Year 13 Science: Human manipulation of genetic transfer

Name: _____ Date: _____

Try these without your notes first, then check the answer key.

Practice

1. A sheep flock averages 4.0 kg of wool per sheep. Parents chosen average 5.0 kg, and $h^2 = 0.40$. Predict the offspring average.

2. EcoRI cuts this 35–base strand after the G in each GAATTC. Give the fragment lengths: CCTGA ATTCA GGCTA ATCGG CATGA ATTCA TGGCA

3. A gene from a bacterium is put into maize so the maize makes an insect toxin. Name this kind of manipulation.

4. Why does a field of cloned plants risk being wiped out by one new disease?

5. A patient's bone marrow cells are edited to treat sickle cell disease. Will the change pass to the patient's children?

Fix the mistake

6. Correct this statement: "Selective breeding creates new genes for the traits we want."

7. Correct this statement: "Gene therapy on a patient's blood cells will be passed on to their children."

8. Correct this statement: "A clone of a prize bull will look and perform exactly the same."

9. Correct this statement: "Gene editing is banned in New Zealand."

Answer key (for parents and tutors)

1. A sheep flock averages 4.0 kg of wool per sheep. Parents chosen average 5.0 kg, and $h^2 = 0.40$. Predict the offspring average.
   S = 5.0 − 4.0 = 1.0 kg; R = 0.40 × 1.0 = 0.40 kg; offspring average 4.0 + 0.40 = 4.4 kg.
2. EcoRI cuts this 35-base strand after the G in each GAATTC. Give the fragment lengths: CCTGA ATTCA GGCTA ATCGG CATGA ATTCA TGGCA
   GAATTC starts at base 4 and base 24, so cuts after bases 4 and 24: fragments of 4, 24 − 4 = 20 and 35 − 24 = 11 bases.
3. A gene from a bacterium is put into maize so the maize makes an insect toxin. Name this kind of manipulation.
   Transgenesis: a gene from another species is inserted.
4. Why does a field of cloned plants risk being wiped out by one new disease?
   All the plants carry the same alleles, so none has resistance the others lack; if the pathogen can infect one, it can infect all.
5. A patient's bone marrow cells are edited to treat sickle cell disease. Will the change pass to the patient's children?
   No: bone marrow cells are somatic cells, so the change is not in eggs or sperm.
6. Correct this statement: "Selective breeding creates new genes for the traits we want."
   Selective breeding only changes how common existing alleles are; new alleles come from mutation.
7. Correct this statement: "Gene therapy on a patient's blood cells will be passed on to their children."
   Somatic gene therapy changes body cells only; only germline changes reach eggs or sperm.
8. Correct this statement: "A clone of a prize bull will look and perform exactly the same."
   A clone has the same genes, but environment, nutrition and epigenetic effects still change its phenotype.
9. Correct this statement: "Gene editing is banned in New Zealand."
   It is regulated, not banned: under the HSNO Act any genetically modified organism needs EPA approval, including gene-edited ones.