example
Alcohol		*-ol*	CH_3OH Methanol
Aldehyde		*-al*	CH_3CH Ethanal
Ketone		*-one*	CH_3CCH_3 Propanone
Carboxylic acid		-oic acid	CH_3COH Ethanoic acid
Amine		*-amine*	CH_3NH_2 Methylamine
Thiol		*-thiol*	CH_3SH Methanethiol
Monophosphate		*phosphate*	$CH_3OPO_3^{2-}$ Methyl phosphate

BIOLOGICAL MOLECULES

Major Organic molecule category	Elements	Subunits or monomers	Examples	Larger molecule assembled by what process?
Protein				
Lipid				
Nucleic acid (DNA and RNA)				
Carbohydrate				

BIOLOGICAL MOLECULES

Major Organic molecule category	Elements	Subunits or monomers	Examples	Larger molecule assembled by what process?
Protein	CHONS	Amino Acids	Muscle, Enzyme	Dehydration Synthesis
Lipid	CHO	Fatty Acids/ Triglycerides	Butter, Fat	Dehydration Synthesis
Nucleic acid (DNA and RNA)	CHONP	Nucleotides	DNA, RNA	Dehydration Synthesis
Carbohydrate	CHO	Monosaccharides (simple sugars)	Glucose, Sucrose, Starch	Dehydration Syntheses

CELL PARTS

	Function	In prokaryote only, eukaryote only, or both	If in eukaryote, in plant only, animal only or both
Nucleoid			
Nucleus			
Mitochondria			
Chloroplast (also called plastid)			
RER			
SER			
Golgi Apparatus			
Lysosome			
Central Vacuole			
Cilia, Flagella			
Plasma membrane			
Cell Wall			
Cytoplasm			
Cytoskeleton			

CELL PARTS

	Function	In prokaryote only, eukaryote only, or both	If in eukaryote, in plant only, animal only or both
Nucleoid	a proto-nucleus in prokaryotes, a cluster of dna in the cell	prokayote	
Nucleus	a membrane bound organelle that contains genetic info	eukaryote	**both**
Mitochondria	a memebrane bound organelle that produces ATP	eukaryote	**both**
Chloroplast (also called plastid)	a membrane bound organelle that does photosynthesis and makes glucose	eukaryote	**plants**
RER	makes proteins for export	eukaryote	**both**
SER	makes lipids and non-protein products for export	Eukaryote	**both**
Golgi Apparatus	packages proteins for transport out of the cell	eukaryote	**both**
Lysosome	vesicle containing digestive enzymes	eukaryote	**animal**
Central Vacuole	fills with water to create turgor pressure	eukaryote	**plant**
Cilia, Flagella	movement	eukaryote	**animal**
Plasma membrane	holds the cell together, separates inside form outside	both	**both**
Cell Wall	adds support and protection to the cell	both	**plant**
Cytoplasm	the fluid and everything held in it inside a cell	both	**both**
Cytoskeleton	support and transport within a cell	eukaryote	**both**
Free ribosomes	make proteins for use inside the cell	both	**both**

FILL IN THE BLANK

	High to low or low to high concentration	Requires a protein (yes or no)	Requires added energy (yes or no)
Diffusion			
Facilitated transport = facilitated diffusion			
Active transport			

FILL IN THE BLANK

	High to low or low to high concentration	Requires a protein (yes or no)	Requires added energy (yes or no)
Diffusion	High to Low	No	**No**
Facilitated transport = facilitated diffusion	High to Low	Yes	**No**
Active transport	**Low to High**	**Yes**	**Yes**

FILL IN THE BLANK

	Red Blood Cell	Plant cell
Hypertonic		
Isotonic		
Hypotonic		

FILL IN THE BLANK

	Red Blood Cell	**Plant cell**
Hypertonic	Crenation	**Plasmolysis**
Isotonic	Nothing	**Nothing**
Hypotonic	**Hydrolysis**	**Turgor Pressure**

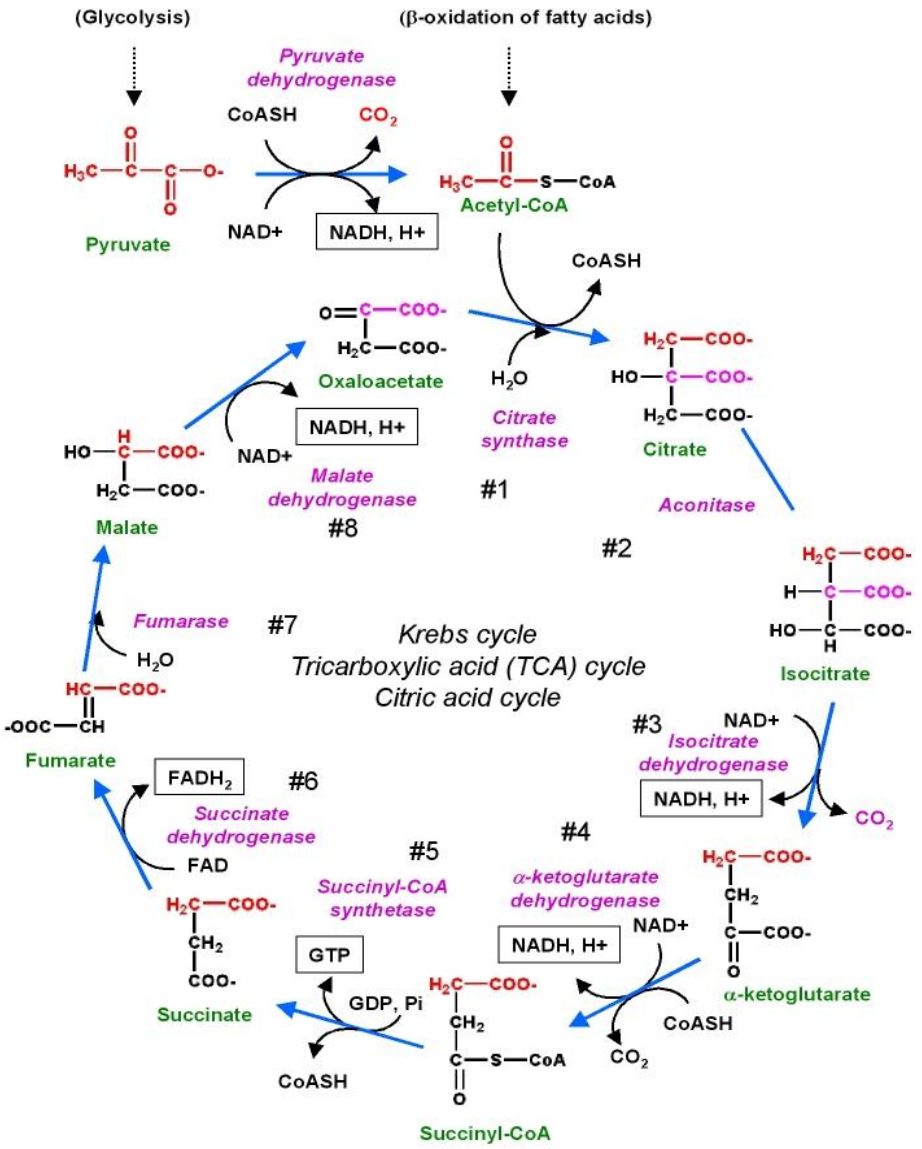
FILL IN THE BLANK

	CO_2 per glucose	Oxygen consumed (yes/no)	Oxygen required (yes/no)	Initial step	Final step	Where proteins located
Glycolysis						
Transition Step						
Krebs cycle						
Electron Transport						
Oxidative phosphorylation (ATP synthase)						

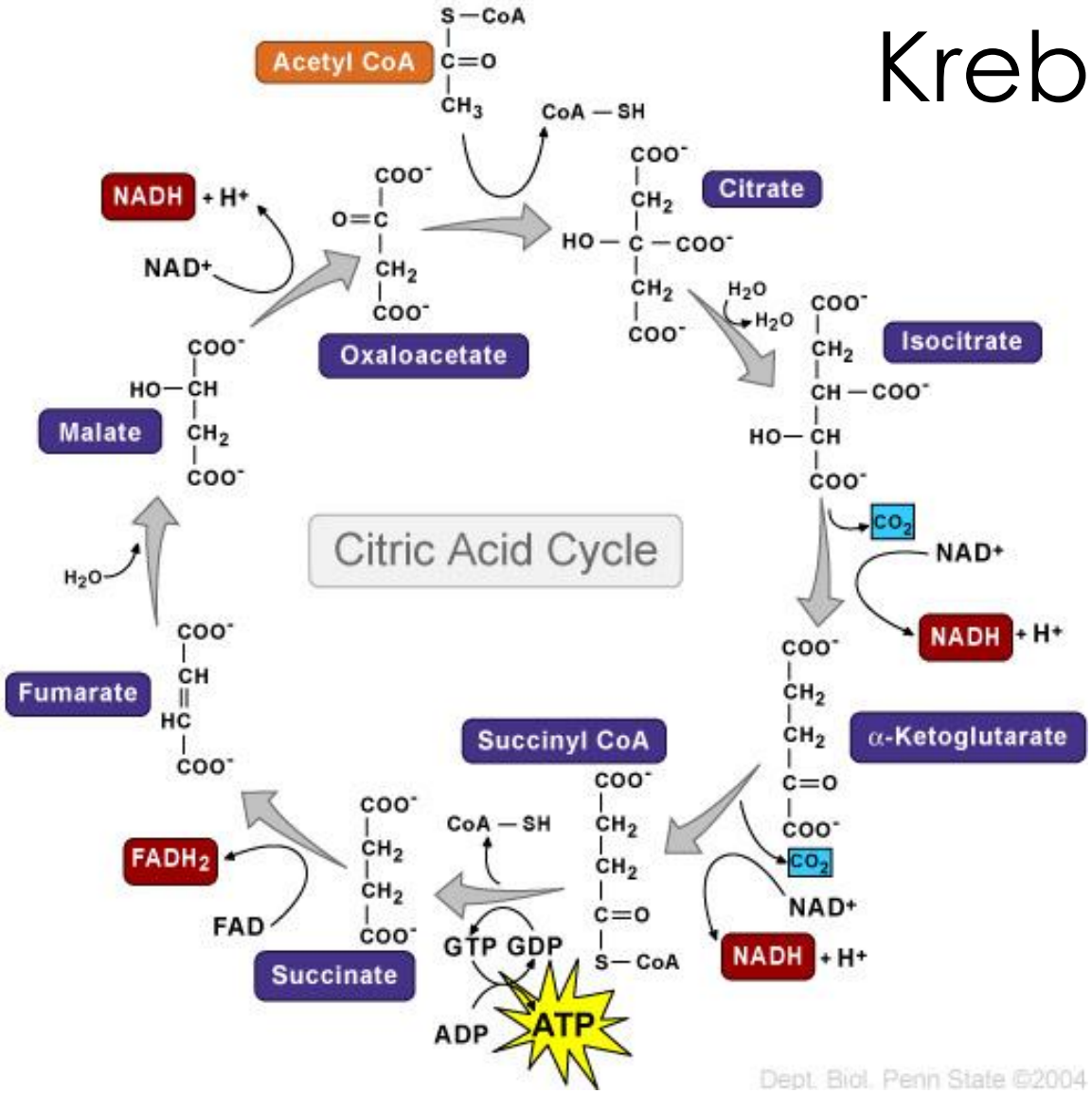
FILL IN THE BLANK

	CO2 per glucose	Oxygen consumed (yes/no)	Oxygen required (yes/no)	Initial step	Final step	Where proteins located
Glycolysis	0	no	no	Glucose 2 ATP	2 Pyruvate 4 ATP 2 NADH	**Cytoplasm**
Transition Step	2	no	yes	2 Pyruvate	2 Acetyl CoA 2 NADH	**Cytoplasm**
Krebs cycle	4	no	no	2 Acetyl CoA 2 Oxaloacetate	6 NADH 2 FADH2 2 ATP	**Mitochondrial Matrix**
Electron Transport	0	yes	yes	10 NADH 2 FADH	34 ATP	**Inner Mitochondrial Membrane**
Oxidative phosphorylation (ATP synthase)	**6**	**yes**	**yes**	**Glucose**	**36-38 ATP**	**Cytoplasm/ Mitochondria**

Krebs Cycle


(Glycolysis)
(β-oxidation of fatty acids)
Pyruvate dehydrogenase
CoASH
CO_2
Pyruvate
NAD+
NADH, H+
Acetyl-CoA
CoASH
Oxaloacetate
H_2O
Citrate synthase
Citrate
NADH, H+
NAD+
Malate dehydrogenase
#1
Malate
#8
Aconitase
#2
Isocitrate
Fumarase
#7
H_2O
Krebs cycle
Tricarboxylic acid (TCA) cycle
Citric acid cycle
Fumarate
#3
NAD+
Isocitrate dehydrogenase
NADH, H+
CO_2
$FADH_2$
#6
Succinate dehydrogenase
FAD
#4
#5
Succinyl-CoA synthetase
α-ketoglutarate dehydrogenase
NADH, H+
NAD+
GTP
GDP, Pi
CoASH
Succinate
α-ketoglutarate
CoASH
CO_2
Succinyl-CoA

Krebs Cycle


Acetyl CoA
CoA — SH
Citrate
Isocitrate
α-Ketoglutarate
Succinyl CoA
Succinate
Fumarate
Malate
Oxaloacetate
NADH + H+
NAD+
FADH2
FAD
GTP GDP
ADP
ATP
CO2
H2O
Citric Acid Cycle
Dept. Biol. Penn State ©2004

FILL IN THE BLANK

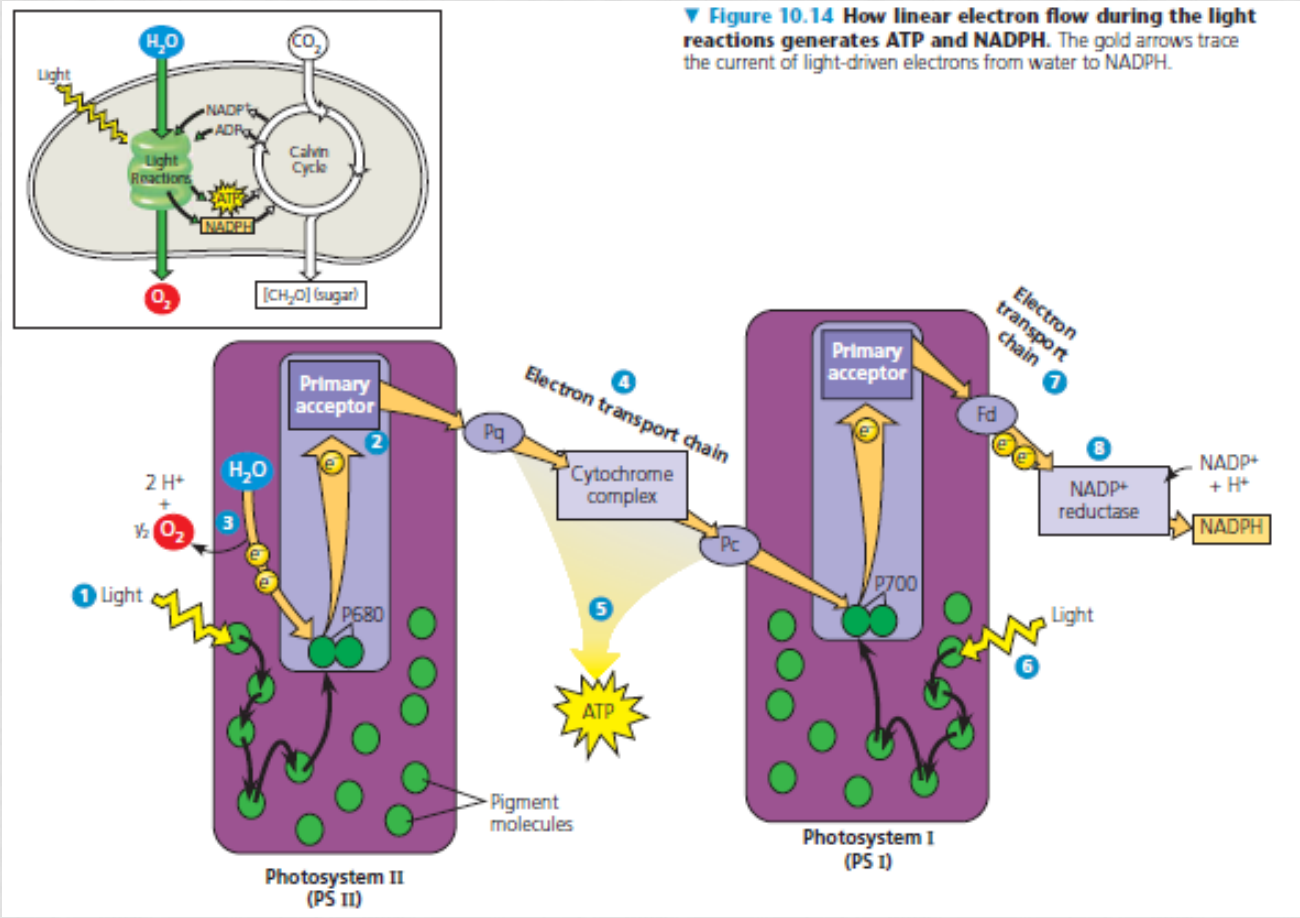
- Know the key steps (organic molecules) of the Calvin-Benson cycle, especially initial steps and final steps. Which molecule forms glucose?
  - Carbon Dioxide
- What are the differences between **"light dependent reactions" of photosynthesis** and **Calvin Cycle or "light independent reactions**" of photosynthesis? [Quick summary table]

Process	Location	Reactants	Products
Light dependent reactions			
Light Independent reactions or Calvin Cycle			

FILL IN THE BLANK

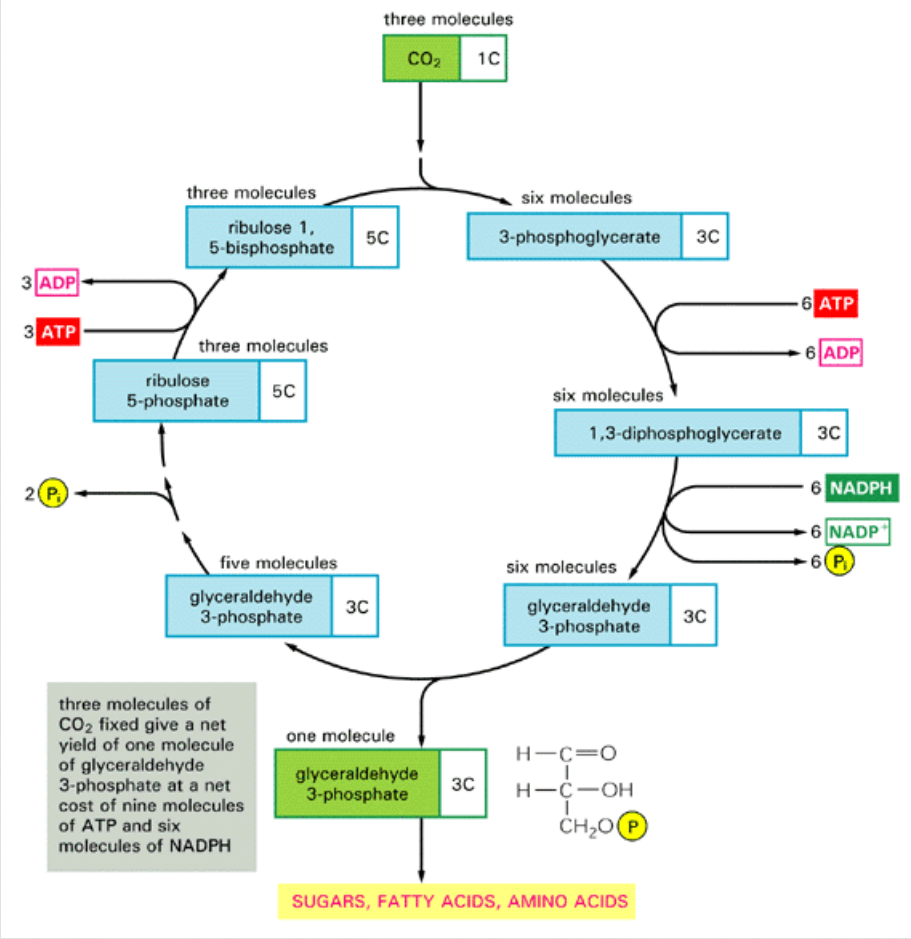
Process	Location	Reactants	Products
Light dependent reactions	Thylakoid Membrane	Water	Oxygen
Light Independent reactions or Calvin Cycle	Stroma	Carbon Dioxide	Glucose

Light Dependent Reactions



▼ **Figure 10.14 How linear electron flow during the light reactions generates ATP and NADPH.** The gold arrows trace the current of light-driven electrons from water to NADPH.

Calvin Cycle



PUNNETT SQUARES

	P	p
P		
p		

PUNNETT SQUARES

	P	p
P	PP	Pp
p	Pp	pp

PUNNETT SQUARES

	I^A	I^B
i		
i		

PUNNETT SQUARES

	I^A	I^B
i	I^Ai	I^Bi
i	I^Ai	I^Bi

Dihybrid Cross:

a cross that shows the possible offspring for <u>two</u> traits

Fur Color:
B: Black
b: White

Coat Texture:
R: Rough
r: Smooth

In this example, we will cross a heterozygous individual with another heterozygous individual. Their genotypes will be:

BbRr x BbRr

DIHYBRID CROSS

BbRr x BbRr

First, you must find ALL possible gametes that can be made from each parent.

Remember, each gamete must have one B and one R.

DIHYBRID CROSS

BbRr x BbRr

Possible gametes:

BR
Br
bR
br

Next, arrange all possible gametes for one parent along the top of your Punnett Square, and all possible gametes for the other parent down the side of your Punnett Square…

DIHYBRID CROSSES:

A CROSS THAT SHOWS THE POSSIBLE OFFSPRING FOR TWO TRAITS

BbRr x BbRr

Fur Color:
- B: Black
- b: White

Coat Texture:
- R: Rough
- r: Smooth

Then, find the possible genotypes of the offspring

	BR	Br	bR	br
BR				
Br				
bR				
br				

DIHYBRID CROSSES:

A CROSS THAT SHOWS THE POSSIBLE OFFSPRING FOR TWO TRAITS

BbRr x BbRr

Fur Color:
- B: Black
- b: White

Coat Texture:
- R: Rough
- r: Smooth

	BR	Br	bR	br
BR	BBRR	BBRr	BbRR	BbRr
Br	BBRr	BBrr	BbRr	Bbrr
bR	BbRR	BbRr	bbRR	bbRr
br	BbRr	Bbrr	bbRr	bbrr

How many of the offspring would have a black, rough coat?

How many of the offspring would have a black, smooth coat?

How many of the offspring would have a white, rough coat?

How many of the offspring would have a white, smooth coat?

	BR	Br	bR	br
BR	BBRR	BBRr	BbRR	BbRr
Br	BBRr	BBrr	BbRr	Bbrr
bR	BbRR	BbRr	bbRR	bbRr
br	BbRr	Bbrr	bbRr	bbrr

Fur Color:
B: Black
b: White

Coat Texture:
R: Rough
r: Smooth

How many of the offspring would have black, rough coat?

How many of the offspring would have a black, smooth coat?

How many of the offspring would have a white, rough coat?

How many of the offspring would have a white, smooth coat?

	BR	Br	bR	br
BR	BBRR	BBRr	BbRR	BbRr
Br	BBRr	BBrr	BbRr	Bbrr
bR	BbRR	BbRr	bbRR	bbRr
br	BbRr	Bbrr	bbRr	bbrr

Phenotypic Ratio

9:3:3:1

Fur Color:
B: Black
b: White

Coat Texture:
R: Rough
r: Smooth

FILL IN THE BLANK

PROBLEM	SOLUTION
DNA Polymerase makes DNA only in the 5' to 3', but DNA is anti-parallel	
Okasaki Fragments must be joined together to make longer pieces of DNA	
DNA polymerase cannot add the FIRST base	
RNA doesn't belong in DNA	
How to break open hydrogen bonds of DNA to open the strands of DNA (helix)?	
How to keep the DNA that has been opened from re-hybridizing	

FILL IN THE BLANK

PROBLEM	SOLUTION
DNA Polymerase makes DNA only in the 5' to 3', but DNA is anti-parallel	Synthesize one strand continuously and the other discontinuously
Okasaki Fragments must be joined together to make longer pieces of DNA	Ligase joins Okazaki fragments together
DNA polymerase cannot add the FIRST base	RNA polymerase (Primase) makes an RNA primer
RNA doesn't belong in DNA	DNA Polymerase removes the RNA primer and Ligase inserts DNA
How to break open hydrogen bonds of DNA to open the strands of DNA (helix)?	Helicase "unzips" DNA
How to keep the DNA that has been opened from re-hybridizing	Single Stranded DNA Binding Proteins

DAYTONA STATE COLLEGE

Questions

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http://www.daytonastate.edu/asc/ascsciencehandouts.html