UNIVERSITY OF YORK
BSc Stage 1 Degree Examinations 2017-18

Department:
BIOLOGY

Title of Exam:
Introduction to Biomedical Sciences part II

Time allowed: 2 hours and 30 minutes
Total marks available for this paper: 50

- Answer all questions in the spaces provided on the examination paper
- The marks available for each question are indicated on the paper

For marker use only:

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For office use only:

Total as %

---------
page 1 of 9
1. a. What developmental abnormality results in an atrial septal defect, and why would an atrial septal defect with blood flowing from right to left atrium be classed as cyanotic? (3 marks)

b. A patient has contracted bacterial endocarditis, which has damaged their aortic valve, preventing it from closing properly. How will this affect blood flow in the heart and what will be the consequences of aortic valve dysfunction? (2 marks)

2. a. Describe an experiment which provided evidence for definitive haematopoietic stem cells arising from the embryo, rather than the yolk sac. (3 marks)

b. How does hypoxia stimulate angiogenesis in the embryo? (2 marks)
3. Describe the pharmacological rationale behind the use of beta blockers in the treatment of angina. (3 marks)

4. 
   a. Outline the primary somatosensory cortex in the diagram below. (1 mark)

   ![Diagram of brain]

   b. What is the main determinant of the resting membrane potential? (1 mark)

   c. If action potentials are generated in response to a person pressing their finger on a table, from which subdivision of the thalamus does this neuron receive synaptic input? (1 mark)

   d. In which part of a neuron is the action potential generated? What property of this part of the neuron facilitates this action potential generation? (1 mark)
The diagram below shows transmembrane currents generated in response to prolonged depolarisation.

The space above this line should be sufficient for your answer
5. The diagram below shows postsynaptic potentials recorded from a neuron located in the brain area most associated with poor impulse control in teenagers. Postsynaptic potentials were recorded in the absence (Control) or presence of TTX (+TTX) – a blocker of voltage-gated Na+ channels. The mean amplitude (height) of the postsynaptic potentials is shown on the right.

![Diagram of postsynaptic potentials with Control and +TTX conditions]

a. In which brain area were the postsynaptic potentials recorded? (1 mark)

b. Which neurotransmitter was likely responsible for the postsynaptic potentials? Explain your reasoning. (1 mark)

c. Provide an interpretation of the data shown above. You should assume that there is nothing wrong with the TTX. (2 marks)
d. Provide a hypothesis for what you would expect to happen to these postsynaptic potentials in the presence of amphetamine. Provide an explanation. (2 marks)

6.

a. The sympathetic nervous system promotes arousal, defence, and escape. The parasympathetic nervous system promotes eating and procreation. Outline four other differences between the sympathetic and parasympathetic nervous systems. (4 marks)
b. The image below shows an ECG trace from a healthy girl and a girl with Rett syndrome. Which girl has been diagnosed with Rett syndrome? Explain your reasoning. (1 mark)

7. Maternal insulin resistance occurs in normal pregnancies during the 3\textsuperscript{rd} trimester. What is the relevance of this? (2 marks)

8. a. How does the placenta help to protect the foetus from infection? (2 marks)
b. Which placental hormone is traditionally detected in a urine dipstick pregnancy test and what is its function? (3 marks)

9. Describe how luteinising hormone (LH) and follicle-stimulating hormone (FSH) stimulate human spermatogenesis. (4 marks)

10. a. What are the main characteristics of the human cleavage stage of development before compaction? (2 marks)
b. Describe two approaches of determining the sex of a cleavage stage embryo. (2 marks)

11. How have researchers exploited the pharmacology of the estrogen receptor to create inducible knockout mice? (4 marks)