BSc Degree Examinations 2018-9

Department:
Biology

Title of Exam:
Understanding health and disease

Time Allowed:
1.5 hours

Allocation of Marks:
Total marks available: 60
Section A: 30 marks, Section B: 30 marks

Instructions for Candidates:
Section A: Answer all questions in the spaces provided on the examination paper.
Section B: Answer either question A or B. Write your answer in the green answer booklet provided and attach it to the back of the question paper using the cable tie provided.

Materials Supplied:
Calculator, Green Answer Booklet

Do not write on this booklet before the exam begins
Do not turn over this page until instructed to do so by an invigilator
SECTION A: Short Answer Questions
Answer all the questions in this section.

1. Explain why an inhibitor of the transcription factor NFAT (Nuclear Factor of Activated T cells) reduces cardiac enlargement in patients with hypertrophic cardiomyopathy.  
   (3 marks)

2. In patients with hypertrophic cardiomyopathy, and in patients following a myocardial infarction, expression of SERCA (sarcoplasmic reticulum Ca$^{2+}$-ATPase) is often reduced. Why is decreased SERCA expression associated with diastolic dysfunction?  
   (2 marks)
3. An experimental study was performed to determine the impact of ranolazine, a sodium channel blocker, on infarct size. Rabbits were subjected to coronary artery ligation, followed by a period of reperfusion. Prior to ligation, rabbits received either ranolazine or saline and infarct size was determined. Describe the data in the figure below and explain how ranolazine produces this effect. 

(3 marks)

![Figure showing infarct size](image)

Figure legend: Rabbits were subjected to coronary artery ligation (1 hour) followed by a period of reperfusion (3 hours). Prior to ligation, anesthetized rabbits received either ranolazine ('ran', 2 mg/kg) or saline as a control ('con'). Sham animals were not subjected to coronary artery ligation (n=15; star indicates significance p<0.05 vs. 'con' group)
4. How do platelet granules help with the formation of a stable platelet plug?  
(2 marks)

5. You are interested in estimating type II diabetes frequency in a population to provide information to health care planners about supportive care for people with the condition. You are debating whether you should estimate prevalence or incidence.

a) Define incidence and prevalence.  
(2 marks)

b) Which measure of frequency will be the most useful to health care planners? Why?  
(1 mark)

The space above the line is sufficient for your answer.
6. The sensitivity of a diagnostic test is 57% and the positive predictive value is 93%. Based on these values, what do you conclude about this test? (2 marks)

7. Occurrence of myocardial infarction among people with and without type II diabetes who have been observed over time.

<table>
<thead>
<tr>
<th>Exposure group</th>
<th>Myocardial Infarction</th>
<th>No Heart problems</th>
<th>Person Years Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type II Diabetes</td>
<td>387</td>
<td>8614</td>
<td>41,405</td>
</tr>
<tr>
<td>No Diabetes</td>
<td>217</td>
<td>18072</td>
<td>46,440</td>
</tr>
</tbody>
</table>

Using the data in the table above:

a) Calculate the incidence of myocardial infarction in this study. Express your answer per 10,000 person years. (1 mark)
b) Calculate the relative risk of developing a myocardial infarction associated with type II diabetes. Interpret your estimate of the relative risk in words. Show your workings. (2 marks)

8. Lead-time bias is associated with the implementation of a disease screening program. Explain the source of this bias and suggest how it may affect the interpretation of the impact of the program. (2 marks)
9. A pedigree from a family with a rare cardiac condition is shown below.

a) Individual II-3 inherits the condition from his father. Which two forms of inheritance does this rule out and why? (4 marks)

b) Who in the pedigree has the same Y chromosome as individual II-3? (4 marks)

c) Give two reasons which could explain why individuals IV 4-7 are unaffected by the disease (2 marks)
SECTION B: Essay Question

Answer either A OR B.

A) Explain how inflammation and apoptosis contribute to plaque rupture in atherosclerosis.

OR

B) Explain how next generation sequencing technology can be used in the diagnosis of a suspected genetic disorder.