

AP Biology End of the Year Review: Separated by Unit

Unit I: Chemistry of Life

Chemistry

1. Draw and describe the following types of bonds:
 - a. Ionic
 - b. Covalent (polar and non-polar covalent)
 - c. Hydrogen
2. Give an example of a compound/molecule that displays each type of bond listed above.

Water

3. List five properties of water. Define each property. Explain how each property is advantageous for a particular organism. Be specific in your examples.

Organic Molecules

4. What is an organic molecule?
5. What is the difference between a monomer and a polymer?
6. What are functional groups? List the functional groups studied in class. Draw a picture of each type of functional group. Provide an example of a molecule in which each functional group can be found.

Carbohydrates

7. Draw a monosaccharide (the monomer of all carbohydrates).
8. What is the difference between alpha glucose and beta glucose?
9. What is the formula for glucose?
10. Draw and give the function for the following carbohydrates.
 - a. Sucrose
 - b. Starch
 - c. Cellulose
 - d. Glycogen
 - e. Chitin (You don't have to draw this one)
11. In what types of foods do you find carbohydrates?
12. Which indicator tests for a monosaccharide? Polysaccharide? What colors will they turn?

Lipids

13. Draw the three types of fatty acid chains and a glycerol backbone (the monomers of most lipids).
14. Draw and give the function for the following lipids.
 - a. Triglycerides (fats...saturated and unsaturated)
 - b. Phospholipids
 - c. Steroids (cholesterol and sex hormones)

Proteins

15. Draw an amino acid (the monomer of a protein).
16. Give the five major groups of proteins and one example of how each group is used in the body.
17. How are amino acids joined together?
18. Draw and describe the following protein structures.
 - a. Primary
 - b. Secondary (alpha helix and beta pleated) (fibrous)

- c. Tertiary (globular) Give the three types of bonds that help form the tertiary structure and explain the hydrophobic effect.
- d. Quaternary structure

Nucleic Acids

- 16. Draw a nucleotide (the monomer of nucleic acids).
- 17. Give the five types of nitrogen bases and identify them as purines or pyrimidines. (Agriculture is pure...)
- 18. Draw a molecule of RNA and one of DNA and give the basic functions of each.

Enzymes

- 19. Enzymes are globular, quaternary structured proteins. What is the main function of an enzyme?
- 20. What is activation energy and how do enzymes affect the activation energy in a reaction?
- 21. What is the difference between catabolism and anabolism? Together, these reactions are referred to as metabolism.
- 22. Draw a picture of an enzyme catalyzed reaction and label the following.
 - a. Substrate, active site, enzyme, enzyme-substrate complex, products
 - b. Why do enzymes follow the so-called lock and key model or induced fit model?
- 23. Give an example of three enzymes and their substrates. How do you know which one is the enzyme, if only given the names?
- 24. How can improper pH and/or temperature affect enzyme function?
- 25. Give an example of a coenzyme and a cofactor and describe how each works.
- 26. Enzyme Activators: Explain how allosteric activators and cooperativity allow enzymes to function. Draw an example of each.
- 27. Enzyme Inhibitors: Explain how competitive, noncompetitive and allosteric inhibitors work and draw an example of how each works.
- 28. Describe the concept of negative feedback with regards to enzyme function.

Unit II: The Cell

Cell Classification

- 1. What is the difference between a prokaryote and a eukaryote?
- 2. Give examples of each.
- 3. Give four differences between plant and animal cells.

Cell Membrane Structure

- 4. Draw a section of the plasma membrane and label the following...Beside each label, provide the function of each structure
 - a. Phospholipids
 - b. Hydrophilic heads
 - c. Hydrophobic tails
 - d. Cholesterol
 - e. Integral and transmembrane proteins: channel, transport, electron transport (see chemiosmosis)
 - f. Peripheral proteins: recognition, receptor, and adhesion

Cell organelles

5. Cut and paste a picture of the plant and the animal cell and beside each label listed below, provide the functions of the organelles. You may need to draw some in.
 - a. Nucleus
 - b. Ribosomes,
 - c. Rough ER
 - d. Smooth ER
 - e. Golgi body
 - f. Vesicles
 - g. Mitochondria
 - h. Chloroplasts
 - i. Lysosomes
 - j. Centrioles
 - k. Vacuoles
 - l. Flagella
 - m. Cilia
 - n. Cell Wall
6. Cut and paste your drawings of the cell functions and give examples of cells that display each type of junction.
7. Draw the following components of a cell's cytoskeleton: microtubules, intermediate filaments, and microfilaments

Cell Membrane Function

8. What does it mean that the cell membrane is selectively permeable?
9. Create a chart comparing the following processes: diffusion, osmosis, facilitated diffusion, and active transport.
Include the following in your chart:
 - a. passive or active
 - b. with or against the gradient
 - c. proteins or no proteins involved
 - d. if proteins are involved, what type
 - e. substances moved by each process
10. Draw a cell in a hypertonic, hypotonic, and isotonic solution
11. Describe the process of plasmolysis
12. Vesicular transport: Draw the processes of exocytosis, endocytosis (phagocytosis and pinocytosis)

Unit III: Cellular Energetics

Cell Respiration

1. Give the formula
2. All organisms undergo glycolysis in their cytoplasm. What is glycolysis?
3. All eukaryotes undergo chemiosmosis in their mitochondria. Why don't prokaryotes?
4. Describe the basic structure of ATP and describe the energy cycle between ADP and ATP.

Glycolysis

5. Glucose is broken down into _____.
6. How many ATP's are invested? What is the net yield of ATP?
7. How many NADH are produced?
8. Where does this occur?

Kreb's Cycle (aka Citric Acid Cycle)

9. What are the 2 pyruvates converted into before they can enter the citric acid cycle?
10. What is released in the process?
11. How many ATP's are released?
12. How many NADH's? Where do they go?
13. How many FADH₂'s? Where do they go?
14. In animal respiration, what happens to the CO₂ that is released?
15. Where does this occur?

Electron Transport Chain

16. Why is this process called chemiosmosis or oxidative phosphorylation?
17. What do the NADH and the FADH₂ do for this process?
18. Describe the ETC in five steps. Be sure to include NADH, FADH₂, cytochrome carrier proteins, H⁺ ions, concentration gradient, pump, ATP synthase, ADP, ATP, oxygen as the final electron acceptor.
19. What is produced when oxygen accepts the final electrons?
20. How many ATP's are produced?
21. Where does this occur?

Anaerobic Respiration

22. What happens if no oxygen is present in the cell after glycolysis?
23. What is the difference between anaerobic respiration in animals vs. anaerobic respiration in plants, yeast, and bacteria?
24. What is another name for anaerobic respiration?

Photosynthesis

25. Give the equation for photosynthesis.
26. What types of organisms undergo photosynthesis?
27. What is the purpose of photosynthesis?

Light Reaction (aka Noncyclic photophosphorylation)

28. Provide a flowchart for the steps of the light reaction. It might be nice to draw the steps too. Include the following terms:
 - a. photosystem II (P680)
 - b. photolysis
 - c. primary electron acceptor
 - d. electron transport chain
 - e. ADP-ATP
 - f. Photosystem I (P700)
 - g. Primary electron acceptor
 - h. Electron transport chain
 - i. NADP-NADPH
29. Where do all of these steps occur?
30. What is cyclic photophosphorylation?

Dark Reaction (aka Calvin Cycle)

31. Provide a flowchart for the steps of the Calvin cycle. It might be nice to draw the steps too. Include the following terms:
 - a. Carbon fixation
 - b. Rubisco
 - c. CO₂
 - d. RuBP
 - e. PGA (3C)
 - f. Glucose (6C)
32. Where does this process take place?

C4 and CAM Photosynthesis

33. What happens when there is not enough carbon dioxide entering the leaf?
34. C₄ Photosynthesis: A 2 step process where carbon is fixed in two different cells
Draw a flowchart for C₄ photosynthesis and include the following:
 - Mesophyll cells
 - PEP Carboxylase
 - 4C "storage" compounds (oxaloacetate)
 - Bundle sheath cells
 - Rubisco
 - Calvin Cycle
35. Which plants undergo C₄ photosynthesis?
36. CAM Photosynthesis: A 2 step process where carbon is fixed at different times of the day. Draw a flowchart for CAM photosynthesis and include the following:
 - a. Stomates open
 - b. Night
 - c. Carbon "storage" compound
 - d. Day
 - e. Stomates closed
 - f. Calvin Cycle
 - g. CO₂
37. Which plants undergo CAM photosynthesis?

Unit IV: Cell Division and Genetics

Cell Cycle

1. Name the four functions of cell division (mitosis)
2. Which cells divide by mitosis?
3. Distinguish between the following terms and name the phase of the cell cycle in which you would find these structures.
 - a. Chromosomes
 - b. Chromatids
 - c. Centromere
 - d. Complementary strands
4. What happens during G₁, S, G₂, and G₀ of interphase?
5. Name the major events of prophase, metaphase, anaphase and telophase.
6. How is cytokinesis different in animal cells and plant cells?
7. How are the following involved in cell division...
 - a. Surface to volume ratio
 - b. Density dependent inhibition

- c. Checkpoints

Meiosis

8. Which cells divide by meiosis?
9. Meiosis I: List the phases of meiosis I and include the following terms as you describe the phases.
 - a. Reduction division
 - b. Homologous chromosomes
 - c. Diploid
 - d. $2n$
 - e. Crossing Over
 - f. Tetrad
 - g. Synapsis
 - h. Independent assortment
10. Meiosis II: List the phases of meiosis II and include the following terms as you describe the phases.
 - a. Haploid
 - b. n
 - c. Sister chromatids
11. Which process produces genetic variation and recombination, mitosis or meiosis?

Heredity

12. Define or describe the following Mendelian inheritance terms. Draw, or include a sample punnett square problem, for each of these terms.
 - a. Locus
 - b. Gene
 - c. Allele
 - d. Homologous pairs
 - e. Dominant
 - f. Recessive
 - g. Phenotype
 - h. Genotype
 - i. Homozygous
 - j. Heterozygous
 - k. Monohybrid cross
 - l. Dihybrid cross
 - m. P, F₁, F₂ generations
 - n. Test cross
13. Describe the following rules and laws of Mendel's and give examples of each.
 - a. Unit Factors
 - b. Dominance
 - c. Segregation
 - d. Independent Assortment
14. Define or describe the following non-Mendelian Inheritance patterns. Draw, or include a sample punnett square problem, for each of these terms.
 - a. Incomplete dominance
 - b. Codominance
 - c. Multiple alleles
 - d. Epistasis

- e. Pleiotropy
- f. Polygenic inheritance
- g. Linkage
- h. Sex-linked
- i. X inactivation
- j. Non-disjunction
- k. Deletion
- l. Duplication
- m. Translocation
- n. Inversion

Unit V. Molecular Genetics and Biotechnology

DNA Replication

1. Describe the steps for DNA Replication by creating a flowchart. Use the following terms in your description.
 - a. Semiconservative replication
 - b. Template strand
 - c. DNA polymerase
 - d. Leading strand
 - e. Lagging strand
 - f. Helicase
 - g. Replication fork
 - h. Single stranded binding proteins
 - i. DNA ligase
 - j. Okazaki fragments
 - k. RNA primase
 - l. RNA primer
 - m. 3' and 5' ends
2. Where in the cell does replication occur?
3. Draw examples of the following types of gene mutations
 - a. Point (aka substitution)
 - b. Frameshift (insertion and deletion)

Protein Synthesis

4. Describe the experiment that led to the one-gene-one-enzyme hypothesis (one-gene-one-polypeptide)
5. Describe the steps of transcription while including the following terms
 - a. mRNA
 - b. RNA polymerase
 - c. RNA processing
 - d. Introns
 - e. Exons
 - f. 5' cap
 - g. Poly-A tail
6. Where in the cell does transcription occur?

Translation

7. Describe the steps of translation while including the following terms
 - a. mRNA

- b. codon
 - c. tRNA
 - d. anticodon
 - e. rRNA
 - f. ribosome
 - g. small RNA subunit
 - h. large RNA subunit
 - i. P site
 - j. A site
 - k. Wobble
 - l. Stop Codon
 - m. Start Codon (Met)
 - n. Initiation
 - o. Elongation
 - p. Termination
8. Where in the cell does translation occur?
9. Name three ways that replication and protein synthesis are different in prokaryotic and eukaryotic cells.

DNA Organization

10. Draw the following
- a. Chromatin
 - b. Histone proteins
 - c. Nucleosomes
 - d. Euchromatin
 - e. Heterochromatin
 - f. Transposons

Viral Reproduction

11. Draw and describe a bacteriophage.
12. Label the capsid, envelope, and genetic material.
13. Describe how a retrovirus infects a cell and describe the role of reverse transcriptase.
14. Give two examples of retroviruses.

Bacterial Reproduction

15. What is a plasmid?
16. Draw the following processes.
- a. Conjugation
 - b. Transduction
 - c. Transformation
17. Create a flow chart for the gene expression of the lac operon gene. You may want to use your coloring sheet for this. Include the following terms:
- a. Regulatory gene
 - b. Repressor protein
 - c. Promoter
 - d. Operator
 - e. Structural gene
 - f. Lactose

18. Create a flow chart for the gene expression of the tryp operon gene. You may want to use your coloring sheet for this. Use the terms listed above, but also include tryp operon, tryptophan, and corepressor

Biotechnology

19. Describe and cut and paste pictures of the following processes.
- Creating recombinant DNA (include the following terms restriction enzymes, sticky ends, ligase, plasmids (vector))
 - Gel electrophoresis
 - RFLPs (restriction fragment length polymorphisms) and DNA fingerprinting
 - PCR (polymerase chain reaction)
 - DNA library
 - cDNA library
 - Reverse transcriptase
 - Probes
 - DNA sequencing
 - Human Genome project
 - Southern blotting

Unit VI: Biological Diversity

Domain Eubacteria

- Draw a typical bacterial cell and label the structures. Provide any unique characteristics of the labels.
- Describe how they produce endospores and why endospores are important.
- How do bacterial flagella work compared to eukaryotic flagella?
- Draw and name the three shapes of bacteria.
- What is the difference between gram positive and gram negative bacteria?
- Describe and give examples of the following types of bacteria:
 - Cyanobacteria
 - Chemosynthetic bacteria
 - Nitrogen fixing bacteria
 - Spirochetes

Domain Archaeobacteria

- Create a chart outlining the three differences between archaeobacteria and eubacteria.
- Describe and give examples of the following types of archaeobacteria:
 - Thermophiles
 - Halophiles
 - Methanogens

Domain Eukarya

Kingdom Protista

- Name and describe the three major groups of Protists.
- Using the Cliff's book, create a chart of the 12 phyla of Algae like and Protozoans. Give one unique characteristic and one example of each phylum.
- Give two examples of fungus like protists.

Kingdom Fungi

12. Describe the kingdom Fungi by using the following terms. Pull your foldable here.
 - a. Hyphae
 - b. Mycelium
 - c. Septa
 - d. Chitin
13. Describe the three methods of asexual reproduction in Fungi.
14. List the six groups of Fungi. Describe an example of each group. Give the method of reproduction for each group.

Kingdom Plantae

15. What are the basic characteristics of all plants?
16. What is alternation of generations? What characterizes the sporophyte generation? Gametophyte generation?
17. Create a chart of the following plant groups and include the following headings for your chart. Bryophytes (mosses), Ferns, Gymnosperms (conifers), Angiosperms (flowering plants)***Study your computer lab and plant life cycle coloring here!
 - a. Dominant generation (sporophyte or gametophyte)
 - b. Seeds or spores
 - c. Vascular or non-vascular
 - d. How is fertilization accomplished?
 - e. Where are seeds found?
18. Create a chart comparing monocots to dicots. Include leaf structure, root structure, xylem and phloem arrangement in stems, number of flower parts, and number of cotyledons.

Kingdom Animalia

19. Animals can be classified based on their symmetry and whether or not they are protostomes or deuterostomes, and coelomates, pseudocoelomates, and acoelomates. What do all of these terms mean?
20. List the 9 phyla of animals and provide their symmetry as well as their classification as a deuterostome or protostome, also divide them by their body cavity type.
21. Study the chart derived in class for the remainder of Animal Stuff☺

Unit VII: Plant Structure and Function

Plant Tissues: ***Use your plant structure and function lab here as well as your Transport Powerpoint!

1. Create a chart of the three types of plant tissues and give the examples of each type of tissue. Describe where each tissue is found in the plant and the function of each type of tissue.
2. Xylem:
 - a. Draw the tracheids and vessel elements.
 - b. Explain the processes of transpirational pull, negative pressure, and osmotic potential with emphasis on water movement up the plant.
 - c. Are the xylem cells alive when mature?
3. Phloem:
 - a. Draw the sieve tubes with sieve plates and companion cells.

- b. Describe the conduction of sugars including bulk flow, source to sink flow and positive pressure.
- c. Are the phloem cells alive when mature?

Plant Growth

4. Explain the process of primary or vertical plant growth while including the following terms:
 - a. Apical shoot
 - b. Apical root
 - c. Root cap
 - d. Zone of cell division
 - e. Zone of elongation
 - f. Zone of maturation/differentiation
5. Explain the process of secondary growth or increase in girth by including the following terms:
 - a. Lateral meristems
 - b. Vascular cambium
 - c. Secondary xylem
 - d. Secondary phloem
 - e. Cork cambium
6. Draw a monocot and a dicot root. Describe the main difference between the two roots.
7. On one of your drawings, identify the following and provide the functions of each
 - a. Epidermis
 - b. Root hairs
 - c. Cortex
 - d. Endodermis
 - e. Casparian strip
 - f. Stele (vascular cylinder)
 - g. Xylem
 - h. Phloem
8. Draw a picture of a leaf and label the structures. Provide the functions of the structures as well.

Plant Hormones

9. Provide the functions of the following plant hormones. **Use your plant hormone drawings here.
 - a. Auxin
 - b. Gibberellins
 - c. Cytokinins
 - d. Ethylene Gas
 - e. ABA (Abscisic acid)

Plant Reproduction

10. Describe alternation of generations by briefly describing these steps in a cycle fashion.
 - a. Multicellular sporophyte (2n)
 - b. Meiosis
 - c. Spores (1n)

- d. Mitosis
 - e. Multicellular gametophyte (1n)
 - f. Mitosis
 - g. Gametes (1n)
 - h. Fertilization
 - i. Multicellular sporophyte (2n)
11. Draw a flower and label the structures. Place the functions of the structures beside each label.
 12. Describe double fertilization in angiosperms. How does double fertilization form the various parts of the seed?
 13. Draw a picture of a seed and label the following. Place the functions beside each label.
 - a. Embryo
 - b. Seed coat
 - c. Endosperm
 - d. Cotyledons (seed leaves)
 - e. Hypocotyl (embryonic stem)
 - f. Radicle (embryonic root)

Plant Response

14. Create a chart of the four plant responses and include the hormones responsible for each response. ***Use your plant behavior drawings here.
 - a. Phototropism
 - b. Gravitropism
 - c. Thigmotropism
 - d. Nastic movement
15. Describe photoperiodism in plants. Include the following terms in your description.
 - a. Circadian rhythm
 - b. Night length
 - c. Phytochrome proteins (P_{fr} , and P_r)
 - d. Long day plants
 - e. Short day plants
 - f. Day neutral plants
 - g. Examples of each type of plant

Unit VIII: Animal Form and Function

Homeostasis

1. Pull your thermoregulation questions and study these.

Respiratory System

1. Describe how gills work with emphasis on counter current exchange.
2. Describe how breathing with lungs is accomplished with emphasis on the following:
 - a. Nose
 - b. Pharynx
 - c. Larynx
 - d. Trachea
 - e. Bronchi

- f. Bronchioles
 - g. Alveoli
 - h. Diaphragm
3. Describe the process of carbon dioxide and oxygen diffusion across the walls of the alveoli and capillaries.
 4. How is oxygen transported in the blood?
 5. How is carbon dioxide transported in the blood?
 6. How is breathing rate regulated?

Circulatory System

7. Describe a closed circulatory system vs. an open circulatory system.
8. What is the difference between hemolymph and blood in relation to question number seven?
9. Create a chart outlining the differences between the two, three, and four chambered heart. Give examples of organisms that possess each type.
10. Diagram the path of blood through the heart including the functions of major structures as you go along.
11. Provide explanations of each of the following terms:
 - a. Pulmonary circuit
 - b. Systemic circuit
 - c. SA node
 - d. AV node
 - e. Systole
 - f. Diastole
12. Pull your blood foldable and provide the functions of red blood cells, white blood cells, platelets and plasma.
13. Give the basic steps of the clotting process.

Excretory System

14. Describe the differences between ammonia, urea, and uric acid with regards to toxicity and who releases each.
15. Diagram how the nephron functions with emphasis on the following:
 - a. Glomerulus
 - b. Bowman's capsule
 - c. Proximal tubules
 - d. Loop of Henle
 - e. Distal tubule
 - f. Collecting duct
 - g. Ureter
 - h. Bladder
 - i. Urethra
 - j. Filtration
 - k. Secretion
 - l. Absorption
16. Describe three methods of osmoregulation in various animals.
17. How are ADH and aldosterone involved in osmoregulation?

Digestive System

18. Pull your story here and study it.

19. Pull your digestion chart too and outline the steps of digestion focusing on the following:
- Mouth (salivary amylase, mechanical digestion)
 - Pharynx
 - Epiglottis
 - Esophagus
 - Peristalsis
 - Stomach (gastric juices, HCl, pepsin, mucus, mechanical digestion, pyloric sphincter)
 - Small intestine (duodenum – proteases), (pancreas- chymotrypsin, lipase, amylase) (absorption through villi)
 - Liver and gall bladder (bile emulsifying fats)
 - Large intestine (water absorption, E.coli symbiotic bacteria)

Nervous System

20. Describe the structures of the nervous system and the functions of each of the following:
- CNS (brain and spinal cord)
 - Peripheral nervous system (sensory and motor neurons)
 - Somatic division
 - Autonomic division
 - Sympathetic
 - Parasympathetic
21. Describe the steps of a typical reflex arc.
22. Draw a neuron and label it while providing the functions of the following:
- Cell body
 - Dendrites
 - Axon
 - Synapse
 - Myelin sheath
 - Schwann cells
23. Describe the steps of the action potential while creating a flowchart.
24. Describe the function of acetylcholine in neuromuscular junctions.
25. Describe the role of epinephrine, dopamine, and serotonin in synapses.

Muscular System

26. What are the main differences between skeletal, smooth, and cardiac muscle? Discuss location as well as structure and function.
27. Describe the structure of a muscle cell starting with the sarcomere and outlining all parts of the sarcomere. You can draw it if it is easier.
28. Describe the steps of muscle contraction including the following terms:
- Sarcomere
 - Sarcoplasm
 - Sarcoplasmic reticulum
 - ACh
 - T tubules
 - Actin
 - Troponin
 - Tropomyosin

- i. Myosin
- j. ATP-myosin binding
- k. Calcium release
- l. Sliding filament theory
- m. Myosin heads

Immune System

- 29. Describe the following defenses in the non-specific (aka first line) defense
 - a. Skin
 - b. Anti-microbial proteins
 - c. Gastric juices
 - d. Tears
 - e. Phagocytes
 - f. Complement
- 30. Describe the process of inflammation including histamine, vasodilation and phagocytes.
- 31. Define and describe the structure of antibodies and antigens.
- 32. Create two flowcharts, side by side, outlining the cell-mediated immune response versus the humoral (antibody mediated) response.
- 33. Describe passive versus active immunity classify the following as such:
 - a. Vaccine
 - b. Antivenom
 - c. Actually getting sick
 - d. Mother passing antibodies to baby
- 34. Describe the differences between complement and interferon. How does each work?

Endocrine System

- 35. Outline a negative feedback loop for the regulation of blood sugar, and calcium balance. You should use insulin and glucagon for the blood sugar loop and parathyroid hormone and calcitonin for the calcium loop.
- 36. Describe negative feedback versus positive feedback. Outline a positive feedback loop for childbirth.
- 37. Describe the roles of the following glands and the hormones they release:
 - a. Hypothalamus
 - b. Posterior pituitary (ADH, oxytocin)
 - c. Anterior pituitary (TSH, ACTH, FSH, LH)
- 38. Describe the role of the following ductless glands and the hormones they release:
 - a. Pancreas (insulin and glucagon)
 - b. Adrenal (epinephrine and aldosterone)
 - c. Gonads (ovaries...estrogen and progesterone) (testes...testosterone)
- 39. Create a diagram of how the following hormones work on their target cells:
 - a. Steroid hormones-transcription factors
 - b. Protein hormones- secondary messengers

Animal Reproduction and Development

- 40. Describe the anatomy and physiology of the human female reproductive system.

41. Describe the anatomy and physiology of the human male reproductive system. You can do this by tracing the path of sperm formation beginning with the seminiferous tubules and ending at the urethra. Be sure to include the functions of all of the glands.
42. Outline oogenesis and spermatogenesis.
43. Outline the female menstrual cycle using the following: (Trace the path as if the egg had been fertilized and the path as if the egg had not)
 - a. GnRH (hypothalamus)
 - b. FSH (pituitary)
 - c. Estrogen (ovary)
 - d. LH (pituitary)
 - e. Progesterone (corpus luteum)
 - f. Ovulation
 - g. Human Chorionic Gonadotropin

Development

44. Draw the steps of animal development including the following:
 - a. Fertilization
 - b. Cleavage
 - c. Morula
 - d. Blastula
 - e. Gastrula
 - f. Gastrulation
 - g. Differentiation
 - h. Organogenesis
45. Describe the various structures and what they become in the adult animal:
 - a. Ectoderm
 - b. Mesoderm
 - c. Endoderm
 - d. Archenteron
 - e. Blastopore
46. Describe the following types of developmental regulation:
 - a. Egg cytoplasm (gray crescent in frogs)
 - b. Embryonic induction (dorsal lip in frogs)
 - c. Homeotic genes