A&P Final Exam Review Study Guide

1. Introduction (3 questions)

- Anatomy – **The study of structure**

- Physiology – **The study of the function of body parts**

- Metabolism – **All of the chemical reactions in the body**

- Homeostasis – **The tendency of the body to maintain a stable internal environment**

- Negative Feedback vs Positive Feedback

  Negative Feedback – **As the body moves away from it's normal internal environment, the change is noted by sensory systems and systems in the body are triggered to bring it back to homeostasis.**

  Positive Feedback – **As a change occurs in the body it triggers even greater changes taking it further from homeostasis.**

- Know the steps in the scientific process

  a. **Observe a pattern**
  b. **Formulate hypothesis to explain the pattern**
  c. **Get rid of some hypothesis**
  d. **Determine the predictions of the remaining hypothesis**
  e. **Run experiments**
  f. **Evaluate results**

- Contrast hypothesis and theories

  Hypothesis – **A tentative explanation for a pattern**

  Theory – **A widely supported view of the world. An idea that has been tested repeatedly and supported.**

2. Chemistry (3 questions)

- Contrast Acids & Bases
  - Acid
    - **Donate hydrogen ions H+**
    - **Ex. $H_2SO_4 \rightarrow 2H^+ + SO_4^{-2}$**
    - **Low pH (0-6.9)**
  - Base
    - **Donate Hydroxyl ions OH-**
    - **Ex. $NaOH \rightarrow Na^+ + OH^-$**
    - **High pH (7.1-14)**

- Buffer

  A substance which can help keep the body's pH balance stable by switching in either direction. If the body's pH becomes too acidic (high in H+) then the

buffer will react and donate OH- to combine with the H+ and create water as well move the pH back towards neutral. If the body's pH becomes to base, the buffer will react by donating H+ ions to again create water and move the body's pH back towards neutral.

- Ion vs isotope

Isotope – **Atoms of an element that have lost or gained neutrons from the normal number.**

Ion – **Atoms or a group of atoms that have lost or gained electrons from the normal number.**

- Electrolytes – **Ions in a solution.**

- Contrast hydrogen bonds, ionic bonds and covalent bonds

- **Ionic Bonding – When an atom takes one or more electron from another atom to fill the outer electron shells evenly, forming positive and negative charged ions which bond due to their charge.**
- **Covalent Bonding – A pair of electrons is shared by two atoms in the molecule to fill their outer shells evenly.**
- **Hydrogen (polar) bonding – A very weak bond formed between polar molecules. The polar molecules have weak charges because the shared electrons spend more time circling the larger atoms then they do circling the smaller atoms.**

- Contrast carbohydrates, lipids and proteins

- Carbohydrates
  - **C:H:O = 1:2:1)**
  - **Sugars**
  - **Monosaccharides, Disaccharides or Polysaccharides**
  - **Water soluble**
  - **Highest concentration of energy**
  - **Commonly stored in Glycogen form (a polysaccharide)**
- Lipids
  - **(C:H = 1:2)**
  - **Little or no O2**
  - **Saturated (no double bonds for carbons)**
  - **Unsaturated (double bonds for carbons)**
  - **Commonly stored as triglycerides (three fatty acids bonded to a glycerol molecule). Stores fats in the body.**
  - **Phospholipids (two fatty acids bound to a phosphate group) are another common lipid. Forms the membrane around cells. Has a Hydrophilic and Hydrophobic end.**
- Proteins
  - **Consists of chains of amino acids**
  - **Contain Nitrogen as well as Carbon, Oxygen and Hydrogen.**

    - **Amino Acids have a Carboxylgroup, an Aminegroup as well as one of 20 (for the body) different chemical molecules combinations**
    - **Peptide bonds are covalent bonds between the carboxylgroup of one amino acid and the aminegroup of the second amino acid.**

- Contrast saturated and unsaturated lipids
    - **Saturated Lipids: No double bonds for carbons, full of hydrogen.**
    - **Unsaturated Lipids: At least one carbon is double bonded, some missing hydrogen.**

- Know primary, secondary and tertiary structures of proteins
    - **Primary Structure – The sequence of amino acids in the protein (connected via a peptide bond: covalent between aminegroup of one and carboxylgroup of next)**
    - **Secondary Structure – Hydrogen bonds between aminoacids in the chain which cause a coil effect to the string of aminoacids**
    - **Tertiary Structure – Where aminoacids (often some distance apart) form disulfide bonds which causes the string of aminoacids to fold in various directions.**
    - **Quaternary Structure – Occurs when two or more separate aminoacid chains bond together.**

- What are enzymes? What is the significants of enzyme shape to their function? What factors cause enzymes to change shape?
    - What are enzymes: **Enzymes are proteins which perform as catalysts to increase the speed of reactions in the body. They do this by reducing the energy required to start the reaction (activation energy).**
    - What is the significants of enzyme shape on their function? **An enzyme must be able to bond to it's substrate, therefore it's shape must match the shape of the molecule it will operate on. If the shape of the enzyme or substrate is modified so that they cannot bind, then the enzyme cannot function and the reaction will not occur.**
    - What factors cause enzymes to change shape?
        - **Heat/Cold**
        - **pH**
        - **ion concentration**

3. Cells (6 questions)

- Know the major cell organelles and their functions (nucleus, rough endoplasmic reticulum, smooth endoplasmic reticulum, golgi body, mitochondria, lysosomes, vacuoles, flagella)

Nucleus: Holds DNA
Rough Endoplasmic Reticulum: Makes proteins
Smooth Endoplasmic Reticulum: Makes carbohydrates and Lipids
Golgi Apparatus: Modifies/repackages carbohydrates, lipids and proteins [for export]

Mitochondria: Powerhouse of the cell, produces ATP
Lysosomes: Holds digestive enzymes
Vacuoles: Store water, salts, sugars, or waste products in the cell.
Flagella: Locomotive organelles

- What is the energy currency of the cell and what is it's high energy and low energy form?

- What is the high energy form of energy currency of the cell?
  - **ATP Adenosine Triphosphate**
- What is the low energy form?
  - **ADP**

- What is diffusion? How do concentration gradients, size of the molecule and temperature affect the rate of diffusion?

- What is diffusion?
  - **A movement of molecules from an area of high concentration to low concentration due to the random movement of molecules.**
  - **Diffusion does not require energy**
  - **All molecules in liquids and gasses have rotational spin.**
- Give three factors that affect the rate of diffusion.
  - **Concentration gradient: The difference in concentration between the inside of the cell and the outside of the cell. The higher the difference (concentration gradient), the faster the diffusion.**
  - **Molecular Size: The larger the molecule the slower the diffusion. (Because the smaller molecule moves faster).**
  - **Temperature: The higher the temperature the faster molecules move and diffuse.**

- Understand the following types of cell transport: solubility diffusion, pore diffusion, facilitated diffusion and active transport? Which require energy?

- Solubility diffusion
  - **Things that are soluble in the membrane naturally diffuse through it (fat soluble).**
- Pore diffusion
  - **Protein pores which allow ions to cross the membrane**
  - **Most only allow a specific ion to pass through**
  - **They can be opened or closed, thus named ion gates.**
  - **Protein pores change shape mostly based on membrane potential.**
  - **I.e. sodium gates, potassium gates**
- Facilitated diffusion
  - **Protein carriers that carry molecules across the cell membrane by diffusion. Often these molecules change shape when they bond to the molecule they are transporting.**
  - **The rate of diffusion can be limited by the number of protein carriers.**

    - **I.e. glucose transport into red blood cells, liver, fat, or muscle tissue.**
- Active Transport
    - **Uses energy to move chemicals across the membrane against the concentration gradient (from low concentration to high concentration).**

- Explain osmosis and be able to explain where water will move in an osmosis example. Know and be able to apply terms isotonic, hypertonic, hypotonic.

- **Osmosis – The diffusion of water across a semi permeable membrane. Osmosis is the diffusion of water, so it is the movement of water from an area of high water concentration to an area of low water concentration. Other particles in water (salts, sugars, etc.) in the water reduce the concentration of the water. Therefore water will move across the membrane from areas with low percentages of salts/sugars(hypotonic) to solutions with high percentages of salts/sugars(hypertonic).**
- **Hypotonic: Low salt/sugars – High water concentration. Water moves from hypo to hyper.**
- **Isotonic: Equal salt/sugar concentration on each side of the membrane**
- **Hypertonic: High salt/sugars – Low water concentration. Water moves from hypo to hyper.**
- **If Mr. Potato Head has more salts/sugars in his body (hypertonic) then in the water he is sitting in (hypotonic), then he will gain water (weight). If on the other hand he has less salt/sugars in his body (hypotonic) then in the water (hypertonic), then the water will be pulled out of his body into the water solution.**

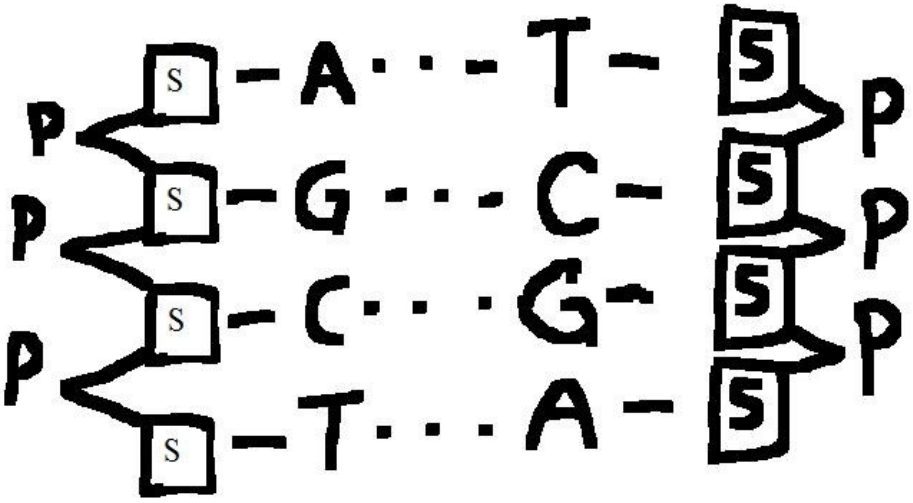
- Explain endocytosis and exocytosis.

Endocytosis – **Movement of materials into the cell by wrapping the membrane around them and budding it off into the cell. This process requires energy.**

Exocytosis – **Movement of materials out of the cell by fusing membrane bound units in the cell membrane and dumping the contents to the outside of the cell. This process requires energy.**

4. Protein Synthesis (2 questions)

- Know the structure of DNA



- Be able to recognize the process of transcription or translation

- **[Transcription] First the DNA representing one gene is replicated into m-RNA. This process is called transcription, occurs inside the nucleus and is performed by separating the double helix DNA for the section that needs to be transcribed so that a small section of m-RNA can be created from it.**
- **The m-RNA is then transferred outside the nucleus to the cytoplasm.**
- **[Translation] The Ribosome locks onto one end of the m-RNA molecule.**
- **[Translation] The ribosome then reads three base sequences at a time (codon) which links to the proper anticodon on the t-RNA. Each t-RNA has a specific amino acid attached to it. Therefore the proper amino acid is attached in the proper sequence of amino acids for this protein. As each amino acid links to the amino acid next to it in the primary sequence, the Ribosome moves down the m-RNA to the next codon and the process continues.**
- **[Translation] Once the ribosome has moved all the way down the m-RNA molecule all the amino acids have been put in place to make the protein.**

5. Mitosis/Meiosis – tumors (3 questions)

Note: Ploidy is the number of homologous sets of chromosomes in a biological cell

- How many cells does mitosis produce and what is their ploidy?

Normal cell division, creates two diploid cells. For growth or repair.

- How many cells does meiosis produce and what is their ploidy?

For reproduction, creates four sex cells, haploids.

- Contrast the terms haploid and diploid?

Haploid – **With one set of chromosomes and no homologous pairs (sex cells)**
Daploids – **With two sets of chromosomes that are homologous**

- Know and be able to define the following terms related to tumors:
hyperplasia, anaplasia, benign, malignant, metastatic/metastasis

Hyperplasia **– uncontrolled cell division**
Anaplasia **– Cells do not specialize the way they should, usually resemble undifferentiated cells.**
Benign **– a tumor that is not metastatic**
Malignant **– a tumor that is metastatic**
Metastatic **– when cells break free from the original tumor and move to other parts of the body where they start new tumors. Metastatic tumors = cancer.**

6. Cell metabolism (1 question)
- Contrast anabolic metabolism and catabolic metabolism
Anabolic Metabolism – **Builds up compounds.**
Catabolic Metabolism – **Breaks compounds down.**
- What is oxygen debt? What accumulates in the body when anaerobic respiration is run in the body?

Oxygen debt is accumulated when anaerobic respiration is performed. It involves the buildup of lactic acid which requires O_2 and energy to remove it.

7. Tissues (Integument, glands, bone and joint structure, muscle types) (13 questions)
- Know the 4 basic types of tissues (epithelial, connective, muscle and nerve)
Epithelial tissue **– Tissue that lines the outside of the body (skin, glands, linings of organs/cavities that receive input from outside body)**
Connective tissue **– Tissue that holds the body together**
Muscle tissue **– Contractile tissue (skeletal, smooth, cardiac)**
Nervous tissue **– Tissue that can carry nerve signals (nerves, brain cells)**

- Contrast the epidermis, dermis, and subcutaneous layers of the integument.

- **Epidermis**
  - **Outer most layer of skin**
  - **Lacks blood vessels**
  - **Stratum corneum**
  - **Filled with keratin**
  - **Cells are hard and dead**
  - **Prevent water loss**
- **Dermis**
  - **Dense, irregular connective tissue**
  - **Has blood vessels**
  - **Mostly connective tissue**
- **Subcutaneous layer**
  - **Layer of mostly fat under the dermis**

- What do melanocytes produce and what is their function

Melanocytes produce melanin which is responsible for the pigmentation of an individuals skin (along with sunlight exposure). It provides protection from UV light.

- Contrast endocrine glands and exocrine glands.

Endocrine glands – **Glands that secrete inside the body and that do not have ducts. I.e. pituitary.**
Exocrine glands – **Glands that secrete things to the outside of the body and have ducts. I.e. sweat glands.**

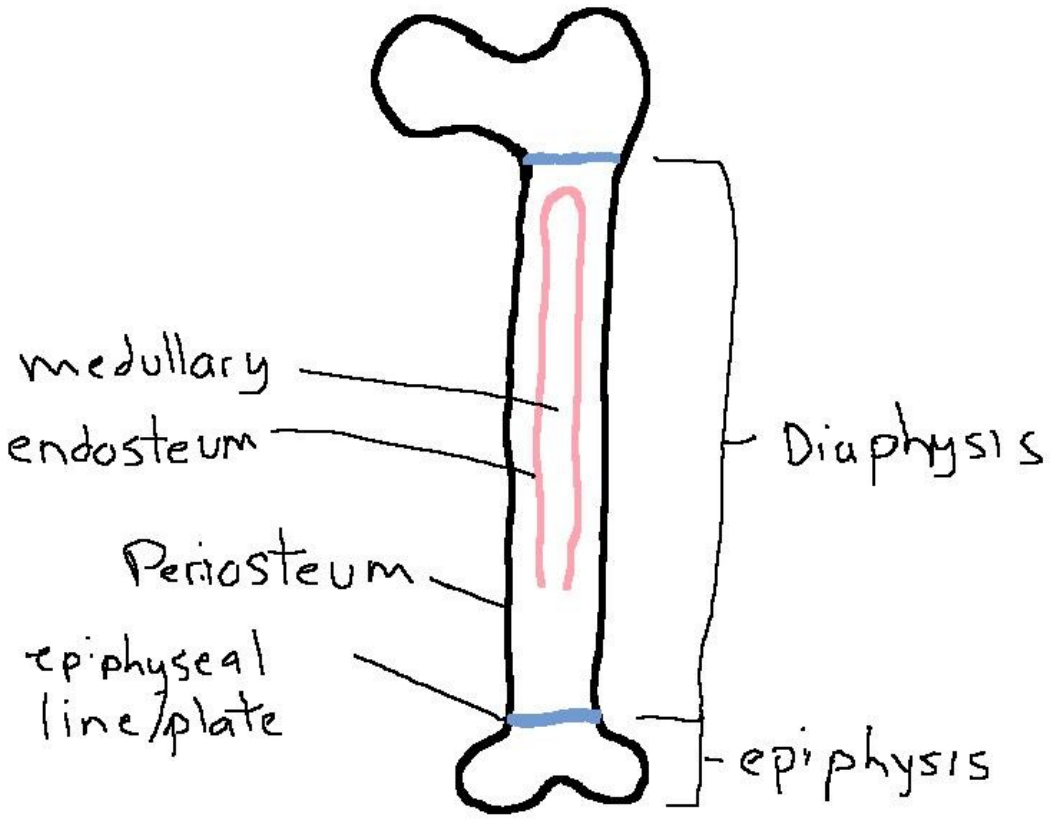
- Contrast the way secretions are produced by holocrine, merocrine and apocrine gland.
    Holocrine – **Produce their secretions when whole cells break off and break open dumping their contents. I.e. sebaceous glands**
    Merocrine – **Produce their secretions by moving material out of the cells by osmosis or exocytosis. I.e. salivary glands, eccrine glands**
    Apocrine – **Produce their secretions by having a portion of the cell break off with the secretions. I.e. mammary glands and apocrine sweat glands.**

- What do the following types of glands in the skin produce and what is the function of these secretions. – Sebaceous glands, apocrine glands, eccrine glands
Sebaceous – **Glands in skin associated with hair follicles and produce an oily secretion called sebum which helps keep the skin soft, pliable and water proof.**
Apocrine sweat – **Sweat glands located in groin and arm pits. Usually associated with hair follicles, not associated with body cooling, produce secretions in association with stress, produce water, salts, and pheromones**
Eccrien sweat – **These glands are all over the body, not associated with hair follicles, primary function is cooling of the body, produce water with a small amount of salt, merocrine glands**

	Produce	Function	Active	Hair?	Type	Where
Eccrine	H20 & Salts	Cooling	Whole life	No	Merocrine	All over
Apocrine	Pheromones H2O & Salts	Sex attractions	Puberty onward	Yes	Apocrine	Pubic/Groin Axillary (Face on men)
Sebaceous	Sebum	H2O proof skin	Whole life	Yes	Holocrine	All

- What are 3 responses of the body if it is too hot or too cold?
- Too hot:
    - **Sweating increased**
    - **Increased blood flow to skin and body extremities**
    - **Reduce metabolism (to produce less heat)**
- Too cold:
    - **No sweating**
    - **Blood vessels move away from skin, less blood sent to extremities keep it in core**
    - **Increase metabolism (to produce more heat)**
    - **Shivering (cause muscles to produce more heat)**

- Be able to define the following bone structures: epiphysis, diaphysis, epiphyseal plate or line, medullary, endosteum, periosteum.



- In what area of the bone do long bones grow? How do long bones grow? **Long bones grow at the epiphyseal plate via Interstitial growth in length and appositional growth in width (see below).**

- What is ossification? **Precipitation of calcium phosphate within the cartilage matrix; makes bones hard and stone-like**

- Know where in the bone spongy bone and compact bone is found. **On long bones the area at the ends of the bones (beyond the epiphyseal plates) are filled with spongy bone and the bone in the shaft (between the epiphyseal plates) is filled with compact bone.**

- What is a harversian system? **The haversian system provides the structure for the osteocytes which are located inside the compact bone. It is made up of the following components:**

- **Central canals – canals in the center of the haversian system that contain blood vessels, lymph vessels, and nerves.**
- **Lamellae – Concentric layers of bone that surround the central canal**

- **<u>Osteocytes – The bone cells located within cavities in the lamellae called lacunae</u>**
- **<u>Canaliculi – Small tubes that connect the lacunae and allow plasma from the blood to circulate around the osteocytes</u>**

- Contrast the functions of osteocytes and osteoclasts?
Osteoclasts - **Bone cells that use lysozymes to reabsorb bone and are important in bone remodeling.**
Osteocytes - **Mature bone cells that lays down and maintain bone. They develop from osteoblasts.**

- Contrast interstitial growth and appositional growth of bones?
- **Interstitial growth:**
  - **Longitudinal growth**
  - **Starts with primary ossification: prior to birth from the center of the diaphysis; creates the compact bone that is the diaphysis at birth.**
  - **Next secondary ossification: prior to birth and through birth; ???**
  - **Occurs at the epiphyseal plate**
  - **Cartilage grows ahead of ossification**
  - **Puberty causes ossification to occur faster then cartilage growth, resulting in ossification of epiphyseal plate and no more growth**
- **Appositional growth:**
  - **Growth in diameter**
  - **Osteocytes in the periosteum on the outsides of the bone lay down new bone adding material to the outside of the bone.**
  - **Osteoclasts in the endosteum in the medullary of bones remove bone material increasing the size of the medullary cavity**

- Contrast the functions of the hormones calcitonin and parathyroid hormone? When are they produced and what do they do?
- **Parathyroid hormone**
  - **Parathyroid gland**
  - **Breakdown bone/increase blood calcium level**
  - **Increase osteoclast activity**
  - **Decrease osteocyte activity**
  - **Also increase calcium reabsorption from urine and formation of calcitroil (active form of vitamin 'D').**
- **Calcitonin**
  - **Thyroid gland**
  - **Build bones/Decrease blood calcium levels**
  - **Increase osteocyte activity**
  - **Decrease osteoclast activity**

- Define and explain the following movements: flexion/extension, abduction/adduction, rotation, circumduction.

Flexion **Decreases the angle between two articulating bones in anterior/posterior plane.**
Extension **Increases the angle between two articulating bones in anterior/posterior plane.**
Rotation **One bone rotates relative to another along its longitudinal axis (atlas/axis and radius/ulna)**
Abduction **Movement of a bone away from the body midline.**
Adduction **Movement of a bone toward a body midline.**
Circumduction **Movement of the distal end of a body part in a circle. Involves abduction, adduction, flexion and extension.**

- Contrast ligaments and tendons? What are bursae?
  - **Ligaments – Holds bone to bone, have some streach.**
  - **Tendons – Collagen fibers that connect muscle to bones. Do not stretch.**
  - **Bursae – Small sack like structures near the joint that alleviate friction with outer tissue layers when the joint moves. Surrounded by synovial membrane and are filled with synovial fluid.**

- Contrast the 3 types of muscle (smooth, skeletal and cardiac) with respect to whether they are striated, myogenic or neurogenic, contraction speed, multinucleate or if they have intercalated disks.

Type	Striated	Intercalated disks	Neurogenic/ myogenic	Contraction speed	Multi-nucleate?
Skeletal	**Yes**	**No**	**Neurogenic**	**Fast**	**Yes**
Smooth	**No**	**No**	**Myogenic**	**Slow**	**No**
Cardiac	**Yes**	**Yes**	**Myogenic**	**Medium fast**	**No**

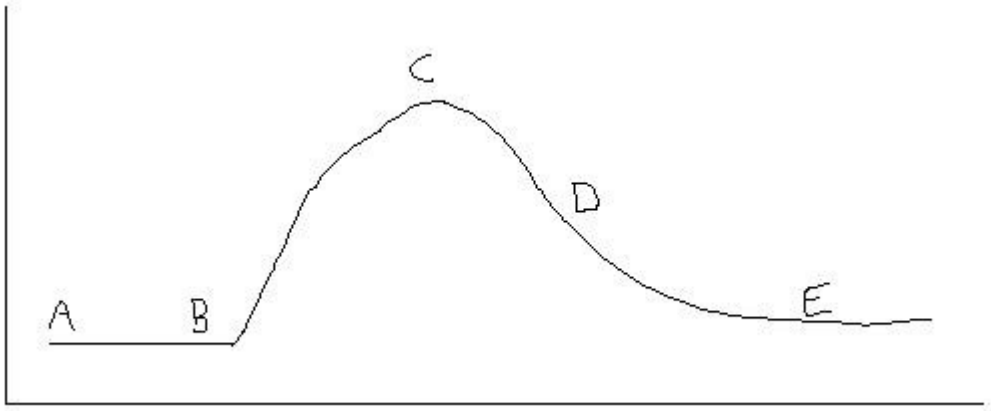
- Contrast repair by regeneration and replacement
  - **Regeneration – Repair of tissue with cells of the same type as were previously there. Usually does not produce a scar.**
  - **Replacement – Repair of tissue with a different type of cell or tissue. Usually forms a scar.**

8. Muscle (physiology and structure) (4 questions)
- Contrast the terms origin, insertion, and action.
  - **Origin – Where a muscle attaches to a bone that is stationary (i.e. the bone that doesn't move when the muscle contracts).**
  - **Insertion – Where a muscle attaches to a bone that moves when it contracts.**
  - **Action – The movement that this muscle creates.**

- What is sarcoplasmic reticulum and what is stored in it
  - **The sarcoplasmic reticulum is a special type of endoplasmic reticulum that stores calcium ions.**

- **The sarcolemma is the plasma membrane that surrounds a muscle cell. The transverse tubules carry the contraction signals nearer to the sarcoplasmic reticulum. Tunnels which carry the sarcolemma membrane potential into the sarcoplasmic reticulum.**

- How and where do ions move when an action potential occurs in a muscle and it is - repolarized?



A.

- **Cell is at resting potential (-90mv)**
- **Na+ outside cell**
- **K+ inside cell**
- **Ca++ inside SR.**

B.

- **Nerve cell signal (neurotransmitter bonds) reaches cell**
- **acetylcholine from the nerve opens the Na+ gates on the muscle cell.**
- **Na+ diffuses into the cell making it more positive.**

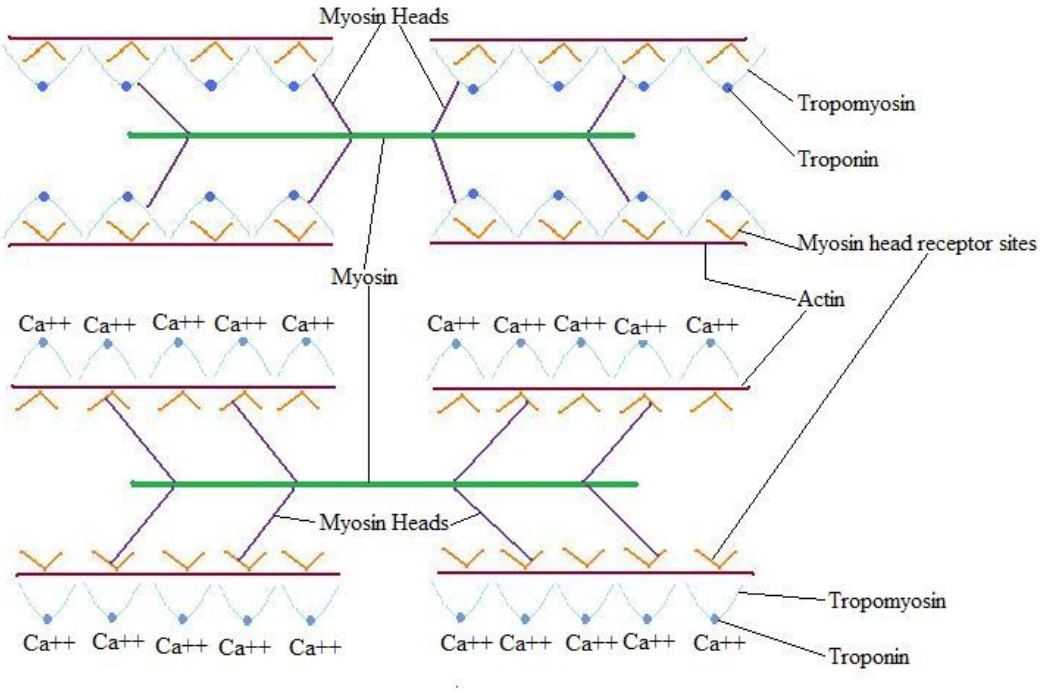
C.

- **Cell reaches action potential (+40mv)**
- **Na+ gates close (Na+ stops diffusing into cell)**
- **K+ gates open (K+ diffuses out of cell)**
- **Ca++ gates on Sarcoplsamic reticulum (SR) opens and Ca++ moves (diffuses) from the SR to the cell cytoplasm (Ca++ causes muscles to contract).**

D.

- **K+ gates close (K+ stops diffusing out of cell)**
- **Na+/K+ pump starts active transport (Requiring ATP) of Na+ and K+ ions (3 Na+ out / 2 K+ in)**
- **Cell returns to resting potential (-90mv)**
- **Ca++ gates on SR close (Ca++ stops diffusing out of SR).**
- **Ca++ is actively transported back into SR (stops the muscle contraction)**

- Be able to explain how the following muscle protein function in skeletal muscle contraction (myosin, actin, troponin and tropomyosin)



- How are contractions in smooth muscle and cardiac muscle different from skeletal muscle?

E3Q19E. In smooth muscle where does most of the calcium that causes muscle contraction come from? (117)

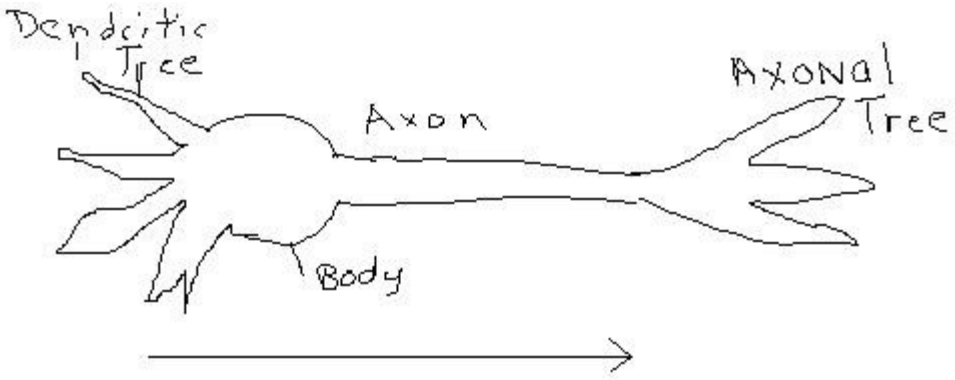
Although some of the calcium comes from the sarcoplasmic reticulum, most of it comes from outside the cell and moves into the cell when the cell reaches action potential.

E3Q19F. Explain in detail how calcium in smooth muscle cells leads to their contraction. (117)

Ca++ ions are outside the cell body. When the Ca++ ions enter the cell, they bind with calmodulin proteins. The Ca++/calmodulin then activates light chain kinase (enzyme) which catalyzes the addition of ATP to myosin head. The myosin head is then allowed to bind with the actin & contract. This is different from skeletal muscle in that there is no troponin/tropomyosin blocking the myosin head bonding sites on the actin.

9. Nervous system (10 questions)

- Explain how a nerve signal travels down a neuron using the terms dendritic tree, axonal tree and axon



- *Contrast white matter and grey matter in the brain*

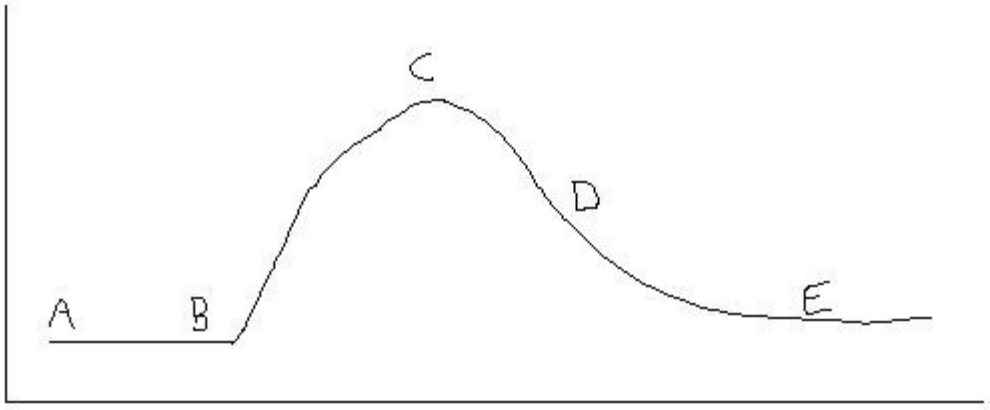
- Explain the main functions of the following cells – astrocytes, oligodendrocytes, microglia cells, ependymal cells

E4Q3. How could you identify the following types of neuroglia cells of central nervous system and what are their functions; astrocytes, oligodendrocytes, microglial cells, and ependymal cells? (120-122)

- Astrocytes –
  - **involved in the metabolism of neurotransmitters**
  - **help maintain the proper potassium balance in nerve cells**
  - **form the blood brain barrier around capillaries in the brain**
- Oligodendrocytes –
  - **Produce myelin sheath in CNS**
- Mycroglial cells –
  - **Phagocytic – They engulf bacteria, dead cells and other undesireable materials.**
- Ependymal cells –
  - **Produce the cerebrospinal fluid.**

- How and where do ions move as an action potential moves down a nerve cells

E4Q6. Explain what is happening at different points on an action potential diagram for nerves. How and where are ions moving? How does the action potential move down the cell? (122-124)



A. **Resting potential (-70mv). K+ is inside the cell, Na+ is outside the cell.**
B. **Neurotransmitter received at the dedritic end. Na+ gates open by the neurotransmitter receptor site. The membrane potential at that area goes up as Na+ rushes in (diffusion).**
C. **Action potential (+40mv) achieved at site. Na+ gates close, K+ gates open K+ rushes out of cell (diffusion). Membrane potential declines.**
D. **K+ gates close. Na+/K+ pump moves 3 Na+ out of cell for two K+ into cell, per ATP using active transport.**
E. **Resting potential achieved.**

As the membrane potential at the dendritic end which received the neurotransmitter goes up, it causes the membrane potential of the cell membrane around it to go up a little as well. This causes the Na+ gates next to it to open up, and the Na+ in that area will rush into the cell too. This process continues until for the length of the dendrite, then the cell body, and finally the axonal tree (assuming no myelin sheath are present. Where myelin sheath are present the membrane potential jumps from one end of the myelin sheath to the other end causing the gates to open up over there.

- How does a myelin sheath affect the nerve transmission speed
The myelin sheath increases the speed in which the nerve can transmit the signal (approximately 100x faster).

- What does acetylcholine bond to when it crosses the synapse and what does it do? What enzyme is necessary to break down acetylcholine?
Acetylcholine bonds to a Sodium gate which opens allowing sodium to diffuse into the post synaptic neuron. Acetylcholinesterase is the enzyme used to break down the acetylcholine neurotransmitter.

- What do monoamine neurotransmitters bond to when they cross the synapse? How is the secondary messenger CAMP activated and what does it do? What two compounds are necessary to stop a monoamine signal and what do these compounds break down?
Monoamine bonds to a G-Protein receptor site. The G-Protein then activates adenlyate cyclase which converts ATP to cyclic AMP (the secondary messenger

within the cell). The Cyclic AMP activates an enzyme which opens the sodium gates. MAO (Monoamine Oxidase) is required to break down the Monoamine neurotransmitter and C-AMP (Catecholamine-O-Methyltransferase) is used to break down the enzyme which opened the sodium gates.

- Explain how in inhibitory post synaptic potential occurs and how it affects the nerve?
Inhibitory post synaptic potentials reduces the likelihood that the cell will reach action potential. They bring the neuron's membrane potential down from -70mv to -85mv. This can be done either by making the cell membrane more permeable to K+ allowing it to leak out of the cell or by opening Cl- gates which allow Cl- to diffuse into the cell. Both will reduce the cells membrane potential.

- Constrast the following parts of the nervous system: central vs peripheral and somatic vs. visceral
- Contrast efferent and afferent nerves
- Contrast the functions of the sympathetic and parasympathetic nervous system?

Central nervous system – brain and spinal cord
Peripheral nervous system – All of the nerves in the body except for those in the CNS. Comprised of both the somatic nervous system and the visceral (autonomic) nervous system:

- **Somatic – nerves you are aware of**
  - **Afferent – Receives sensory information**
  - **Efferent – Controls the muscles of the body**
- **Visceral –**
  - **Afferent – Sensory information from organs**
  - **Efferent – Controls organ functioning.**
    - **Consists of two subsystems:**
      - **Sympathetic – Flight or Fight**
        - **Increases:**
          - **Heart rate**
          - **Vasoconstriction**
          - **Breathing rate**
          - **Blood flow**
          - **Blood glucose**
        - **Decreases:**
          - **Gut contraction and digestive enzymes released.**
      - **Para-sympathetic**
        - **Decreases:**
          - **Heart rate**
          - **Vasoconstriction**
          - **Breathing rate**
          - **Blood flow**
          - **Blood glucose**
        - **Increases:**

    - **Gut contraction and digestive enzymes released.**

- What does the corpus callosum do?
Connects the two hemispheres of the brain

- What form of memory causes structural changes in the brain?
Long term memory

- What is a reflex arch and where is it processed?
It is processed in the spinal cord, and it is where the sensory nerve signal causes a direct response to be sent down one or more motor neurons.

10. Central nervous system (9 questions)
- Know how the layers of the meninges are arranged (dura matter, arachnoid matter, and pia matter)
Dura mater
- **Just below the cranial bones**
- **Above the brain is split into two layers with the superior sagittal sinus between them.**

Superior sagittal sinus
- **The space between the dural layers superior to the brain.**
- **Filled with venous blood and carries this blood back to the heart via veins.**
- **CSF is moved back into the blood by moving through the arachnoid villi into the superior sagittal sinus.**

Subdural space
- **Very narrow space between the dura mater and the arachnoid mater.**

Arachnoid mater
- **Layer below dura mater**
- **Has arachnoid villi**

Arachnoid villi
- **Lobe like extension of the arachnoid matter that extend into the superior sagittal sinus.**
- **Allow the CSF to be reabsorbed by the blood in the superior sagittal sinus where it is then transported back to the heart.**

Subarachnoid space
- **The space between the arachnoid mater and the pia mater**
- **CSF is found in this space**

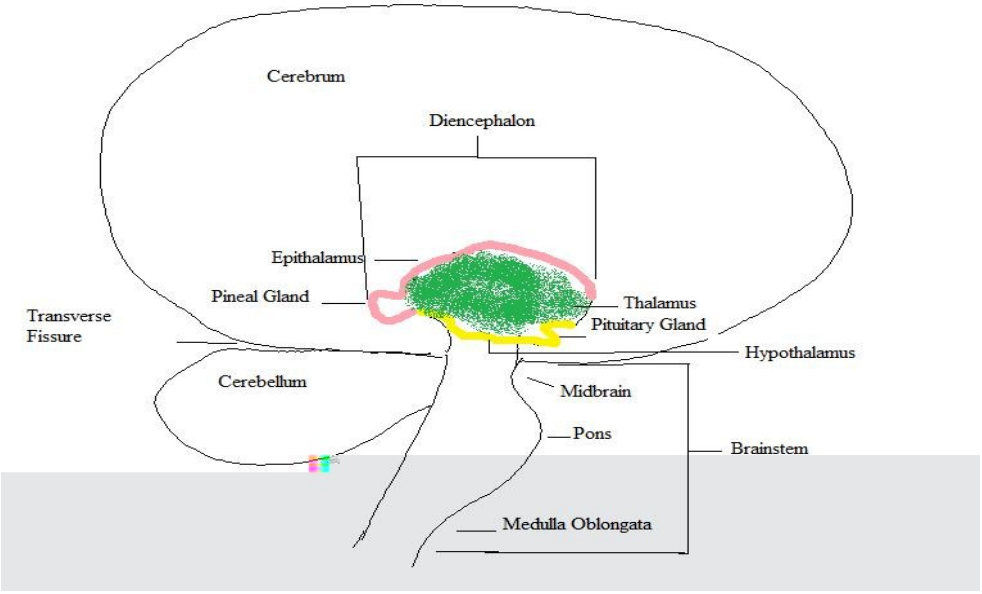
Pia mater
- **Inner most layer of meninges that covers the brain and spinal cord.**

- In what space does cerebrospinal fluid travel around the brain and spinal cord?
Sub-arachnoid sapce

- Where is cerebrospinal fluid produced? What are ventricles, choroids plexuses and ependymal cells?

CSF is made from blood plasma by ependymal cells that line the choroids plexuses of the ventricles of the brain.
The brain has four ventricles or cavities that are filled with CSF. The ventricles have capillary beds in them called Choroid plexuses. These choroids plexuses are lined with ependymal cells which manufacture the CSF.

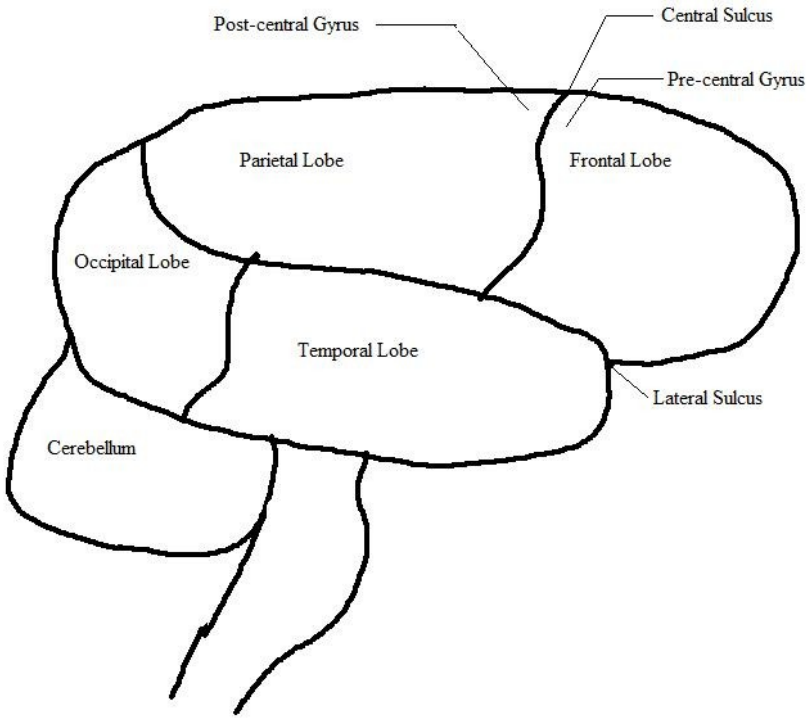
- Know how the following parts of the brain are arranged relative one another (cerebrum, cerebellum, diencephalons, epithalamus, thalamus, hypothalamus, brain stem, midbrain, pons and medulla oblongata)?



- Contrast the terms cortex and medulla?
Cortex – The outer surface of an organ.
Medulla – The middle of an organ.

- What are basal nuclei
Basal nuclei – Masses of unmyelinated nerves found in the medulla of the cerebrum.
Corpus striatum – The main nuclei in the cerebrum which has two parts the caudate nucleus and the lenticular nucleus. The lenticular nucleus has two parts the putamen and globus pallidus.
Caudate nucleus and putamen – control autonomic movements of skeletal muscles that help you maintain balance like swinging your arms while you walk.
Globus pallidus – regulates muscle tone.

- Know the positions of the following parts of the cerebrum relative to one another (frontal lobe, parietal lobe, occipital lobe, temperal lobe, lateral sulcus, central sulcus, precentral gyrus, postcentral gyrus)?



- What are the major functions of the precentral gyrus and postcentral gyrus?

Pre-central gyrus – The gyrus located just in front of the central sulcus on the posterior of the frontal lobe. Has the primary somatic motor area which controls skeletal muscle. (aka motor cortex)

Post-central gyrus – The gyrus locateion just behind the central sulcus on the anterior of the parietal lobe. Has the primary somatosensory area which receives and interprets sensory information. (aka sensory cortex)

- Know the major functions (one or two) of the following parts of the brain (cerebrum, limbic system, basal nuclei, cerebellum, epithalamus, thalamus, brain stem, midbrain, pons, medulla oblongata)?
- What are 5 things the hypothalamus controls?
- Where is the reticular formation and what are its two functions?

Limbic system:

- **Governs emotional aspects of behavior**
- **Controls sensation of pain and pleasure**
- **Involved in memory formation and retrieval**
- **Controls most involuntary aspects of behavior, by linking the cerebral cortex which controls voluntary aspects of behavior with the brain stem which controls involuntary aspects of behavior.**

Basal nuclei – Masses of unmyelinated nerves found in the medulla of the cerebrum.

Corpus striatum – The main nuclei in the cerebrum which has two parts the caudate nucleus and the lenticular nucleus. The lenticular nucleus has two parts the putamen and globus pallidus.
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Globus pallidus – regulates muscle tone.

Cerebellum:
- **Regulate equilibrium and balance**
- **Compares actual with intended movements.**

Epithalamus:
The pineal gland is part of the epithalamus (roof of the third ventricle). It produces melatonin. Melatonin is a hormone that promotes sleep and is involved in setting your daily biological clock.

Thalamus:
- **Formation and retrieval of memories.**
- **Crude sensory perception.**
- **Help waking up from sleep.**

Midbrain:
- **Substantial nigra: Nuclei that regulate and coordinate muscle movements. (degenerate in parkinsons, causing jerky motions.)**
- **Red nucleus: Involved in unconscious movements of skeletal muscle to maintain balance.**
- **Superior colliculus: Involved in reflex movements of the eyes and head in response to visual and other stimuli**
- **Inferior colliculus: Involved in reflex movements of the head and body in response to auditory stimuli**

Pons:
The pneumotaxic and apneustic areas together with the medullary rhythmicity area help regulate breathing.

Medulla Oblongata:
- **Cardiovascular center: rate and force of heart contractions**
- **Medullary Rhythmicity center: Rhythm of breathing, swallowing, vomiting, coughing, sneezing, and hiccupping.**

Hypothalamus:
- **Blood sugar levels**
- **Water balance**
- **Body temperature**

- **Sleep patterns**
- **Hunger sensations**
- **Thirst sensations**
- **Regulates autonomic nervous system**
- **Produces, stores and controls release of hormones**
- **Diurnal rhythm – body clock**
- **Involved in certain emotional responses.**
-

Reticular Formation:

- **Located: runs through the brainstem (midbrain, pons and medulla oblongata).**
- **Regulates muscle tone**
- **Reticular activating system (wakes you up)**

- Contrast cranial nerves and spinal nerves. How many cranial nerves are there?

- **Cranial nerves originate in the brain (12 pair)**
- **Spinal nerves originate from the spinal cord**