NCEA Level 1 Science (Genetics #3)

This worksheet is on reproduction and variation.

Questions

1. Explain why variation is advantageous for a species over time.
2. [NZQA 2015] The photograph below shows a large number of plants that are all the same species.

   (a) The yellow-brown colour in some of the plants has been caused by a disease. The disease is present throughout the field, but affects only some plants. This is because of variation in the plants. Explain why variation means not all the plants get the disease.

   (b) The plants in the photograph were grown from seeds. Seeds are the result of sexual reproduction.

      i. Name one process that occurs during sexual reproduction, and explain how it results in variation.

      ii. Discuss the advantages of sexual reproduction for a species when the environment changes. In your answer you should:
      - give examples of a changing environment
      - explain the impact of changing environments on a population
      - consider the importance of variation in a population in a changing environment.

3. [NZQA 2017] Wild bananas have large seeds, and reproduce sexually. Farmed bananas are produced asexually, from suckers called "banana pups".

   (a) How does the production of gametes by the wild banana plants result in variation?

   (b) Suggest what possible problems may arise for the asexually produced farmed plants that do not arise for the wild plants.

4. "Pseudomonas syringae pv. actinidiae (Psa) is a bacteria that can result in the death of kiwifruit vines. It was first discovered in New Zealand in November 2010 and rapidly caused widespread and severe impacts to New Zealand's kiwifruit industry.

   "New genetic material of any strain is a concern due to the potential of horizontal gene transfer and the impact new strains may have on new or existing kiwifruit cultivars.

   "New strains of Psa are also expected to evolve within New Zealand, of which the characteristics and virulence to new and existing kiwifruit cultivars are unknown. Good biosecurity practices are vital to prevent the spread of any new strains between orchards and growing regions."*

* http://www.kvh.org.nz/about_psa

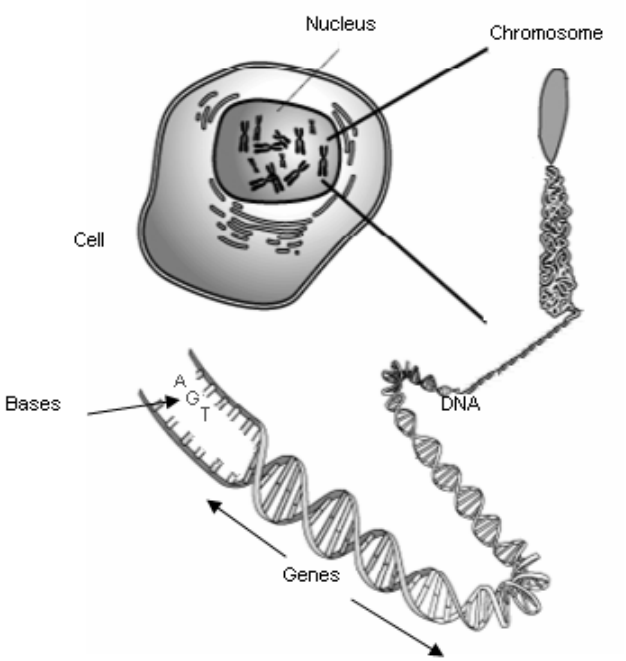
Discuss why biological threats to New Zealand plants, like the Psa virus, tend to affect cultivated species rather than wild species.

In your answer, you should (with reference to the example above):

- Describe how cultivated plants are reproduced, and contrast this to the reproduction of wild plants.
- Explain how this difference makes cultivated plants more susceptible to diseases.
- Guess the meaning of 'horizontal gene transfer' with respect to the bacteria involved, and explain why it is advantageous for the bacteria species. [Hint: normal sexual reproduction results in *vertical* gene transfer.]

Homework

1. [NZQA 2012] The diagram below shows the relationship between chromosomes, genes, and DNA (deoxyribonucleic acid).



   (a) Explain the relationships between DNA, chromosomes and genes. You may add notes and labels to the diagram above to support your answer.

   (b) Explain how the relationships in your answer to (a) lead to different characteristics and how this contributes to genetic variation.

2. [NZQA 2012] A blood disorder caused by red blood cells with an unusual curved (sickle) shape is inherited through a single gene with two possible alleles, normal and sickle.

   Use 'H' to represent the dominant 'normal' allele, and 'h' to represent the recessive 'sickle' allele.

   (a) Explain how two parents with normal blood cells can have a child with sickle-shaped blood cells, with reference to the genotypes of **both** normal parents and a child with sickle-shaped blood cells. You may refer to a Punnett square in your answer.

   (b) The parents in part (a) have four children all with sickle-shaped blood cells. They are expecting a fifth child. Explain how normal parents could have produced **four** children with sickle-shaped blood cells, and calculate the chance that the fifth child will also have sickle-shaped blood cells.