



**VICTORIA JUNIOR COLLEGE**

**JC 2 PRELIMINARY EXAMINATION 2017**

**NAME** : \_\_\_\_\_

**CT CLASS** : \_\_\_\_\_

**H1 BIOLOGY**

**8875/2**

**Paper 2**

**2 hours**

**READ THESE INSTRUCTIONS FIRST**

Write your Name and CT class on all the work you hand in.

Write in dark blue or blue pen.

You may use a soft pencil for any diagrams, graphs or rough working.

Do not use any staples, paper clips, highlighters, glue or correction fluid.

**Section A**

Answer **all** questions.

**Section B**

Answer any **one** question.

Write your answers on separate answer paper provided.

At the end of the examinations,

1. hand in section A and the one question you attempted from section B separately;
2. fasten all your work securely;
3. enter the number of the section B question you have answered in the grid opposite.

The intended number of marks is given in brackets [ ] at the end of each question.

For Examiner's Use	
<b>Section A</b>	
<b>1</b>	
<b>2</b>	
<b>3</b>	
<b>4</b>	
<b>Section B</b>	
<b>Total</b>	

..... [4]

In Angelman syndrome, a severe and rare neurodevelopmental disorder, it has been reported that the lack of ubiquitin protein ligase E3A (*UBE3A*) expression leads to a disruption of structure and function of Organelle A. Ubiquitin protein ligases are enzymes that attach a small molecule called ubiquitin to certain proteins. Such proteins are then degraded by the cells.

- (b)** Suggest how the lack of E3A expression can lead to a disruption in the structure and function of Organelle A.

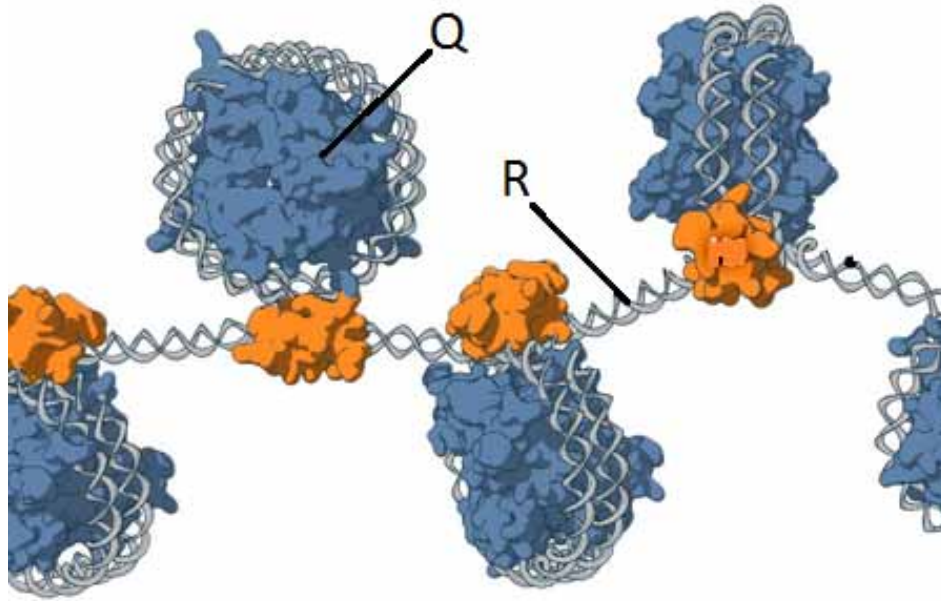
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.....  
..... [2]

The diameter of a prokaryotic cell is usually between 1-10  $\mu\text{m}$ , whereas a typical eukaryotic cell is between 10-100  $\mu\text{m}$ . The size of a cell is often restricted by its ability to metabolise nutrients to produce energy. A possible reason for the small size of the prokaryotes is the lack of membrane-bound organelles.

- (c)** Explain the importance of membrane-bound organelles in allowing the increase in size of eukaryotic cells.

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.....  
..... [3]  
[Total: 10]

- 2 Fig 2 below shows a magnified view of the eukaryotic chromosome.



**Fig. 2**

- (a)(i)** Structures **R** and **Q** are two different biomolecules that make up a typical chromosome. Identify structures **R** and **Q**.

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 ..... [1]

- (ii)** State two structural differences between **R** and **Q**.

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 .....  
 .....  
 ..... [2]

- (iii)** With reference to Fig 2, discuss the significance of the interaction between **R** and **Q** in eukaryotes.

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 .....  
 .....  
 ..... [2]

The centromere is part of a eukaryotic chromosome that links sister chromatids together. During nuclear division, spindle fibres attach to the centromere via a specific type of proteins known as kinetochore.

**(b)(i)** Suggest how the kinetochore proteins is able to bind specifically to the centromeric sequences.

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..... [2]

**(ii)** Explain the consequences to the cell if the kinetochore protein is unable to bind successfully to the centromere during cellular division.

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..... [2]

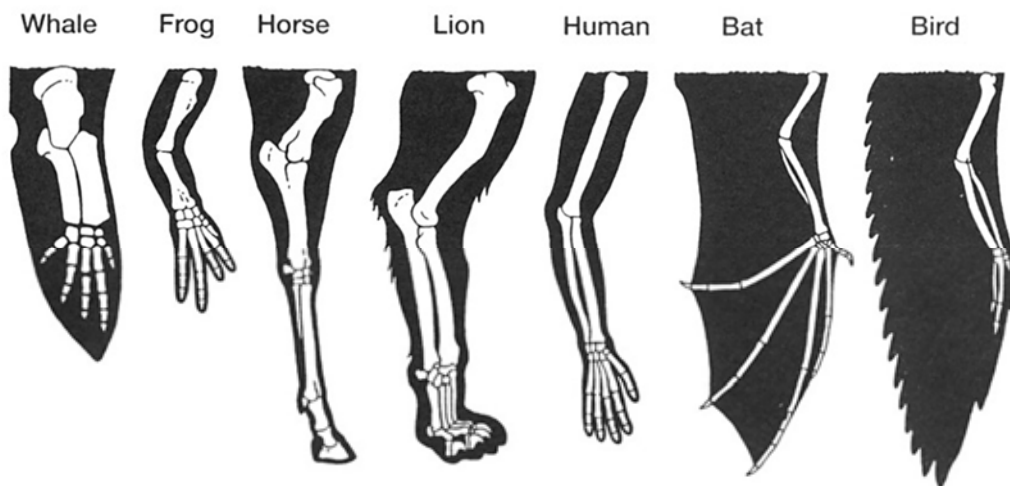
**(iii)** Suggest what would happen to a chromosome if a mutation causes it to contain more than one centromeric sequence.

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.....[1]

[Total: 10]

**3** Fig 3 shows the forearms of different vertebrates.



**Fig 3**

**(a)(i)** Using Fig 3, explain what is meant by “a homologous feature”.

..... [2]

**(ii)** Explain how this provides evidence in support of Darwin's theory of natural selection.

..... [4]

- (b)** DNA from the fossil material of these birds were extracted and amplified. State the name of the technique used and outline the major steps involved.

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- (c)** State two advantages of using molecular data over morphological data to establish relationships between different vertebrates.

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..... [2]

[Total: 11]

- 4 Commercial aquaculture is the most rapidly growing segment of the agricultural industry, accounting for more than 60 million tons in 2012, versus 90 million tons of wild-caught fish. *AquAdvantage salmon* is a genetically modified (GM) Atlantic salmon developed by AquaBounty Technologies. The purpose of the modifications is to increase the speed at which the fish grows without affecting its ultimate size or other qualities. The fish grows to market size in 16 to 18 months rather than three years as shown in Fig 4.1 below.

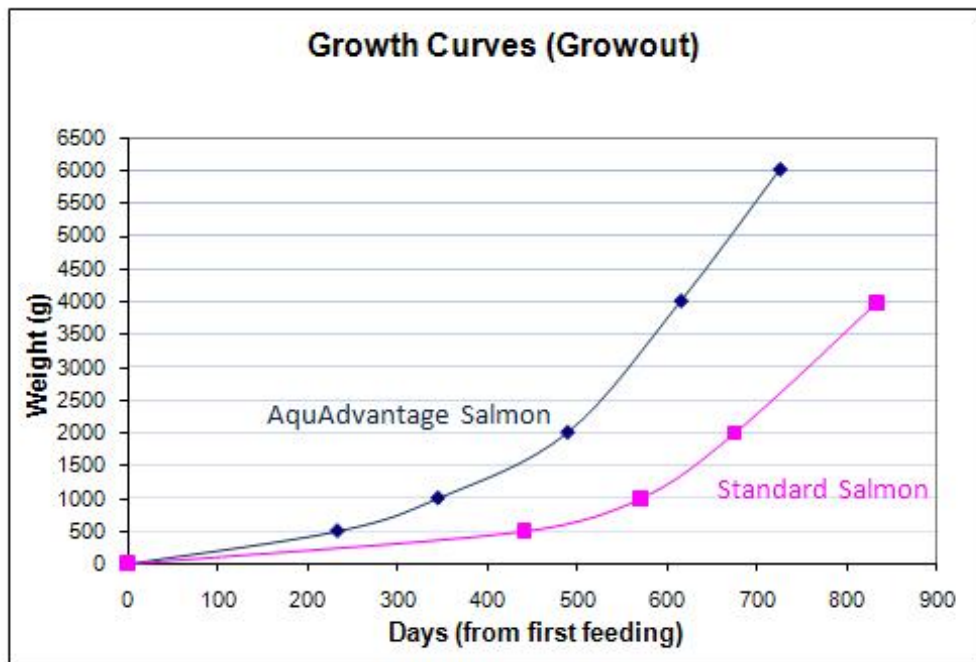


Fig 4.1

source: <http://www.21stcentech.com/fishing-update-gmo-salmon-fda-approval-united-states/>

- (a)** Describe how GM salmon is produced in the laboratory

[4]



- (b) Describe briefly the advantages of farming GM salmon (*AquAdvantage*) over normal salmon

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..... [2]

There are many public concerns about the impact of GM organisms on the natural ecosystems. The following chart shows the results of an experiment conducted by Biotech companies who made GM salmon.

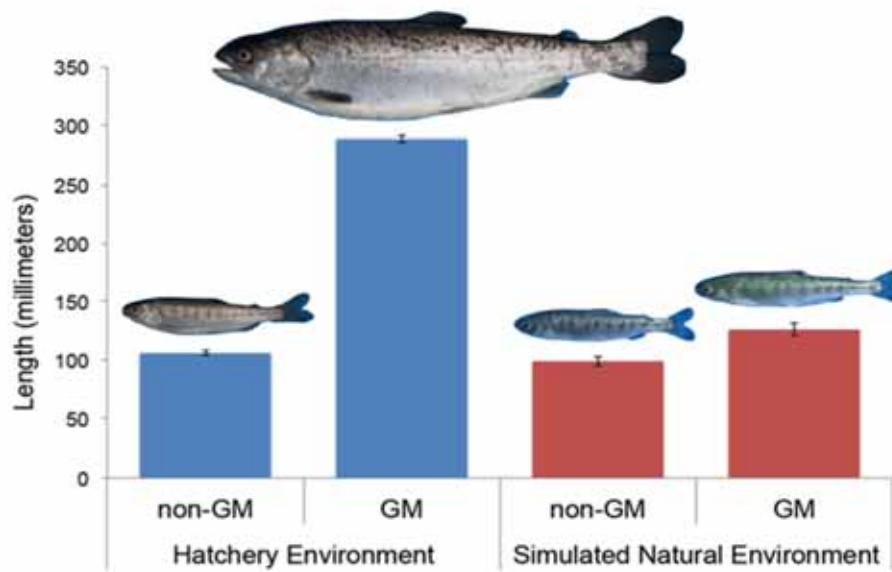


Fig 4.2

source: <http://sitn.hms.harvard.edu/flash/2015/challenging-evolution-how-gmos-can-influence-genetic-diversity/>

- (c) With reference to Fig 4.2, explain why public worries on GMO could actually be unfounded.

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..... [3]

[Total: 9]

**Section B**

Write your answers on the separate answer paper provided.  
Your answers should be illustrated by large, clearly labelled diagrams, where appropriate.

Your answers must be in continuous prose, where appropriate.  
Your answers must be set out in sections **(a)**, **(b)** etc., as indicated in the question.  
Begin each of sections **(a)**, **(b)** etc. on a **FRESH SHEET** of answer paper.

**Either**

- 5 (a)** Methylene blue, a common stain used to dye cells for microscopy work, can function as an effective hydrogen acceptor. It changes from blue to colourless upon reduction.

Using methylene blue, describe an experiment to study the effects of different concentrations of glucose on the enzyme catalysed reactions in respiring yeast cells. Explain the principles behind the design of your experiment. [9]

- (b)** A small amount of inhibitor is added to reaction mixture, explain how you would go about determining the mode of action of this inhibitor. [7]
- (c)** Using a named example, explain the normal function of stem cells in a living organism. [4]

[Total: 20]

**Or**

- 6 (a)** Explain how the structural features of the cell membrane enable it to transport materials in and out of the cell [9]

- (b)** Explain the significance of having double membranes in organelles like mitochondria and chloroplasts [5]

- (c)** Outline the role of hydrogen bonds in biomolecules [6]

[Total: 20]