

**The University of Melbourne**

**Semester One Assessment 2003**

**Department:** Anatomy and Cell Biology  
**Subject Number:** 516-306  
**Subject Title:** Developmental Neurobiology

**Exam Duration:** 2 hours

**Reading Time:** 15 minutes

**This paper has 3 pages**

**Authorized materials:**

None allowed.

**Instructions to Invigilators:**

Script Books: 1 x 14 page.  
Exam paper may be removed from the exam room.

**Instructions to Students:**

Answer ALL 6 questions.  
**Some questions have multiple parts. Answer ALL parts of each question.**  
ALL questions have equal value.  
DIAGRAMS should be used wherever possible.

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**QUESTION 1:**

Discuss the cellular and molecular mechanisms that underlie dorso-ventral patterning in the vertebrate neural tube. Include in your answer some of the experimental evidence that the notochord and the protein Sonic Hedgehog are involved in this process.

(20 minutes)

**QUESTION 2:**

Answer all parts a), b) and c) of this question

- a) Dorsal root ganglia are segmental. Outline the evidence supporting the idea that signals originating from the somites are critical for the segmental organization of dorsal root ganglia.
- b) Neural crest cells in the hindbrain move in three streams. Describe the relationship between the three migratory streams of neural crest cells and the segmentation of the hindbrain into rhombomeres.

(10 minutes)

AND

- c) Present some of the evidence that neurogenesis takes place in at least two regions of the adult mammalian brain.

(10 minutes)

**QUESTION 3:**

Answer both parts a) and b) of this question

- a) Outline a model for how cell adhesion molecules could affect the behaviour of the growth cone and present some of the experimental evidence supporting the involvement of one class of cell adhesion molecules in axon growth and guidance.

(10 minutes)

AND

- b) Netrin is a secreted molecule that both attracts and repels growing axons. Outline a model for how one guidance cue could play both roles and present some of the experimental evidence in support of this model.

(10 minutes)

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**QUESTION 4:**

**Answer both parts a) and b) of this question**

- a) Outline the role of neurotrophic survival factors in the development of the nervous system, using at least one neurotrophin or neurotrophic factor as an example. (10 minutes)

AND

- b) Neural regeneration is far more effective in the peripheral than in the central nervous system. Several factors have now been identified that limit regeneration of central axons. By manipulating these factors it might be possible to enhance regeneration following injury. Briefly discuss the evidence underlying these statements. (10 minutes)

**QUESTION 5:**

During the development of the nervous system there is an overproduction of synapses followed by an elimination of synapses in the process of refinement of specific functional connections. Describe

- (i) the major morphological events that occur when a synapse is formed and  
(ii) the factors that are thought to be involved in the process of elimination of synapses.

Use the visual system as an example.

(20 minutes)

**QUESTION 6:**

Several neurological disorders that manifest postnatally are now thought to have their origins during gestation. Select two of these disorders and discuss the possible mechanisms that might result in abnormal brain development in each case.

(20 minutes)

**END OF EXAM**