**Southern River College**

**YR12 HUMAN BIOLOGY 2022 Unit 4**

**Task 6: Test – Variation, Mutation and Evolution**

**Time allowed: 55 minutes**

**Name:** …………………………………… Total Mark: /50

**Section One: Multiple Choice [10 marks]**

Place a ~~cross~~ through the selected letter.

1. A B C D 6. A B C D

2. A B C D 7. A B C D

3. A B C D 8. A B C D

4. A B C D 9. A B C D

5. A B C D 10. A B C D

**Section Two: Short Answer [25 marks]**

**Question 11 (10 marks)**

## Martha’s Vineyard is an island off the coast of the USA. During the 1700s and 1800s there were a large

## number of Deaf individuals within the population on the island.

## What effect was most likely to be responsible for the large numbers of Deaf individuals?

## (1 mark)

## …………………………………………………………………………………………………………………………

## Briefly explain how this effect would have caused the high number of deaf individuals on the island

## (4 marks)

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1. Suggest a factor that would have changed in the 1900’s to result in the reduced incidence of genetically-inherited deafness in the Martha’s Vineyard population.

(1 mark)

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1. Identify another example of a specific population with a high incidence of a genetically- inherited disease. State the population and the disease in your answer.

(2 marks)

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1. A mutation is another type of evolutionary mechanism that can affect frequencies of alleles in populations. Explain the difference in consequences between a mutation occurring in a somatic cell and one occurring in a gamete (2 marks)

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**Question 12 (5 marks)**

West Nile Virus (WNV) is currently on the rise in developed countries such as the USA, and is known to lethally infect humans. Studies have found that allele for the protein CCR5(+) and its mutated form CCR5∆32 are associated with WNV susceptibility. The table below shows the distribution of genotypes in patients with and without WNV in Northern America.

|  |  |  |  |
| --- | --- | --- | --- |
| Genotype: | +/+ | +/∆32 | ∆32/∆32 |
| Patients with WNV | 321 | 78 | 18 |
| Patients without WNV | 155 | 16 | 2 |

1. Using the data above, the allelic frequency of **CCR5∆32** homozygotes was calculated and is stated below:

Patients with **CCR5∆32** and with WNV: 0.04

Patients with **CCR5∆32** and without WNV: 0.01

Given that the percentage of **CCR5∆32 homozygotes** in North America is usually 1%, compare frequency of **CCR5∆32 homozygotes** in both populations studied. (2 marks)

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1. Propose an explanation for the data, stating whether an advantage is present. (3 marks)

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**Question 13 (10 marks)**

Since World War I, mustard gas has been used as a weapon in chemical warfare. Within 24 hours of exposure to mustard gas, victims develop chemical burns, which appear as large blisters to the exposed skin and respiratory surfaces.

In 1940, Auerbach and Robson completed the first research into the other potential effects of mustard gas. They exposed *Drosophila* flies to mustard gas and then examined the chromosomal damage in the flies’ offspring over several generations. Their results showed a dramatic increase in the number of chromosomal mutations compared to the control group.

Najafi and others (2014) studied human victims 25 years after their exposure to mustard gas during the Iran/Iraq War. It found there were 122 different mutated genes in the respiratory pathways of the victims.

1. The studies described above outline how mustard gas has been shown to cause mutations.

Mustard gas can therefore be classified as a: (1 mark)

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1. Auerbach and Robson were studying chromosomal mutations. Describe **two** types of these

mutations that can occur in organisms. (4 marks)

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1. The 2014 study examined mutated genes. Describe how this type of mutation differs from a

chromosomal mutation. (2 marks)

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1. Explain why Auerbach and Robson studied the offspring flies, not the parent flies, and what

information this gave about the type of mutations that occurred. (3 marks)

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**Section Three: Extended Response [15 marks]**

Sickle Cell Anaemia is a disease that occurs due to a gene mutation affecting the formation of haemoglobin, and therefore the shape of the red blood cells. This disease is one example of where *heterozygote advantage* can occur.

Define heterozygote advantage, then use the principles of natural selection to explain how heterozygote advantage occurs with Sickle Cell Anaemia.

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