**Review Worksheet ANSWERS: Synapses and Neurotransmitters**

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1: What are neurotransmitters?

(3 marks)

*Neurotransmitters are chemicals (0.5) released into the synaptic cleft (0.5) by the presynaptic axon terminal (0.5). They move across the synaptic cleft and bind to receptors on the postsynaptic membrane (0.5) and cause either excitation (0.5) or inhibition (0.5).*

2: List two common neurotransmitters

(2 marks)

*The two most common ones that we talk about in Human Bio are*

* *Acetylcholine (ACh) (1)*
* *Noradrenalin (NAdr) (1)*

*Give yourself marks for any two that are listed in your notes though.*

3: What is stored in the vesicles at the axon terminals?

(1 mark)

*Neurotransmitters are stored in the vesicles (1)*

4: a) What ion stimulates the movement of vesicles to the pre-synaptic membrane and the release

of their contents?

(1 mark)

*Calcium ion / Ca2+*

b) What process occurs to make the ion enter the axon terminal?

(4 marks)

*The AP in the presynaptic neuron (1) reaches the axon terminal (1). This triggers the opening of Ca2+ channels in the membrane (1) allowing it to enter the cell (1).*

5: How does the neurotransmitter (NT) move across the synaptic cleft?

(1 mark)

*The NT diffuses (1) across the synaptic cleft.*

6: What does the neurotransmitter do when it reaches the post-synaptic membrane, and what is the result?

(6 marks)

*The NT binds to receptors (1) on the post-synaptic membrane (1), causing changes to ion channels (1) that then either causes depolarisation and a new AP (1) or causes inhibition (1), preventing or slowing further APs (1)*

7: What happens to the neurotransmitter after the process is finished?

(2 marks)

*The NT is either reabsorbed by the presynaptic axon terminal (1) or is broken down and removed (1)*

8: a) When an inhibitory neurotransmitter binds to the post-synaptic receptors, what happens?

(6 marks)

*It causes either K+ gates to open (1), allowing K+ to move out of the post-synaptic neuron (1), or it causes Cl- gates to open (1) causing Cl- to move in to the post-synaptic neuron (1). In both cases, the membrane potential becomes increasingly negative (hyperpolarisation) (1), meaning that it is harder to reach the threshold for a new AP to be generated. (1)*

b) What does this mean for the speed of transmission?

(1 mark)

*It will be slowed (0.5) or stopped (0.5)*

9: List two similarities and two differences between a synapse and a neuromuscular junction

(4 marks)

*Similarities: (1 mark each for any two of:)*

* *Excitable cells separated by synaptic cleft*
* *Axon terminals store and release neurotransmitter*
* *Binding of NT to receptors on the post-synaptic membrane opens ion channels, altering membrane potential.*

*Differences: (1 mark each for:)*

* *Synapse joins two neurons, NMJ joins neuron and muscle fibre*
* *Synapse can excite or inhibit, NMJ can only inhibit*

10: Snail bait contains an organophosphate that prevents breakdown of Acetylcholine at the neuromuscular junction. What symptoms would you expect a dog that has eaten snail bait to exhibit, based on this information?\*

(4 marks)

*You would expect repeated muscle contractions/muscle twitching (1). A muscle contraction would be generated by the ACh binding on the post-synaptic membrane of the muscle fibre (1). Because the ACh is not broken down (1), it would continue to stimulate the post-synaptic membrane (1) after each refractory period, causing repeated contractions.*