**ATAR HUMAN BIOLOGY – UNIT 2**

**Task 11 – Inheritance (DNA) Practical**

**Breeding Reebops Assessment**

NAME: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ WEIGHTING: *Total part 1 + part2* **5 %**

TEACHER: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ PART 1 MARK: \_\_\_ / 11

Inheritance and variation are two key observations on which the theory of evolution by natural selection is based. The following practical will lead you through a breeding program of imaginary animals called Reebops using the same procedures as in a breeding program with real organisms, and applying the same rules that are found in genetics. To carry out the practical you will need to draw upon your knowledge of DNA, genes and chromosomes, meiosis and the laws of inheritance.

**The assessment will be in two parts.**

**Part 1** – Time 1 class period

You are going to carry out a breeding program for Reebops. During the breeding program you will be required to take notes of the procedures being used, the genotypes and phenotypes of the animals in the breeding program and any other information you think is relevant.

**Part 2** – Time 1 class period

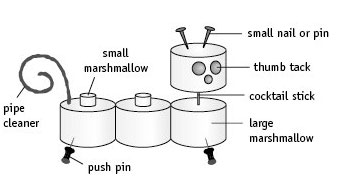
This is a written assignment where you will be required to answer questions using the information you acquired from the breeding program and you general scientific knowledge about genetics.

**Part 1 - Breeding Reebops**

Reebops are imaginary animals made out of marshmallows, lollies and cocktail sticks (to hold together). They have 16 chromosomes (eight pairs) in their somatic cells which determine their characteristics. Below is the information sheet which outlines the genotypes and phenotypes of the Reebops.

**Genotype Decoding Key:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Characteristic** | **Genotype/ phenotype code** | | |
| Antennae (black liquorish) | **AA** = 2 antennae | **Aa** = 2 antennae | **aa** = no antennae |
| body segments (*marshmallows*) | **BB** = 3 body segments | **Bb** = 3 body segments | **bb** = 2 body segments |
| Tail (*black liquorish*) | **TT** = curly tail | **Tt** = curly tail | **tt** = straight tail |
| Nose (*candy*) | **NN** = Red nose | **Nn** = Green nose | **nn** = White nose |
| Legs (*musk sweets + red liquorish*) | **LL** = Pink legs | **Ll** = Pink legs | **ll** = Red legs |
| Sex (*colour of marshmallow*) | **XX** = female (pink) | **XY** = male (white) |  |
| Eyes (*candy*) | **EE** = 2 eyes | **Ee** = 2 eyes | **ee** = one eye |
| Humps (*small marshmallows*) | **HH** = 1 hump | **Hh** = 1 hump | **hh** = 3 humps |



Black liquorish

Candy

This is what a Reebop looks like before it becomes male or female.

Black liquorish

Musk sweets/liquorish)

**Part 1 - On lined paper (11 marks)**

1. You are given a model of an adult male and adult female Reebop. Both parents are **heterozygous** for all their characteristics (except their sex). Study their characteristics.

Using the information in the chart above record their genotypes and phenotypes for all characteristics. Include any addition notes if needed.

1. You are provided with two envelopes. One contains Reebop Mum chromosomes and the other contains Reebop Dad chromosomes. There are 16 chromosomes (eight pairs) in each envelope. Open the envelope and take out the pack of cards.

**You are now going to carry out a breeding program to create a baby Reebop.**

* 1. Turn the chromosome cards face down, so that you cannot see the genotypes (letters) on them. Keep the Mum and Dad chromosomes separate, so that you have two groups of cards.
  2. Sort the cards into pairs of the same length.
  3. Now randomly take one chromosome of each paired length from the Mum chromosomes and place them in a pile. Repeat for each pair of Dad chromosome and place them in a different pile.
  4. Now carry out “fertilisation by mixing the female and the male piles to form a “baby gene pile”.
  5. Put the remaining chromosomes back into the envelopes.
  6. Record the genotype and phenotypes of the Reebop baby you have created, refer to the genotype decoding key to check the characteristics your baby has inherited.
  7. Using the materials supplied create your baby Reebop. Your baby will be assessed.

1. Now you have created your baby add it to the nursery provided. Have a look at the other babies present. Remember that all the Mum Reebops had the same chromosomes as one another and that each Dad Reebop had the same chromosomes as the other Dads.
2. What do you notice about the features that the babies have?
3. Are there any babies that are identical?
4. How many babies are the same as their parents? Which parent?
5. Choose a baby to breed with your baby. The babies grow up rapidly and become parents for the next generation of Reebops. Record the genotype and phenotype of the other baby.
6. Choose **one** feature. Draw a punnet square to show the possible baby Reebops your couple could have using the feature you choose only, include the parents genotypes and the possible outcomes.

**Part 1** – mark allocation

1. Genotypes and phenotypes of parents recorded accurately. (1 mark)
2. Genotypes and phenotypes of baby recorded accurately. (2 marks)
3. Baby created according to phenotype. (1 marks)
4. Notes made on babies and their characteristics in the nursery. (3 marks)
5. Genotype and phenotype of “mate” recorded. (1 mark)
6. Punnet square of cross drawn accurately for chosen characteristic and outcomes. (3 marks)

**ATAR HUMAN BIOLOGY – UNIT 2**

**Task 11 – Inheritance (DNA) Practical**

**Breeding Reebops Assessment - Part 2**

NAME: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ WEIGHTING: ***Total part 1 + part2* 5 %**

TEACHER: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ PART 2 MARK: \_\_\_ / 29 ***Total \_\_ /40* \_\_\_ %**

Using the data you collected from Part 1 of this assessment complete the following questions. Be sure to read each question carefully before writing your answer.

**Part 2 (29 marks)**

**Question 1**

1. State two similarities and one difference between the inheritance of the nose characteristics and the inheritance of the leg characteristics; include the name of each type of pattern of inheritance. (5 marks)

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1. The symbols shown on the Decoding Key for the nose genotype are incorrect. How could you change the symbols used to properly show this type of inheritance. (1 mark)

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**Question 2**

1. What do the two “piles” of chromosomes, you created initially in the breeding program, represent in real life? (1 mark)

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1. Name and describe two processes that can occur during the formation of the gametes that can cause variation. (3 marks)

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**Question 3**

List the genotypes and phenotypes of your baby. (1 mark)

**Question 4**

Answer the following using the information you collected from the baby Reebops in the nursery.

1. What was the most common phenotype for characteristic you chose, amongst the babies? (1 mark)

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1. Is this the expected trend that you would predict for this characteristic? Explain your answer. (2 marks)

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**Question 5**

1. During your breeding program your baby grew up and had offspring of its own. In the space below draw a pedigree chart of the **phenotype** you choose for the two filial generations that you observed during your breeding program. Your baby and its partner had two children, decide on their phenotype. (2 marks)
2. From your pedigree chart is it possible to state the genotype of the two offspring in the second filial generation? Explain your answer. (2 marks)

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**Question 6**

How many males and females were present in the nursery? \_\_\_\_\_\_\_ males, \_\_\_\_\_\_\_ females.

1. When a couple have a baby the expected ratio of males to females is 1:1. Explain the ratio of males to females obtained in your breeding program. (2 marks)

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1. If you wanted to carry out a breeding program which ensured all the offspring had 2 antennae you would choose only pure breeding adults to breed?

Explain why only pure breeding adults would be used. (1 mark)

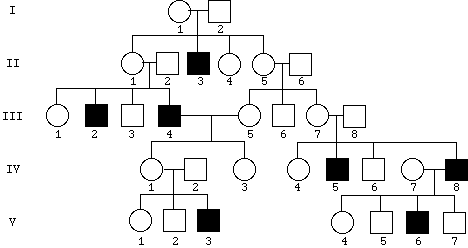
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How could a breeder prove for certain that his 2 antennae adult was a pure bred? (2 marks)

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**Question 7**

The pedigree chart below shows the inheritance of the condition “Stacky Back” in Reebops, where a body segment is smaller than normal leading to stability issues.



a) What is the pattern of inheritance shown in the pedigree chart? (1 mark)

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b) Explain your answer, with reference to the pedigree chart. (2 marks)

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c) (i) What is the genotype of *IV child 3?* (1 mark)

(ii) If this female gets together with a healthy male Reebop, what is the probability that she will have a

male baby with the condition “Stacky Back”? Include a punnet square in your answer. (2 marks)

**Question 8**

Explain why males are more commonly affected by recessive sex-linked disorders than females. (3 marks)

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