



ROYAL AUSTRALASIAN COLLEGE
OF
DENTAL SURGEONS
INCORPORATED
ABN 97 343 369 579

PRIMARY EXAMINATION IN
CELL BIOLOGY AND BIOCHEMISTRY

Tuesday 28 November 2006

Time allowed: **Two hours**

INSTRUCTIONS TO CANDIDATES

The complete examination in Cell Biology and Biochemistry is in two parts:

This paper is worth 75% of the final mark;

The viva is worth 25% of the final mark.

- **There are five (5) sections to this paper, of which FOUR (4) sections are to be answered . Each section is worth 30 marks. Each section must be answered in a separate booklet.**
- **Answer all of Section 1**
- **Answer any THREE (3) of the other four sections.**
- **The total marks for this paper will be scaled to constitute 75% of the final mark.**

SECTION 1 (30 minutes)

This section is COMPULSORY and must be completed by ALL candidates.

Mrs Freda Johnson, aged 63, comes to your surgery. She is obese and tells you that she has had diabetes for the last 5 years and that it is not well controlled by diet/exercise and oral hypoglycaemic agents.

Q1.1 What is the normal mechanism of insulin secretion and insulin action at its receptor?
(10 marks)

Q1.2 What is the most likely cause of her diabetes and how could diet and exercise overcome this?
(5 marks)

Q1.3 How will her diabetes lead to:

- a. altered metabolism within adipose tissue? (5 marks)
- b. periodontal disease? (5 marks)
- c. other long term complications? (5 marks)

Total for Section 1 = 30 marks



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written paper continued – answer THREE (3) of the following four sections

SECTION 2 (30 minutes)

Jonathan Thorpe, aged 6 years, fell off his bicycle and broke both of his arms. Physical trauma led to the secretion of both adrenaline and cortisol.

Q2.1 What are the metabolic roles of adrenaline and cortisol? (10 marks)

Q2.2 Describe in detail the action of adrenaline on its receptor and the second messenger response leading to one of the metabolic consequences of adrenaline action. (10 marks)

Q2.3 Explain in detail how the action of cortisol on its receptor leads to the synthesis of new proteins. (10 marks)

Total for Section 2 = 30 marks

SECTION 3 (30 minutes)

The epithelial cells of the oral cavity are regularly being replaced by new cells. This requires a series of steps involving cell division, growth and differentiation. This process can be disrupted by nutrient deficiencies.

Q3.1 Outline the major stages of the cell cycle and the major molecular events occurring within each stage. (10 marks)

Q3.2 What vitamins are required to maintain active cell division, growth and differentiation? What role do these vitamins play? (10 marks)

Q3.3 What would be the advantages and disadvantages of using embryonic or adult stem cells to replace damaged oral epithelium? (10 marks)

Total for Section 3 = 30 marks



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written paper continued

SECTION 4 (30 minutes)

Cells of the oral cavity can become cancerous.

Q4 Outline the mechanisms whereby this occurs. In your answer refer to the role of:

- a. reactive oxygen species (5 marks)
- b. growth factors and their signal transduction pathways (10 marks)
- c. cyclins and p53 (15 marks)

Total for Section 4 = 30 marks

SECTION 5 (30 minutes)

A teenager left home to live in a group house and decided to become a vegan. Unfortunately the diet adopted by the teenager was deficient in protein.

Q5.1 What are some of the possible clinical manifestations of a protein deficient diet? (5 marks)

Q5.2 How would normal protein synthesis be disrupted? (5 marks)

Q5.3 You wonder whether this low protein diet affects the pattern of gene expression of proteins in the parotid gland. You decide to investigate this using DNA microarray technology. What is DNA microarray technology and how would it be used in this circumstance? (10 marks)

Q5.4 What are the protein products from the parotid that could be altered by a low protein diet and what would happen if they were not produced? (10 marks)

Total for Section 5 = 30 marks

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