Genetics Inquiry Test

Score:\_\_\_\_\_\_/30

***Study the pedigree below and answer questions 1.***

Duchene muscular dystrophy is a sex-linked inherited condition which causes degeneration of muscle tissue. It is caused by a recessive allele. The diagram below shows the inheritance of muscular dystrophy in one family.



Use the letter D and d when writing genotypes for this question.

1a) What are the genotypes and phenotypes of male (9) and female (8) in the second generation who married and produced two daughters and one son? (4 marks)

Male (9): Gentoype: X D Y (1)

Pheontype: Normal vision (1)

Female (8): Genotype: X D X d (1)

Pheonotype: Normal vision/ carrier (1)

1b) Explain how you can be certain of the genotypes in 1a). (2 marks)

**ANY 2 MARKS**

Both individuals have normal vision so each individual must have the dominant allele in their genotypes (1)

The couple have an affected child (13) therefore one parent must have a recessive allele in order to pass it onto individual 13 (1)

The mother must be a carrier as she has two X chromosomes but still has normal vision (1)

***Questions 2 -5 below refer to this pedigree for attached earlobes.***



1. Given the information in the pedigree, name the type of inheritance attached earlobes displays. Give a reason for your answer. (3 marks)

Autosomal recessive (must have both) (1)

Both parents in generation 3 (III 3 and III 4) have free earlobes but have three children (IV 1, IV 2 and IV 3) with attached earlobes. (2)

**1 mark for statement, 1 mark for reference to specific individuals**

1. Using a punnet square, predict the genotype and phenotype of individual III 2.

(4 marks)

Key: E = allele for free earlobes

e = allele for attached earlobes

Parent genotypes: ee (mother) x Ee (father) (1)

Phenotypes: attached earlobes x free earlobes

|  |  |  |
| --- | --- | --- |
|  | E | e |
| E | Ee | ee |
| E | Ee | ee |

(1)

Offspring genotypes: 50% Ee 50%ee

Phenotypes: 50% free earlobes 50% attached earlobes (1)

Individual III 2 has genotype Ee and phenotype free earlobes (1)

***Read the following information and answer questions 4 -7.***

Huntington’s disease is described as an inherited disorder that results in lack of control over muscles and progressive mental deterioration to the point where sufferers are unable to look after themselves. The symptoms rarely appear before 40 years of age and by that time individuals with the disorder may have passed the allele for the condition on to their children. Huntington’s disease is transmitted by a dominant allele.

The following paragraphs describe a family in which Huntington’s disease has occurred.

Jennifer is 45 years old and has just developed the symptoms of Huntington’s disease. Her father, James, is 70 Years old and is hospitalised with the disorder, but her mother, Anne, two years younger than her father, does not have the condition. Jennifer’s husband, John, also 45 years old, does not have Huntington’s disease, and there is no history of the condition in his family. Jennifer’s older brother, Malcolm, does not have the disease.

Jennifer and John have two children, Andrew (25 years old) and Michele (21 years old). Michele is married to Tony, who is the same age as her brother, and she has just given birth to a child called Darren. There is no history of Huntington’s disease in Tony’s family.

1. Construct a pedigree to show all the individuals in the family. Indicate the individuals who have Huntington’s disease by shading the relevant circles or squares. (5 marks)

James

Anne

I

Key:

Jennifer

Malcolm

John

II = male with Huntington’s

= female with Huntington’s

Tony

Michele

Andrew

= male without Huntington’s

III

=female without Huntington’s

Darren

IV

Correct placement of individuals with correct relationships

(2 marks - 0.5 mark per generation)

Correct shading (1 mark)

Correct use of symbols (1 mark)

Key (1 mark)

1. Write down the possible genotypes of James, Anne, Jennifer and John. Explain the symbols you are using. (5 marks)

Symbols: H = allele for Huntington’s disease (1)

h = allele for normal condition

James: Hh (1) Jennifer:Hh (1)

Anne: hh (1) John: hh (1)

1. What is the probability that Michele has inherited Huntington’s disease? Using a punnet square, set out the cross between Michele’s parents in full.

(4 marks)

Parent genotypes: Hh (Michele) x hh (John) (1)

Phenotypes: Huntington’s disease x normal

|  |  |  |
| --- | --- | --- |
|  | H | h |
| H | Hh | hh |
| H | Hh | hh |

(1)

Offspring genotypes: 50% Hh 50%hh

Phenotypes: 50% Huntington’s 50% normal (1)

Michele has a 50% chance of developing Huntington’s disease. (1)

1. Is the gene that determines Huntington’s disease on an autosomal chromosome or an X chromosome? Explain your answer. (3 mark)

Autosomal (1)

Evidence in this pedigree indicates it could be either (1)

As we only have the first and second generation data given that the symptoms of Huntington’s are rarely visible before the age of 40. (1)