

Answer BOTH questions 1 and 2

1. The scientific article you have studied is adapted from a book called *MUTANTS – on the Form, Varieties and Errors of the Human Body* by Armand Marie Leroi. Use the information from the article, and your own knowledge, to answer the following questions.

(a) Explain what is meant when someone is described as inheriting a greater risk of developing cardiovascular disease.

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(b) Explain why some diseases, such as Alzheimer’s disease, are described as polygenic.

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- (c) The allele APOE ϵ 4 has been implicated in the majority of cases of Alzheimer's disease in French people. However, Alzheimer's disease does not appear to be significant amongst African pygmies, despite an even higher frequency of the APOE ϵ 4 allele in this population.

Suggest reasons for the difference in the occurrence of Alzheimer's disease between these two populations.

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- (d) Which factor, suggested in the article, has made the most significant contribution to the increased life expectancy in the West between 1750 and 1950?

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(e) Using examples from the text, explain why animals with an energy restricted diet may live longer than animals with a normal diet.

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(f) Suggest why 'most scientists would now agree that superoxide dismutase can be struck from the list of elixirs that might one day stave off the decline of our later years'.

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(g) (i) Summarise the steps involved in screening an adult for a genetic disorder such as Huntington's disease.

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(ii) Describe **one** advantage and **one** disadvantage of offering genetic screening for Huntington's disease to a family with a relative affected by the disease.

Advantage

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Disadvantage

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(2)

(Total 20 marks)

Q1

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2. Use the data in the data booklet provided, and your own knowledge, to answer the following questions.

This question is about changes in the physiology of whales, penguins, seals and humans when they hold their breath to dive below the surface of water.

(a) Figures 1 and 2, in the data booklet, show the changes in blood lactate concentration during diving in white whales and emperor penguins.

(i) Explain why the blood lactate concentration increases when these animals dive under water.

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(ii) The difference between the blood lactate concentration of whales before and after diving was found to be 'significant ($p < 0.05$)'. Briefly explain what the word 'significant' means in this context.

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(iii) Describe the relationship between blood lactate concentration and dive duration in emperor penguins. Suggest an explanation for this relationship.

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(b) Referring to Figure 3 in the data booklet, describe and explain the effect of diving depth on the heart rate of grey seals.

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(c) Referring to Figure 4 in the data booklet:

(i) Name the wave of depolarisation labelled X in Figure 4 and explain the part it plays in the cardiac cycle.

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(ii) Calculate the woman's heart rate before and during her dive. Show your working.

Heart rate before dive

Heart rate during dive

(2)

(d) Referring to Figures 5(a) and 5(b) in the data booklet:

(i) Suggest an explanation for the difference in heart rate while diving at 25°C and at 35°C.

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(ii) Suggest an explanation for the woman's high heart rate just before diving.

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(Total 20 marks)

Q2

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Answer ONE of the following essay questions.

You should choose EITHER Question 3 OR Question 4.

You are expected to answer in continuous prose. You should use examples from the biology course you have studied but need not restrict yourself to the course content.

You should spend approximately 45 minutes answering Question 3 or Question 4, including planning time.

Marks will be awarded for the following areas:

Breadth: selection of a range of relevant examples **(up to 6 marks)**

Depth: Further description and discussion of the examples **(up to 8 marks)**

Balance: Have you answered the question asked; for example have you recognised the advantages and disadvantages or benefits and risks **(up to 6 marks)**

Style: Coherence, clarity and expression **(up to 4 marks)**

3. Some people claim that many medical problems, such as the shortage of suitable organs needed for transplant surgery, may become a thing of the past. The use of stem cells, which may have had a specific gene or genes inserted, could give rise to many new treatments.

Write an essay on: **‘Manipulating stem cells: a miracle cure or a dangerous development?’**

(Total 20 marks)

OR

4. The effect of climate change on the world’s ecosystems is often seen as a potential catastrophe. Yet wild species and ecosystems are able to adapt to climate change and have done so many times in the past.

Write an essay on: **‘Biological effects that might be caused by climate change in the 21st Century: a catastrophe or a harmless change?’**

(Total 20 marks)



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(Total 20 marks)

**Q3
or
Q4**

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TOTAL FOR PAPER: 60 MARKS

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