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516-201 Cell Biology: Tissues and Organs
Semester 1, 2006

The University of Melbourne
Semester One Assessment 2006

Department: Anatomy and Cell Biology
Subject Number: 516-201
Subject Title: Cell Biology: Tissues and Organs

Student Number: _____

Exam Duration: 2 hours

Reading Time: 15 minutes

This paper has 5 pages

Authorized materials:

None allowed

Instructions to Invigilators:

Script Books: 4 x 7 page

The examination paper may be removed from the exam room.

Instructions to Students:

This examination consists of **four** parts - Part A, B, C and D.

Answer each part in a separate script book.

The Subject Number is 516-201. Ensure that you put the Subject Number and your Student Number on all script books used.

ALL 11 questions should be attempted.

Question 9 has an internal choice.

The value of each question is indicated after the question.

LABELLED DIAGRAMS should be used wherever possible.

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The University of Melbourne
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Subject Number: 516-201

Subject Title: Cell Biology: Tissues and Organs

PART A - 45 minutes (Start a new booklet)

Answer ALL Questions

- Q1. Write short notes (no more than six lines in each case) on each of the following topics.
- a) Active transport of solutes across a cell membrane
 - b) The structure and function of the glycocalyx
 - c) Compare constitutive and regulated exocytosis
 - d) Paracrine signalling compared to endocrine signalling
- (12 mins)
- Q2. Describe how the steroid cortisol can regulate gene expression
- (4 mins)
- Q3. Describe experiments to demonstrate that signal sequences are both NECESSARY and SUFFICIENT to direct a protein to a particular organelle
- (4 mins)
- Q4. Discuss how actin filament growth is regulated in cells
- (5 mins)
- Q5. Describe the molecular events that lead to activation of the Ras protein after stimulation of a receptor tyrosine kinase. Explain why Ras is referred to as a "molecular switch"
- (8 mins)
- Q6. The tumour suppressor genes p53 and Retinoblastoma (Rb) are frequently observed to be mutated in cancers. Explain why loss of p53 or Rb is associated with tumour formation by describing their functions in regulating cell division
- (12 mins)

PART B - 25 minutes (Start a new booklet)

Answer ALL Questions

- Q7. With the aid of labelled diagrams, compare and contrast the location, structure and function of desmosomes and adherens junctions in epithelial tissues. (10 mins)
- Q8. Stem cells in the epithelia of the skin, the gut and the lens undergo distinct programs of proliferation, movement, differentiation and death that ensure the maintenance of these tissues. These processes are regulated by various signalling pathways.
- i. With the aid of diagrams show the structure of **one** of these epithelial tissues and describe the life cycle of cells within it. Include in your answer where stem cells divide, move, differentiate (provide morphological and molecular markers of differentiation) and undergo apoptosis.
 - ii. With the aid of diagrams describe **one** signalling pathway that affects the behaviour of cells in this epithelial tissue and the consequences of abnormal signalling for the structure of this tissue.

(15 mins)

PART C - 25 minutes (Start a new booklet)

Q9. Answer one only of the following questions.

- a) What is the structure of an artery and how does this structure relate to the function of the artery?

(25 mins)

OR

- b) Connective tissue consists of an extracellular matrix (ECM) and connective tissue cells. Selecting a single example of a connective tissue, describe the organisation of the ECM and connective tissue cells that is characteristic for that tissue.

(25 mins)

PART D - 25 minutes (Start a new booklet)

Answer ALL Questions

Q10.

- a) Discuss the roles played by the FGF-like molecule Branchless and its receptor Breathless in regulating branching of the tracheal system in the embryo of the fruitfly *Drosophila*.

(12 mins)

- b) Briefly describe how the molecule Sonic Hedgehog determines the antero-posterior pattern of the vertebrate limb. Describe an experiment that supports this role.

(8 mins)

- Q11. List four ways in which the behaviour of cancer cells differs from normal cells in the body.

(5 mins)

End of Exam