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MODULE 0230725: CELLULAR AND MOLECULAR NEUROSCIENCE

Part i: Short answer questions

Answer all questions in the spaces provided.

1. Draw a diagram to illustrate the molecular structure of the mammalian sodium channel. (8 marks)

The space above this line should be sufficient for your answer

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2. Briefly outline THREE functions of astrocytes in the CNS. (9 marks)

(i)

(ii)

(iii)

3. a) Draw and label a diagram to show how oligodendrocytes ensheath axons in the CNS with a myelin sheath as observed in electron micrographs. On your diagram indicate the location of myelin basic protein and proteolipid protein and other relevant detail. (4 marks)

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b) Outline TWO characteristics that would allow you to distinguish between oligodendrocyte precursor cells and mature oligodendrocytes. (2 marks)

(i)

(ii)

c) Explain what is meant by 'molecular mimicry' in relation to demyelination in Multiple Sclerosis. (3 marks)

4. a) Give three behavioural symptoms of Alzheimer's disease. (3 marks)

(i)

(ii)

(iii)

b) Give three neuroanatomical features of Alzheimer's disease. (3 marks)

(i)

(ii)

(iii)

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- c) Outline the function of the presenilin gene product. (4 marks)
- d) Name a cholinergic drug used in Alzheimer's disease. (1 mark)
- e) Give three of the main reasons why cholinergic therapy is used to treat Alzheimer's disease. (3 marks)
- (i)
 - (ii)
 - (iii)

The space above this line should be sufficient for your answer

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Part ii: Essay questions

Write your essay in the answer book provided.

EITHER

- a) Discuss the function and workings of metabotropic receptors in the CNS.

OR

- b) Hippocampal neurons are dissociated and placed in culture for 15 days. After 10 days in culture, the neurons are then transfected with a construct that allows the expression of an inwardly rectifying potassium channel in a small number of the neuronal cells. The potassium channel acts to eliminate action potentials and 'silences' the cells in which it is expressed.

You suspect that over time, the synaptic connections between the potassium channel expressing cells and untransfected neurons may be modified compared to connections between untransfected neurons. What physiological parameters would you record? What morphological parameters would you quantify? Employing the Homeostasis Hypothesis, what physiological and morphological parameters would you predict would change and why?