



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

PRIMARY EXAMINATION IN  
CELL BIOLOGY AND BIOCHEMISTRY

Wednesday 26th November 2008

Time allowed: **Two hours**

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**INSTRUCTIONS TO CANDIDATES**

- There are Six (6) sections to this paper. Each section is worth 24 marks.
- Candidates are required to complete the compulsory Section 1
- In addition they must also complete FOUR (4) other Sections from the FIVE Sections offered (Sections 2-6).
- Each section must be answered in a **separate booklet.**

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**SECTION 1 (24 minutes)**

**This section is compulsory and must be completed by all candidates.**

The formation of bone requires the presence of matrix materials, especially calcium salts and the protein collagen. Collagen is made in the osteocytes and secreted into the matrix where it forms fibres that give the bone strength and flexibility. Many things can go wrong with osteocytes that lead to abnormal collagen and hence abnormal bone formation. The major events that happen to cells are meiosis and fertilisation, growth, division, repair and maintenance and differentiation.

Q1 Outline how each of these major events that happen to osteocytes, or osteocyte precursor cells, could contribute to the formation of abnormal collagen? **24 marks**

**Total for Section 1 = 24 marks**

**SECTION 2 (24 minutes)**

Mrs Johnstone, aged 85, comes to your surgery for help with her caries. She tells you that she has Sjogrens syndrome, which leads to her having a dry mouth and difficulty in swallowing solid foods. You notice that she has cracks and fissures at the corners of her mouth and her tongue is red. She says that she has not been eating much for the last few months and has lost a lot of weight.

Q2 What energy reserves are available for use when calorie intake is inadequate?  
Detail the biochemical mechanism(s) whereby these energy reserves are mobilized by adrenaline and then how they are used? **15 marks**

Q3 Amongst the range of possible micronutrient deficiencies, Mrs Johnstone is likely to be deficient in folate intake. Detail the biochemical mechanism of folate action and the consequences of folate deficiency. **5 marks**

Q4 Why has Mrs Johnstone got increased caries? **4 marks**

**Total for Section 2 = 24 marks**



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**SECTION 3 (24 minutes)**

Fred Snape is a young footballer who has difficulty in controlling his weight and in the off-season, frequently increasing his BMI well above the level he is able to maintain during the season. He blames it on his love of chips and coca cola.

Q5 Detail the biochemical mechanism(s) for carbohydrate metabolism from the point of ingesting the food and explain how increased carbohydrate intake and lack of exercise can lead to an increase in BMI. **20 marks**

Q6 What effect could this diet have on Fred's general and dental health? **4 marks**

**Total for Section 3 = 24 marks**

**SECTION 4 (24 minutes)**

Julie Byrnes is 28 and is attending your clinic for a routine dental check. She is anxious and sweating. You ask her how she is. She explains that she has just been diagnosed with hyperthyroidism and has to go to the endocrinologist next week.

Q7 Detail the biochemical mechanism whereby thyroid hormone is normally made and released? **10 marks**

Q8 Detail the molecular mechanism(s) whereby thyroid hormone acts to cause anxiety and sweating. **10 marks**

Q9 What effect would excessive thyroid hormone have on dental health? **4 marks**

**Total for Section 4 = 24 marks**



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**SECTION 5 (24 minutes)**

Mr Norton comes to you to have some teeth removed and to have a denture fitted. He is 72. He is overweight and has had diabetes for 20 years.

Q10 Outline the normal molecular mechanisms whereby insulin is secreted and then leads to a decrease in blood glucose levels. **15 marks**

Q11 What goes wrong in Diabetes type 2 which leads to blood glucose remaining high?  
Use adipose tissue to illustrate the mechanism. **9 marks**

**Total for Section 5 = 24 marks**

**SECTION 6 (24 minutes)**

During routine treatment of a patient for a tooth extraction you observe an abnormality on her throat. You suspect that this abnormality could be a cancer.

Q12 Discuss the sequence of events that can lead to the formation of cancer cells under the following headings:

- Protooncogenes and tumour suppressor genes **8 marks**
- Apoptosis signalling pathways **8 marks**
- Cancer is a multistep process **8 marks**

**Total for Section 6 = 24 marks**

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