HSS 307: Human Physiology

Exam 1 KEY: CORRECT ANSWERS ARE IN RED, EXPLANATIONS ARE IN PARENTHESES

Name___________________________________

For each test item, circle the letter corresponding to a correct response. There may be 0 to 4 correct responses for each item.

1. Homeostasis examples include:
    a. Summing of graded potentials at a neuron (NOT HOMEOSTASIS; GP SUMMATION IS NOT ASSOCIATED WITH MAINTAINING ECF TEMP, COMPOSITION OR VOLUME. INSTEAD IT DETERMINES IF AN ACTION POTENTIAL SHOULD BE SENT, P.180)
    b. Kidney's function on blood (TABLE 1.1: REGULATING BLOOD VOLUME AND ION CONCENTRATIONS)
    c. Increased blood flow to the skin during high heat conditions (P.13, MAINTAINING ECF TEMPERATURE)
    d. The regenerative opening of Na^+ gates during depolarization (P.185 AND FIG.7.15; THIS IS MORE LIKE A POSITIVE FEEDBACK LOOP THAT WORKS TO GREATLY INCREASE Na+ ION CONCENTRATION IN THE NEURON'S ICF)

2. At a neuron's resting membrane potential:
    a. Na^+ ions pass through voltage-gated channels at the same rate that K^+ ions leave the cell (TABLE 7.3; THROUGH LEAK CHANNELS, NOT VOLTAGE-GATED CHANNELS)
    b. K^+ has an electrochemical force equal to but opposite to that of Na^+ (P.178; Na^+'s ELECTROCHEMICAL FORCE IS MUCH HIGHER)
    c. K^+ diffuses out of the cell (DUE TO CONCENTRATION GRADIENT, FIG. 7.8)
    d. Unlike during the depolarization phase of its action potential, K^+ ions flow out of the cell only through leak channels (TABLE 7.3; K^+ IONS FLOW OUT ONLY THROUGH LEAK CHANNELS DURING BOTH RESTING AND DEPOLARIZATION)

3. IPSP's, unlike action potentials in the same presynaptic neuron:
    a. Can be spatially and temporally summed (FIG.8.8)
    b. Can cause hyperpolarization in the post-synaptic neuron (P.204-5 AND FIG.8.8; IPSP's IN THE PRESYNAPTIC NEURON WILL INHIBIT AN AP WHICH WILL LEAD TO NO REACTION IN THE POST-SYNAPTIC NEURON. ONLY AP'S CAN CAUSE HYPERPOLARIZATION IN THIS SCENARIO)
    c. Propagate only via electrotonic conduction (P.189-90; IPSP'S, WHICH ARE GRADED POTENTIALS, CAN ONLY TRAVEL VIA ELECTROTONIC CONDUCTION. AP's TRAVEL VIA ELECTROTONIC IN UMYELINATED AXONS AND VIA SALTATORY CONDUCTION IN MYELINATED AXONS)

   d. Are decremental in strength (P.181 AND FIG.7.11; EPSP'S, WHICH ARE GRADED POTENTIALS, ARE DECREMENTAL AS THE SIGNAL MOVES FROM THE STIMULUS SITE. AP's ARE ALL-OR-NONE)

4. The depolarization phase of an action potential:
   a. In an inhibitory neuron, can be achieved by summing enough IPSP's at the neuron's axon hillock (P.202; CAN'T POSSIBLY HAPPEN WITH ONLY IPSP's – WHICH ONLY HYPERPOLARIZE)
   b. Is caused, in part, by K^+ moving down its electrochemical gradient out of the cell via voltage gates (TABLE 7.3; DURING DEPOLARIZATION, K^+ VOLTAGE GATES ARE CLOSED)
   c. Is a phase during which time another action potential could be generated as long as the stimulus is strong enough (FIG.7.17; DEPOLARIZATION OCCURS DURING THE ABSOLUTE REFRACTORY PERIOD – THE TIME DURING WHICH NO ACTION POTENTIAL IS POSSIBLE NO MATTER WHAT)
   d. Causes a large change in the Na^+ concentration in the neuron's intracellular fluid (P.183; NUMBER OF IONS THAT MOVE ACROSS THE MEMBRANE DURING THIS PHASE IS STILL RATHER SMALL RELATIVE TO THE TOTAL NUMBER OF Na^+ IONS IN THE INTRACELLULAR AND EXTRACELLULAR FLUIDS)

5. Presynaptic facilitation and presynaptic inhibition share the following similarities:
   a. Requires an action potential from the presynaptic neuron (FIG.8.9; THIS IS THE ONLY WAY NEURONS CAN COMMUNICATE WITH EACH OTHER)
   b. Requires two neurons each synapsing with the same post-synaptic neuron (FIG.8.9; ONLY ONE SYNAPSES WITH THE POST-SYNAPTIC NEURON IN THIS TYPE OF AXOAXONIC ARRANGEMENT)
   c. Requires summation of graded potentials in the post-synaptic neuron at the axoaxonic synapse (FIG.8.9; THERE ARE NO GRADED POTENTIALS AT THE POST-SYNAPTIC SIDE OF AN AXOAXONIC SYNAPSE – ONLY CHANGES IN CALCIUM GATING THAT AFFECTS HOW MUCH NEUROTRANSMITTER IS RELEASED FROM THE POST-SYNAPTIC NEURON)
   d. Causes an action potential in the post-synaptic neuron (FIG.8.9; NOT IN THE CASE OF PRESYNAPTIC INHIBITION, WHICH CAN SERVE TO PROHIBIT AN ACTION POTENTIAL)

6. The pupillary light reflex can be classified as (P.236 AND 239; NEARLY VERBATIM FOR ALL):
   a. Somatic (AUTONOMIC SINCE EFFERENTS ARE GOING TO SMOOTH MUSCLE OF IRIS)
   b. Cranial (TABLE 9.3)
   c. Efferent (FIG.9.18; ALL REFLEXES HAVE AFFERENT AND EFFERENT ACTIVITIES)
   d. Peripheral (FIG.9.18; ALL REFLEXES RECEIVE FROM AND SEND EFFERENT SIGNALS TO THE PERIPHERAL NERVOUS SYSTEM)

7. In sensory coding:
    a. Lateral inhibition can be used to increase stimulus strength acuity (P.259; LATERAL INHIBITION IMPROVES LOCALIZATION ACUITY)
    b. Strength is coded by the magnitude of the first order neuron's action potentials (P.258; BY FREQUENCY, NOT MAGNITUDE OF ACTION POTENTIALS)
    c. Very high somatosensory localization acuity is associated with larger corresponding mapping on the sensory homunculi (P.231 AND FIG.9.15; SUCH ACUITY AS IS FOUND IN THE LIPS CORRESPONDS TO A LARGE MAPPED AREA ON THE SENSORY HOMUNCULI)
    d. Localization acuity for touch is generally less in the sole of the foot than in the big toe (TABLE 10.2, SMALLER NUMBER MEANS HIGHER ACUITY)

8. In emmetropia, unlike hyperopia:
    a. Distant objects can be clearly focused without correction and without accommodation (FIG.10.27; DISTANT OBJECTS REQUIRE ACCOMMODATION IN HYPEROPIA WITHOUT CORRECTION)
    b. For focused vision, near objects generally require accommodation (FIG.10.27; ACCOMMODATION REQUIRED FOR BOTH; WITH HYPEROPIA, IT MUST BE CORRECTED)
    c. The lens has enough accommodating capacity without correction to focus near objects (FIG.10.27; HYPEROPIA WITHOUT CORRECTION DOES NOT HAVE ENOUGH ACCOMMODATING CAPACITY TO CONVERGE LIGHT RAYS FROM NEAR OBJECTS)
    d. The eyeball length is generally long enough to focus near objects without correction (FIG.10.27; WITH HYPEROPIA, THE EYEBALL LENGTH IS TOO SHORT FOR THE POORER ACCOMMODATING POWER OF THE LENS)

9. In the process of sound transduction:
    a. Higher pitch sounds translate into higher frequency of action potentials in the afferent neuron (P.290; HIGH PITCH = HI FREQUENCY OF SOUND WAVES; LOUDER SOUND TRANSLATES INTO HIGHER FREQUENCY OF ACTION POTENTIALS IN THE AFFERENT NEURON)
    b. The hair cells within the inner ear are classified as mechanoreceptors (TABLE 10.1)
    c. Louder sounds will deflect the tectorial membrane more (FIG. 10.41 AND P.290; LOUD SOUNDS YIELD LARGER AMPLITUDE WAVES WHICH WILL DEFLECT THE TECTORIAL MEMBRANE MORE)
    d. High frequency sounds will cause deflection of the tectorial membrane closer to the oval window (FIG.10.41)