**Final Exam Review #4 KEY**

**QUESTIONS – PART A**

1. **A – Na - Remember "Not in Axon"**
2. **B – Axon = "Away" from cell body.**
3. **C - ANS = Autonomic Nervous System = Sympathetic + Parasympathetic. Smooth muscle is found in wall of gut organs (ex. esophagus) and blood vessels.**
4. **A - + 40 mV is a reading after depolarization (Na + ions flooded in)**
5. **B – Think Sympa – FEELT – One "E" is for "NorEpinephine" same as Noradrenalin, which is the neurotransmitter. Epinephine and Andrenalin are the hormone.**
6. **A – Which requires ATP to move the synaptic vesicles over to the pre-synaptic membrane.**
7. **D – First event is sodium gates open and Na+ enters in, this causes upswing (deporization).**
8. **C**
9. **D – All are required to get the job done.**
10. **A – They work to keep the Na+ ion out while pumping K+ back in to help maintain resting potential.**

**SHORT ANSWER – PART A**

1. **A) Cerebellum – Posture, Coordination and Balance.**

**B) Medulla Oblongata – Contains many vital reflex arcs (such as hiccupping, gagging, sneezing) and also regulates breathing, blood pressure and heart rate.**

**C) Corpus Callosum – Consist of nerve tracts that run between both cerebral hemispheres. It allows the hemispheres to share information.**

**D) Cerebrum – Consist of many lobes that deal with interpreting in-coming sensory as well as consciously controlling output motor. Learning, reasoning, motor etc.**

**E) Hypothalamus – Integrating center for homeostasis of hormone levels, thirst, body temperature etc. Works by regulating the Pituitary Gland.**

**F) Thalamus – Acts as a relay station for almost all in-coming sensory input. It will sort this input and send it off to the appropriate areas of the cerebrum.**

1. **See picture below:**

**Motor Neuron:**



**Sensory Neuron:**



**B)**

 **Sensory Receptors initiate action potential when triggered by stimulus.**

**Dendrites receive neurotransmitters and if threshold is reached they will fire and impulse toward the cell body.**

**Cell Body houses nucleus as well as many of the cells organelles.**

**Axon carries impulse away from Cell Body toward synaptic endings.**

**Synaptic endings/Axon bulbs release neurotransmitters to transmit impulse across the synapse.**

1. **The advantage of a reflex arc is that you do not have to wait for the brain to receive and interpret the incoming sensory message and then integrate a response that needs to travel back down to the appropriate effector.**
2. **A) Saltatory Conduction occurs along mylenated nerve fibers. It is about 10X faster rate of impulse because the action potential steps need only happen at the nodes of Ranvier. The impulse can skip from node to node.**



**B) Transmission Across a synapse takes place as follows. When the action potential reaches the axon bulb, the pre-synaptic membrane allows Ca++ ions to enter in. These calcium ions bind onto contractile protein filaments attached onto the synaptic vesicles. The cell will use ATP to drag these vesicles over to the presynaptic membrane. As the synaptic vesicle merges with the pre-synaptic membrane, exocytosis takes place. The neurotransmitter are released into the synaptic cleft. The neurotransmitters will then diffuse across the cleft and land on the appropriate receptors on the post-synaptic membrane. If enough of the proper receptors are triggered, then threshold may be reached. If so, the post-synaptic neuron will fire an action potential.**



1. **To generate an action potential in a nerve cell the following must take place.**
2. **Sodium Gates Open up**
* **Sodium ions move into neuron**
* **Inside of Neuron takes on a +40 mV charge**
* **DEPOLARIZATION is occurring**
1. **Potassium Gates Open up**
* **Potassium Ions move out of neuron**
* **Inside of Neuron takes on a – 65 mV charge**
* **REPOLARIZATION is occurring**
1. **Both sodium and potassium gates shut**

**- Sodium/Potassium pumps turn on**

**- Sodium is pumped back out of neuron, while Potassium is pumped back into Neuron**

**- RECOVERY is taking place**

1. **A and B – See below**



1. **Sympathetic – Think Sympa –FEELT**
* **Ganglion between pre and post-ganglionic motor neurons is found FAR from the effector**
* **Sympathetic system kicks in when body goes into EMERGENCY (Survival) mode**
* **The Sympathetic neurons will release NOR-EPINEPHRINE from their axon bulbs.**
* **The Sympathetic nerves branch off of the LUMBAR and THORACIC regions of the spinal cord.**

**For the Parasympathetic – Think Para-SCANN**

* **Nerves of the parasympathetic division branch off of the SACRAL region of spinal cord or they are CRANIAL nerves that come straight off of the brain.**
* **The parasympathetic neurons will release ACETYLCHOLINE from their axon bulbs.**
* **The Ganglion between the pre-ganglionic neuron and the post-ganglionic neuron is found NEAR the effector.**
* **The parasympathetic runs the body when it is in NORMAL mode.**
1. **Adrenalin (AKA Epinephrine) is produced and released from adrenal glands during times of emergency (when the sympathetic system is activated). It is a hormone that has the same effect as the neurotransmitter Noradrenalin, but it's affects last longer than Noradrenalin.**
2. **During the FIGHT or FLIGHT response when the Sympathetic division kicks in the following affects will be seen:**
3. **Pupils will dilate**
4. **Airways will dilate**
5. **Blood vessels will constrict to raise blood pressure**
6. **Liver will rapidly convert Glycogen into Glucose**
7. **Heart Rate will speed up**
8. **Blood will be shunted to the skeletal muscles**
9. **Digestive processes will be inhibited.**
10. **The Hypothalamus is considered a neuro-endocrine link because it is part of the nervous system and it contains a variety of chemo-receptors to monitor blood chemistry in the body. It also has the ability to make hormones that can direct the Pituitary gland as to what action to take place to correct situations. Therefore helping maintain homeostasis via hormones in the body.**



**QUESTIONS – PART B**

1. **B – HHb is reduced hemoglobin, it will drop its H+ ion off at the lungs as the lungs are cooler and less acidic. Those conditions cause hemoglobin to slightly change shape so that it can no longer hold H+, but it will have the perfect shape to pick up and hold Oxygen to form Oxyhemoglobin (HbO2)**
2. **D – The medulla is constantly checking levels of H+ ion in the blood along with HCO3- Ions (which is the main form of how CO2 is carried in the blood).**
3. **B – Gases just diffuse through cell membranes.**
4. **B – When hemoglobin grabs H+ ions, that will raise the pH of the blood making it less acidic.**
5. **A – During internal respiration. H2O + CO2 🡪 H2CO3 🡪 H+ + HCO3-**
6. **C – Inspiration = Inhalation. This is the result of the Diaphragm contracting and the intercostal muscles contracting to pull the rib cage out and up. Both movements cause the volume of the thoracic cavity to expand which takes pressure off of the lungs.**
7. **C –**
8. **D – Medulla Oblongata with the help of the Pons, help regulate the breathing rate.**
9. **D – Pulmonary Arteries are leaving the right ventricle heading toward the lungs. The blood they carry is deoxygenated so it will be rich in CO2, H+ and HCO3-. Many of the H+ ions will be carried by hemoglobin to form HHb.**
10. **D – External Respiration occurs between the pulmonary capillaries and the alveoli.**

**SHORT ANSWERS – PART B**

1. **A) Mucus is secreted from goblet cells found lining the airways and nasal passages. The mucous acts as a trap. This dirty mucus is then moved up and out of the airways by cilia up to the throat where it can be cleared from the body.**

**B) Bronchioles are the smaller airways that branch off all over the lungs to associate with clusters of alveoli. These airways carry air in and out of the lung tissue. They have muscle built into their walls so that they can change the diameter of these airways. They do not possess cartilage.**

**C)There are two Pleural Membranes, one pleural membrane known as the Visceral Pleural Membrane encases the lungs. The other pleural membrane known as the Parietal Pleural Membrane lines the thoracic cavity. These membranes are vacuum-sealed together. They produce and release serous fluid that acts as a lubricant to prevent inflammation of the tissues as they move against each other.**

1. **A) External Respiration occurs between the Alveoli and the Pulmonary Capillaries.**

**The following reaction will occur at the lungs to free up CO2 and H2O which can then diffuse into the alveoli and then be removed during exhalation. This reaction takes place inside erythrocytes and it runs to the right at the lungs, as the lungs are cooler and the pH is higher (less acidic)**

 **H+ + HCO3- 🡪 H2CO3 🡪 H2O + CO2**

 **Hydrogen Bicarbonate Carbonic Acid Water Carbon Dioxide**

**B) Internal Respiration occurs between the Systemic Capillaries and the Tissue Fluid around the body's cells. The following reaction will occur to help convert the CO2 to a form that can be transported by the blood's plasma. This reaction will again occur inside erythrocytes, and it will run to the right, due to the fact that the bodily tissues are warmer and the pH is lower (more acidic)**

 **H2O + CO2 🡪 H2CO3 🡪 H+ + HCO3 –**

1. **Alveoli have the perfect anatomical features to serve their function. The alveoli are microscopic and very numerous (millions and millions per lung) this helps create more surface area to facilitate diffusion. Alveoli also build their walls so that the wall is only one cell thick, in addition the type of cell used for the alveolar wall is a squamous epithelial cell, which is very flat to further facilitate diffusion. Another key structural feature of alveoli, is that they possess an inner lining of surfactant lipoproteins to help prevent them from collapsing. Alveoli also possess stretch receptors which relay messages to the Medulla to tell it when to stop triggering inspiration, this prevents them from over inflating and bursting.**



1. **When Hemoglobin is in lower pH and warmer environments (such as environments found during internal respiration) it takes on the perfect shape for carrying Carbon Dioxide and Hydrogen Ions.**

**When Hemoglobin is in higher pH and cooler environments (such as the environment around the lungs) it takes on the perfect shape to carry oxygen.**

1. **CO2 is transported as follows:**
2. **Approx 10% is dissolved and carried by blood plasma**
3. **Approx 25% is carried by hemoglobin as Carbaminohemoglobin**
4. **Approx 65% is converted to Bicarbonate ions which can then be carried by blood plasma.**
5. **Hb (hemoglobin) is considered a buffer, because in the right environment it can pick up excess H+ ions and carry them up to the lungs as reduced hemoglobin.**

**HCO3- ions can act as a buffer, because when there are extra H+ ions around, the Bicarbonate ion will pick up a H+ ion and then undergo the reaction below.**

 **H+ + HCO3- 🡪 H2CO3 🡪 H2O + CO2**

 **Hydrogen Bicarbonate Carbonic Acid Water Carbon Dioxide**

1. **When blood levels of CO2 (in the form of Bicarbonate ions) and H+ ions concentrations are high, the Medulla Oblongata will fire a nerve impulse down from the brain. This impulse will travel down the phrenic nerve to the diaphragm causing it to contract. The impulse will also travel down the Intercostal Nerve to the Intercostal muscles causing them to contract. As they contract, they pull the rib cage up and out. Both actions result in increasing the volume of the thoracic cavity. This causes inhalation.**

**After the lungs are full, the alveolar stretch receptors fire an impulse up the Vagus nerve to tell the Medulla to stop firing its impulses. As a result the intercostals and the diaphragm relax and come back to their normal position, which results in an increase in pressure put onto the lungs to cause exhalation.**

1. **See above and see below.**

