Biology 201-Worksheet on Nervous System
(Answers are in your power point outlines—there is no key!)

1. The study of the normal functioning and disorders of the nervous system is called: __________________________

2. Name 4 functions of the nervous system. __________________________
   __________________________
   __________________________
   __________________________

3. Distinguish between threshold and subthreshold stimuli. __________________________
   __________________________

4. What does CNS stand for? Name the two parts that make it up. __________________________
   __________________________

5. Identify the kind of neuron based on the description provided.
   a. Neuron that carries AP's towards the CNS. __________________________
   b. Neuron that carries AP’s away from the CNS. __________________________
   c. Neurons that allow communication between the incoming and outgoing information in the CNS. __________________________

6. Structures that detect stimuli are called: __________________________

7. Examples of effectors in the body are: __________________________ and __________________________

8. What does PNS stand for? What is it composed of? __________________________
   __________________________

9. What are the two main divisions of the nervous system? __________________________

10. What are the two main divisions of the PNS? __________________________

11. What are the two main divisions of the Efferent (Motor) System? __________________________

12. For question 11, what are the effector structures that each of these divisions innervates? __________________________

13. What are the two main divisions of the Afferent (Sensory) System? __________________________

14. For question 13, where are the sensory structures for each of these divisions? __________________________

15. What are the two subdivisions of the Autonomic NS? __________________________

16. Give a general function for each of the two subdivisions in question 15. __________________________

17. Name two kinds of nerve cells. __________________________

18. Identify the kind of neuroglial cell based on the information provided.
   a. Myelinate axons in CNS only. __________________________
   b. Star-shaped cells important in blood-brain barrier. __________________________
   c. Origin from monocytes; CNS only. __________________________
   d. Ciliated cuboidal epithelium lining cavities of spinal cord and brain. __________________________
e. Surround neurons cell bodies of PNS.  
f. Myelinate axons in PNS only.  
g. Increase velocity of AP’s in PNS.  
h. Increase velocity of AP’s in CNS.  

19. Collection of Schwann cells that cover axon is called the:  

20. Spaces between Schwann cells and Oligodendrocytes are called:  

21. Describe the physical relationship between Schwann cells and Oligodendrocytes to their axons.  

22. Axons that have a myelin sheath are said to be:  

23. Axons that lack a myelin sheath are said to be:  

24. What substance makes the myelin sheath white?  

25. What is the white material in your nervous system collectively called?  

26. What is the gray material in your nervous system collectively called?  

27. What is multiple sclerosis?  

28. What is a glioma?  

29. What is Tay-Sachs disease?  

30. A neuron has two main divisions; they are:  

31. A neuron has two kinds of processes; they are:  

32. Write a description of the cell body.  

33. A group of cell bodies outside the CNS is called a(n):  

34. A group of cell bodies inside the CNS is called a(n):  

35. Write a description of a dendrite.  

36. Write a description of an axon.  

37. A group of nerve fibers outside the CNS is a(n):  

38. A group of nerve fibers inside the CNS is a(n):  

39. Describe the differences among: axon hillock, axon collateral, axon terminal, and synaptic end bulb.  

40. What is a neurotransmitter? Where are they found?  

41. What would you name the plasma membrane of an axon?  

42. What would you name the cytoplasm of an axon?  

43. What is axonal transport?  

44. Distinguish between anterograde and retrograde axonal transport.  

45. What is the function of slow axonal transport?  

46. Identify the kind of neuron based on the information provided.  
   a. Single process off cell body.  
   b. Conduct AP’s from receptors to the CNS.  
   c. Found in the retina, inner ear, and olfactory areas.  
   d. Many dendrites and one axon coming off soma (cell body).  
   e. Conduct AP’s from the CNS to effectors.  
   f. Confined to CNS; connects sensory with motor neurons.
47. Identify the neuron/nerve coverings based on the information provided.
   a. Connective tissue sheath that surrounds each fascicle.
   b. Connective tissue sheath that surrounds whole nerve.
   c. Connective tissue sheath that surrounds each nerve fiber.

48. List 3 factors that are responsible for the resting potential.

49. Write a definition for the resting potential.

50. Answer the following questions about the resting potential (RP).
   a. What is the approximate charge on the outside of the axon?
   b. What is the approximate charge on the inside of the axon?
   c. On what side of the axolemma is Na\(^+\) in highest concentration?
   d. On what side of the axolemma is K\(^+\) in highest concentration?
   e. What kind of channels control Na\(^+\) entry/exit?
   f. What kind of channels control K\(^+\) entry/exit?
   g. Which direction does Na\(^+\) move when its channels are open?
   h. Which direction does K\(^+\) move when its channels are open?
   i. What structure moves Na\(^+\) and K\(^+\) against their concentration gradients?
   j. What is the condition of the Na\(^+\) channel during the RP?
   k. What is the condition of the K\(^+\) channels during the RP?
   l. What happens as a result of the different conditions for these two channels?
   m. What are anions and where are they located?
   n. What is the key component that drives the formation of the RP? (Choose from one of the 3 listed in question 48. Why?)

51. Answer the following questions about the action potential (AP).
   a. Where does the AP start?
   b. Why does it start there and not somewhere else?
   c. What kind of gated channels line the axon?
   d. A threshold stimulus causes which channels to open?
   e. During depolarization, which ion moves and what direction (in or out) does it move?
   f. What event causes the depolarization event to spread out from its point of origin?
   g. What happens to the Na/K pump during an AP?
   h. What happens to the inside membrane polarity after depolarization?
   i. Why does the next Na\(^+\) gated channel open after the previous channel opened?
   j. What are the two main phases of an AP?
   k. As the internal voltage approaches 30 mV, what happens next?
   l. During repolarization, what ion moves and in what direction (in or out)?
   m. How do Na\(^+\) and K\(^+\) channels differ with regard to length of time they are open?
   n. What causes hyperpolarization?
   o. What membrane protein is important in restoring the disrupted ion balance?
   p. How far does the AP travel on an axon?
   q. What are Na\(^+\) gated channels doing in response to a subthreshold stimulus?
52. Draw a graph of an AP in the space provided. Be sure to label axes and units on each axis. You should also be able to label depolarization, repolarization, hyperpolarization, threshold, and resting potential.

53. The time period when a threshold stimulus cannot initiate a second AP is referred to as: __________________________

54. The time during which not even a suprathreshold stimulus can trigger an AP is the: __________________________

55. The time period during which only a suprathreshold stimulus can trigger an AP is the: __________________________

56. What is the advantage of having a refractory period in neurons? __________________________

57. Why do myelinated axons have faster AP’s than unmyelinated ones? __________________________

58. Besides increased speed, what is another advantage of axons being myelinated? __________________________

59. What is the disadvantage of axons being myelinated? __________________________

60. The speed of an AP is not affected by the ______________ of a stimulus.

61. What 3 factors affect the speed of an AP and why?
   Factor 1: __________________________
   Factor 2: __________________________
   Factor 3: __________________________

62. Identify the type of nerve fiber based on the information provided.
   a. Lightly myelinated and medium diameter. __________________________
   b. Unmyelinated. __________________________
   c. White matter of CNS and preganglionic fibers of ANS. __________________________
   d. Speeds over 100 m/sec. __________________________
   e. Heavily myelinated and large diameter. __________________________
   f. Gray matter of CNS and postganglionic neurons of ANS. __________________________
   g. Somatic afferent and somatic efferent neurons. __________________________

63. What is a synapse? __________________________

64. Identify with a description or definition the following:
   a. presynaptic neuron __________________________
   b. postsynaptic neuron __________________________
   c. presynaptic membrane __________________________
   d. postsynaptic membrane __________________________
65. List 4 functions for a synapse.

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_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________

66. How are chemical and electrical synapses different?

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_________________________________________________________________________

67. Distinguish among axodendritic, axonsomatic, and axoaxonic synapses.

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_________________________________________________________________________
_________________________________________________________________________

68. Answer the following questions about neurotransmitters (NT).
   a. Most NT’s are made by neurons from: ________________________________
   b. NT’s are stored in: _______________________________________________
   c. NT’s are released in response to an influx of: _________________________
   d. NT’s are released from the presynaptic membrane by the process of:
       ________________________________________________________________
   e. NT’s move across the synaptic cleft by the process of:
       ________________________________________________________________
   f. What kind of gated channel awaits a NT? __________________________

69. List and describe the 3 kinds of gated channels (in terms of what they are sensitive to).
   GC 1 __________________________________________________________________
   GC 2 __________________________________________________________________
   GC 3 __________________________________________________________________

70. What kind of action (inhibitory or excitatory) will occur in the postsynaptic neuron if the NT binds to and opens a(n):
   a. Na+ GC __________________________________________________________
   b. K + GC __________________________________________________________
   c. Na+ and K + GC __________________________________________________
   d. Cl – GC _________________________________________________________

71. What is it called (EPSP or IPSP) when these channels are opened?
   a. Na+ GC __________________________________________________________
   b. K + GC __________________________________________________________
   c. Na+ and K + GC __________________________________________________
   d. Cl – GC _________________________________________________________

72. Draw a graph with properly labeled axes showing the RP, threshold, EPSP, and IPSP.

73. Define EPSP. ________________________________________________________

74. Can a single AP initiate another AP in the postsynaptic neuron? ____________
75. List 3 NT’s that generate EPSP’s: ____________________________________________________

76. What is and what causes synaptic delay? _____________________________________________

77. What is and what causes synaptic fatigue? _____________________________________________

78. Define IPSP. ____________________________________________________________________

79. List 2 NT’s that generate IPSPs.

80. When a postsynaptic neuron is brought closer to threshold, it is said to be ____________________.

81. Distinguish between temporal and spatial summations. ________________________________

82. Integration is the sum of: ____________________________________________________________________

83. If the number of EPSPs is greater than the number of IPSPs and the sum is less than threshold, what happens in the postsynaptic neuron? ____________________________________________________________________

84. If the number of EPSPs is greater than the number of IPSPs and the sum is greater than threshold, what happens in the postsynaptic neuron? ____________________________________________________________________

85. If the number of IPSPs is greater than the number of EPSPs, what happens in the postsynaptic neuron? ____________________________________________________________________

86. What is integration? ____________________________________________________________________

87. Answer the questions below regarding neurotransmitters (NT).

   a. Most NTs are made from: ____________________________________________________________________

   b. ACh is made from: ____________________________________________________________________

   c. Give 3 examples of catecholemines. ____________________________________________________________________

   d. This NT is released at all myoneural junctions involving skeletal muscle. ____________________________________________________________________

   e. ACh is released in units called: ____________________________________________________________________

   f. ACh is almost always excitatory except in: ____________________________________________________________________

   g. This is the most common inhibitory NT in the brain: ____________________________________________________________________

   h. This NT is released in many brain areas including the substantia nigra of the midbrain. ____________________________________________________________________

   i. This NT is released at some myoneural and neuroglandular junctions associated with the ANS; it is excitatory for arousal, mood, and dreaming. ____________________________________________________________________

   j. Valium opens these kind of receptors: ____________________________________________________________________

   k. Curare is a competitive inhibitor with this NT: ____________________________________________________________________

   l. This inhibitory NT is most common in spinal cord, but is also found in the brain and retina. ____________________________________________________________________

   m. Nicotine activates these kind of receptors? ____________________________________________________________________

   n. Nicotine makes the RP more/less negative? ____________________________________________________________________

   o. Strychnine blocks these kind of receptors? ____________________________________________________________________

   p. Huntington’s chorea is caused by the destruction of these kind secretory neurons? ____________________________________________________________________

   q. Nerve gases and organophosphate pesticides produce their effects by inactivating this enzyme? ____________________________________________________________________

   r. Amphetamines are chemical mimics of this NT. ____________________________________________________________________

   s. This NT is important in mood elevation; also involuntary control of skeletal muscles. ____________________________________________________________________

   t. Destruction of neurons that secrete this NT are a primary cause of Parkinson’s disease. ____________________________________________________________________

   u. Lowered levels of this NT often associated with chronic depression; especially in women. ____________________________________________________________________

   v. Prozac, Paxil, and Zoloft inhibit reuptake of this NT? ____________________________________________________________________

   w. Chains of 2 to 40 amino acids that modify actions of NT’s. ____________________________________________________________________

   x. Raising the number of receptors in response to a deficiency of a NT is called: ____________________________________________________________________

   y. Lowering the number of receptors in response to an excess of a NT is called: ____________________________________________________________________
88. Describe the process of neuron regeneration in the PNS.

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____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

89. What are the problems with a repaired PNS axon?

90. Why is it more difficult to repair axons in the CNS than PNS?

____________________________________________________________________________________

____________________________________________________________________________________

91. Sensory neurons are often organized into:

92. Motor neurons are organized into:

93. Interneurons are organized into:

94. Define neuronal pool.

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

95. Identify the kind of neuronal pool based on the information provided.
   a. Several presynaptic neurons synapse on the same postsynaptic neuron giving strong excitation or inhibition.
   b. Input neuron stimulates several pathways which stimulate the output neuron to go on firing for a longer time after input has truly stopped.
   c. On presynaptic neuron synapses on 2 or 3 postsynaptic neurons and these postsynaptic neurons (now presynaptic) synapse on another 2 or 3 postsynaptic neurons.
   d. Neurons stimulate each other in a linear sequence but one cell restimulates the first cell (presynaptic neuron) to start the process all over again.
   e. This neuron pool is common in the withdrawal reflex.
   f. Diaphragm and rib muscles both under subconscious control, but can be consciously overridden when holding your breath.
   g. Pain information spreads quickly into multiple areas of CNS.
   h. Major type pathway in short-term memory.

96. Describe the symptoms, diagnostic anatomy, and cause of Alzheimer’s disease.

____________________________________________________________________________________

____________________________________________________________________________________

97. What does the term neurofibrillary tangles refer to?

____________________________________________________________________________________

98. What kind of neurons degenerate in Parkinson’s patients?

____________________________________________________________________________________

99. Describe, with an example, how the deficiency of a NT causes the symptoms of Parkinson’s disease.

____________________________________________________________________________________

____________________________________________________________________________________

100. What are some treatments for Parkinson’s disease?

____________________________________________________________________________________