Exam 3  Version A
Zoology 250, Fall 2002

Please SIGN your name here if you would like me to post your grade by the last five digits of your social security number ________________

Short Answer/Terminology (1 pt each except where noted, 31 pts total)

1. In terms of the major parts of their structure, neurons receive information at the ________, send information out along the ________, and perform basic cell maintenance functions in the _________.
   (3 pts)

2. In the table below, check one box on each row to indicate whether the cellular response, experimental result described, or name of the hormone best fits under 'steroid' or 'protein' hormone (1 pt ea., 6 pts total)

<table>
<thead>
<tr>
<th>Characteristic, Action, or name</th>
<th>Steroid</th>
<th>Protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example: spelled 'steroid'</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Hormone binding alters the activity of Phospholipase C</td>
<td></td>
<td></td>
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<tr>
<td>Actions are blocked by a toxin that impairs ribosome function</td>
<td></td>
<td></td>
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<tr>
<td>Pertussin toxin, a stimulator of G-protein function, mimics the hormone's action</td>
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<tr>
<td>Hormone can bioaccumulate in adipose tissue (i.e., fat cells)</td>
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<tr>
<td>Hormone is released into the hypothalamo-pituitary portal system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Progesterone</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. What is meant by negative feedback regulation of a hormonal system? (1 pt) Give a brief example that operates in a mammal (2 pts). You may use a diagram for the second part of the question if you wish. (3 pts total for this question)

4. If you were to count individual cells in your brain, what would be the most common type of cell? (use the general term for this type of cell here)
5. What is the key difference between excitable and non-excitable cells in your body? (answer by naming a class of proteins)

Questions 6 through 14 refer to the electrical recording from a single neuron over a few milliseconds shown below:

6. The membrane voltage difference the neuron is showing at point A is referred to specifically as the ________________

7. If you characterized the movement of ions across the membrane at point A, which specific ion would you find was showing the greatest rate of diffusion across the neuron membrane and in which direction would the net movement of this ion type be (i.e., would it be moving into or out of the neuron)? (2 pts total here)

8. Which specific protein is critical for maintaining the neuron in the state shown at point A? (hint: this protein uses ATP).

9. Assume the neuron receives input from another neuron in the form of an Excitatory Post-Synaptic Potential (an EPSP) and indicate on the X-axis approximately where this stimulus is received (put an upwards pointing arrow (↑) at the appropriate place on the X-axis on the figure above to answer here).

10. The level of membrane voltage difference shown by the dashed line (the arrows from 'F' are pointing to it) is referred to specifically as the:
11. What is the important change in the neuron in activity/permeability as the membrane voltage difference approaches and crosses the dashed line? (1 pt) What **very specific** structure accounts for this change in ion channel permeability? (1 pt, 2 pts total for question 11)

12. Why specifically does the rapid upwards sweep in membrane voltage difference shown at point C represent positive feedback? (2 pts)

13. Three things/changes we talked about act to limit the upwards sweep of the membrane voltage difference (shown at point 'D' in the diagram). List two of these three that are occurring around point 'D' on the figure (2 pts).

14. If you characterized the movement of ions across the membrane at point E, i) **which** specific ion would you find was showing the greatest movement across the neuron membrane, ii) **which direction** would this ion be moving in (i.e., would it be moving into or out of the neuron), and iii) **which specific** protein is primarily responsible for allowing movement of this ion at point E? (3 pts)

15. You have isolated a compound from the brain of your study organism and hypothesize that it is a new neurotransmitter. List two things (of three possible that we discussed) that you would need to demonstrate to convince other neuroscientists that you had indeed discovered a new neurotransmitter (2 pts total for this question).
Multiple Choice Questions (1 pt each)

1. I am writing Exam Version _____
   a) A
   b) B

2. Identifying endocrine disrupting compounds is relatively straightforward because they show strong chemical similarities to natural estrogens and androgens.
   a) This statement is true
   b) This statement is false

3. In a condition termed androgen-insensitivity syndrome, individuals have an XY genotype, but have a female external phenotype. This condition results from a faulty copy of the androgen receptor gene. This real-life medical example illustrates what basic feature of mammalian sexual development?
   a) External sexual phenotype development is controlled entirely by which sex chromosomes an individual inherits at fertilization.
   b) External sexual phenotype development in mammals can be characterized mainly as active feminization of an essentially 'default' male phenotype.
   c) External sexual phenotype development in mammals can be characterized mainly as active masculinization of an essentially 'default' female phenotype.
   d) External sexual phenotype development is controlled by the external environment.

4. Which of the following is not a tropic hormone?
   a) Gonadotropin releasing hormone
   b) Thyroid stimulating hormone
   c) progesterone
   d) Corticotropin releasing hormone
   e) B and D

5. In your body, _______ reduces blood levels of glucose while _________ acts to increase blood levels of glucose.
   a) insulin, glucagon
   b) glucagon, insulin
   c) insulin, GnRH
   d) glucagon, vasopressin
   e) none of the above
6. Sex is determined at fertilization in all animals by the chromosomal contributions of the mother and father.
   a) This statement is true
   b) This statement is false

7. What accounts for the white part of the spinal cord appearing white? (i.e., if we removed this part the tissue would no longer appear white)
   a) the lack of blood to these cells
   b) the axon
   c) the cell bodies
   d) myelination

8. You would find 'white matter' in the central nervous system of a crayfish similar to that found in your spinal cord.
   a) This statement is true
   b) This statement is false

9. The basic model for how the nervous system works is input, integration, output. At the level of the system the input is the
   a) motor neuron
   b) sensory neuron
   c) interneuron
   d) skeletal muscle

10. A neurotransmitter that changed the voltage difference across the membrane in a post-synaptic cell from -70 mV to -60 mV would be said to be ___________ and likely act by opening ___________ channels
    a) hyperpolatizing, potassium
    b) hyperpolarizing, sodium
    c) hyperpolarizing, chloride
    d) depolarizing, potassium
    e) depolarizing, sodium

11. The part of a neuron that has neurotransmitter-gated channels (channels that are opened in response to neurotransmitter binding) on it.
    a) Schwann cell
    b) dendrites
    c) axon
    d) synaptic knob (end of the axon)
12. Administration of a large amount of potassium to a person can be life threatening. At the level of individual neurons, what would you predict the effect of raising the concentration of potassium in the extracellular space would be (i.e., increasing potassium outside the neuron)?
   a) hyperpolarization
   b) depolarization
   c) no change

13. Which of the following is critical for generating an action potential.
   a) neurotransmitter-gated channels
   b) voltage-gated calcium channel
   c) Schwann cell
   d) voltage-gated sodium channel
   e) A and C are correct

14. Thanksgiving comes up in a couple of weeks and most people will sit down for a big meal that will induce a very calm, almost sleepy state afterwards. Under these conditions, the ________ division of the ________ nervous system is the major influence on basic bodily functions.
   a) parasympathetic, autonomic
   b) sympathetic, autonomic
   c) sympathetic, vestibular
   d) parasympathetic, vestibular
   e) sympathetic, central

15. The basic brain division considered the ‘seat of intelligence’ in humans:
   a) myelencephalon
   b) metencephalon
   c) mesencephalon
   d) diencephalon
   e) telencephalon

Bonus: What special embryonic cell type most contributes to increasing action potential conduction speed in your nervous system? (1 pt)