# Passage of information from parent to offspring

#### **Question Paper 1**

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Inherited change
Sub Topic	Passage of information from parent to offspring
Booklet	Theory
Paper Type	Question Paper 1

Time Allowed: 56 minutes

Score : /46

Percentage: /100

#### **Grade Boundaries:**

A*	А	В	С	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

#### Save My Exams! - The Home of Revision

For more awesome GCSE and A level resources, visit us at www.savemyexams.co.uk/

1	In mice,	the intensity	of pigmentation	of the fur is	controlled by	multiple alleles	of a single gene.
---	----------	---------------	-----------------	---------------	---------------	------------------	-------------------

The alleles are listed below in order of dominance, with **C** as the most dominant.

- **C** = full colour
- C<sup>ch</sup> = chinchilla
- **C**<sup>h</sup> = himalayan
- C<sup>p</sup> = platinum
- $C^a$  = albino

(a)	Explain how multiple alleles arise.
	[2]

- **(b)** Eye colour in mice is controlled by two alleles of a single gene, **B/b**:
  - allele **B** codes for black eyes
  - allele b codes for red eyes.

A mouse with full colour fur and black eyes was crossed with a mouse with himalayan fur and black eyes. One of the offspring was albino with red eyes.

Using the symbols above, draw a genetic diagram to show the genotypes and phenotypes of the offspring of this cross.

Occasionally during meiosis, homologous chromosomes fail to separate at anaphase. This is known as non-disjunction. Turner's syndrome is the most common chromosome mutation in human females. It can occur due to non-disjunction in meiosis during gametogenesis. Some resulting gametes will be missing an X chromosome.

Some forms of Turner's syndrome occur when one of the pair of X chromosomes is not missing but has become damaged. The damaged X chromosome may have been broken and re-formed so that part of its structure is lost.

Fig. 7.1 is a diagram of a normal X chromosome and two forms of 'damaged' X chromosomes,  $X_1$  and  $X_2$ .

- In X<sub>1</sub>, a section of the 'p' arm of the chromosome is missing. This deletion leads to reduced height of the female and abnormalities such as narrowing of the aorta.
- In X<sub>2</sub>, a section of the 'q' arm of the chromosome is missing. This deletion leads to little or no development of the ovaries.

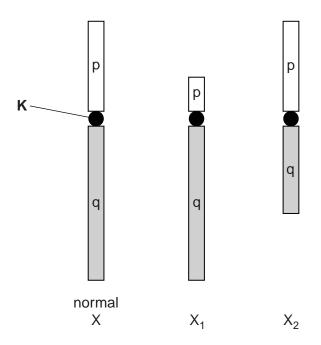


Fig. 7.1

(a)	Name structure <b>K</b> .
	[1]

(b)	Explain why X <sub>1</sub> and	X <sub>2</sub> result in different phenotypes.	
			[2]
(c)	Mothers with the X <sub>1</sub> daughters but not to		ss on the chromosome mutation to their
		tic diagram below to show how ters from a mother with Turner's sy	the chromosome mutation $\boldsymbol{X}_1$ may be yndrome.
parental phenotyp	oes	female with Turner's syndrome	normal male
parental genotype	9s	XX <sub>1</sub>	
gametes			
genotype daughter			
phenotyp daughter			
daugriter	J		[4]
			[Total: 7]

**3** Collared lizards, *Crotaphytus collaris*, show variation in body length and running speed. Fig. 4.1 shows a collared lizard.



Fig. 4.1

An investigation was carried out to find out whether body length and running speed affected the number of offspring that a male lizard sired (fathered). The lizards reproduce sexually, and females lay eggs after mating with males.

A large number of male lizards was captured during the breeding season.

For each lizard:

- body length was measured
- it was chased down a small race track and its fastest running speed over 1 m recorded
- a blood sample was taken and DNA sequences at 10 different loci were analysed.

The lizards were then released back into the place where they were captured, to allow mating to occur.

Several weeks later, after the lizards' eggs had hatched, as many young hatchlings as possible were captured. DNA testing was carried out on each hatchling to determine which male was the father. The results were used to determine the number of offspring sired by each of the male lizards in the first sample.

(a)	Outline how DNA analysis can be carried out and then used to establish which male lizard sired each hatchling.

**(b)** Fig. 4.2 shows the number of offspring sired plotted against the body length of the adult male lizards.

Fig. 4.3 shows the number of offspring sired plotted against the fastest running speed (sprint speed) of the adult male lizards.

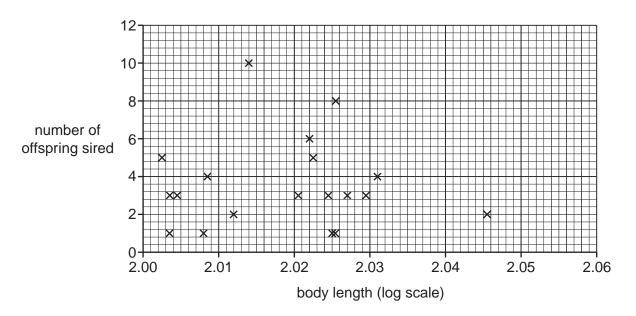


Fig. 4.2

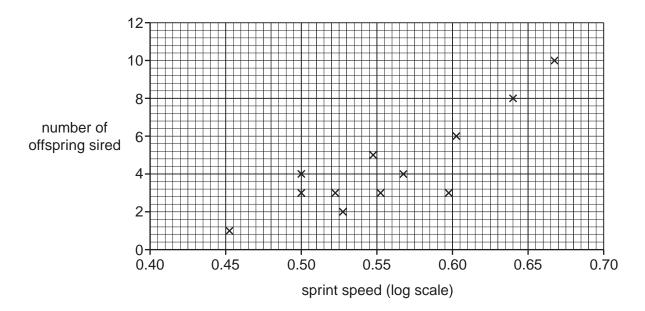


Fig. 4.3

(1)	<ul> <li>With reference to Fig. 4.2 and Fig. 4.3, describe the relationships between</li> <li>body length and the number of offspring produced</li> <li>sprint speed and the number of offspring produced.</li> </ul>	
	body length	
	sprint speed	
	_	
	[4	4]
(ii)	Research has also shown that, in a population of collared lizards with varying leg lengths those with longer hind legs are able to run faster.	Ī
(ii)	Research has also shown that, in a population of collared lizards with varying leg lengths	s,
(ii)	Research has also shown that, in a population of collared lizards with varying leg lengths those with longer hind legs are able to run faster.  With reference to the results shown in Fig. 4.3, explain how, over time, this could lead to	s,
(ii)	Research has also shown that, in a population of collared lizards with varying leg lengths those with longer hind legs are able to run faster.  With reference to the results shown in Fig. 4.3, explain how, over time, this could lead to a change in the mean hind leg length in a population of collared lizards.	s,
(ii)	Research has also shown that, in a population of collared lizards with varying leg lengths those with longer hind legs are able to run faster.  With reference to the results shown in Fig. 4.3, explain how, over time, this could lead to a change in the mean hind leg length in a population of collared lizards.	s,
(ii)	Research has also shown that, in a population of collared lizards with varying leg lengths those with longer hind legs are able to run faster.  With reference to the results shown in Fig. 4.3, explain how, over time, this could lead to a change in the mean hind leg length in a population of collared lizards.	s,
(ii)	Research has also shown that, in a population of collared lizards with varying leg lengths those with longer hind legs are able to run faster.  With reference to the results shown in Fig. 4.3, explain how, over time, this could lead to a change in the mean hind leg length in a population of collared lizards.	s,
(ii)	Research has also shown that, in a population of collared lizards with varying leg lengths those with longer hind legs are able to run faster.  With reference to the results shown in Fig. 4.3, explain how, over time, this could lead to a change in the mean hind leg length in a population of collared lizards.	s,
(ii)	Research has also shown that, in a population of collared lizards with varying leg lengths those with longer hind legs are able to run faster.  With reference to the results shown in Fig. 4.3, explain how, over time, this could lead to a change in the mean hind leg length in a population of collared lizards.	s,
(ii)	Research has also shown that, in a population of collared lizards with varying leg lengths those with longer hind legs are able to run faster.  With reference to the results shown in Fig. 4.3, explain how, over time, this could lead to a change in the mean hind leg length in a population of collared lizards.	s,

(c)	Small islands often contain species of lizards that are not found on other islands or on the mainland.
	Explain how a population of collared lizards that became isolated on an island could evolve to form a new species.
	[5]

[Total: 15]

#### Save My Exams! - The Home of Revision

For more awesome GCSE and A level resources, visit us at www.savemyexams.co.uk/

Neurofibromatosis (NF) is a genetically inherited condition in humans where tumours grow in the nervous tissue. One symptom, which can develop around the age of 20 years, is loss of sight due to tumours on the optic nerve. (a) If one parent has NF, there is at least a 50% chance that his or her children will develop the condition, even if the other parent is unaffected. Complete the genetic diagram below to show how NF may be transmitted from parent to child. key to symbols ...... ...... parental phenotypes parent with NF unaffected parent parental genotypes gametes offspring genotypes offspring phenotypes [3] **(b)** Suggest how a person may develop NF when there is no family history of the condition.

.....[2]

(c)	Suggest how a tumour on the optic nerve could prevent the transmission of nerve impulses to the brain.
	[3]
	[Total: 8]

5

Coat colour in cats is determined by a sex-linked gene with two alleles coding for black and

• the ma		always the same	shell (black and ora colour as their mot	
	•	-		
dox iii iida .				
gene				
90770				
	symbols <b>B</b> for th ne genetic diagra		c coat and <b>O</b> for the	e allele for orange co
arental henotypes	tortoiseshel	l female	blad	ck male
arental enotypes				
rametes (				
ffspring venotypes				
ffspring henotypes				
(c) Explain why	y a male cat can	not have a tortoi	seshell coat.	
•••••				

.....[2]

[Total: 8]