

名詞說明 (30%，每題 3%)

- 1) Hardy-Weinberg equilibrium
- 2) Quantitative trait
- 3) Reverse genetics
- 4) Cis-acting regulatory sequence
- 5) Bacterial conjugation
- 6) Three-point test-cross analysis
- 7) Dosage-compensation in sex-linked gene in human
- 8) Wildtype
- 9) Mismatch repair
- 10) Microsatellite DNA

選擇題 (48%，每題 3%)

- 1) When one DNA molecule is copied to make two DNA molecules, the new DNA contains
 - A) none of the parent DNA.
 - B) 50% of the parent DNA.
 - C) 75% of the parent DNA.
 - D) 100% of the parent DNA

- 2) Consider the following sentence: "The dog did not eat." Which of the following variations of this sentence is most like a frameshift mutation?
 - A) The did dog not eat.
 - B) The dod idn ote at.
 - C) The did not eat.
 - D) The dog did dog did not eat.

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Cats normally have a total of 18 toes, 5 on each front paw and 4 on each back paw. But some cats express the dominant phenotype for

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polydactyly, which results in the development of extra toes on one or more paws. Jake, a Canadian tabby cat, has 28 toes and is recognized by the Guinness Book of World Records as the cat with the most toes.

Suppose that Jake mates with a female cat, Lucy, who has 18 total toes. Over several years, they have multiple litters and a total of 16 kittens (10 males and 6 females). The total number of toes on each kitten ranges from 21 to 25.

3) If we use the letter P to represent the polydactyly gene, what is Jake's genotype?

A) PP

B) Pp

C) pp

D) You cannot determine Jake's genotype from this information.

4) One of Jake and Lucy's kittens mates with another cat that has 18 total toes. What is the probability that one of their offspring would have 18 total toes?

A) 100%

B) 75%

C) 50%

D) 0%

5) Along with having a variable number of toes, some kittens from Jake and Lucy's litter had a white spot on their nose. In fact, out of the 16 kittens, all 10 males had the white spot, but none of the 6 females had the white spot. Jake has a white spot on his nose, but Lucy does not. What can you conclude from this information?

A) A sex-linked gene that controls the expression of the white spot is found on the Y chromosome.

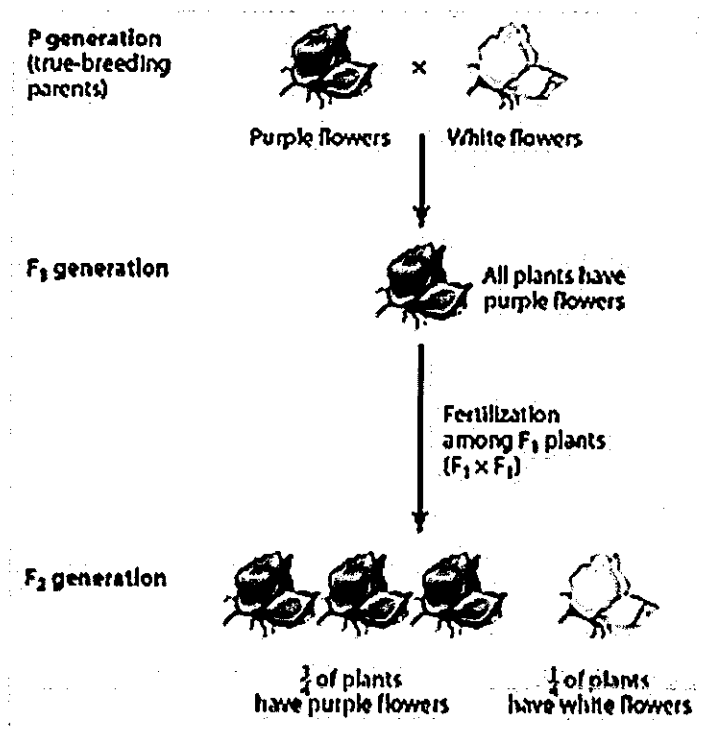
B) A sex-linked gene that controls the expression of the white spot is found on the X chromosome.

C) The genes for the white spot and for polydactyly are linked.

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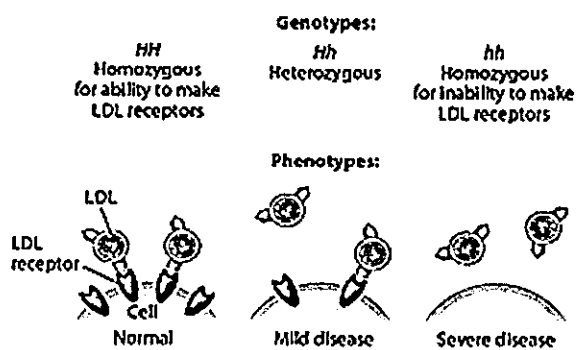
D) The genes for the white spot and for polydactyly are not linked.

6) Which plants in this figure must all be heterozygous?



- A) purple-flowered plants in the P generation
- B) white-flowered plants in the P generation
- C) purple-flowered plants in the F1 generation
- D) purple-flowered plants in the F2 generation

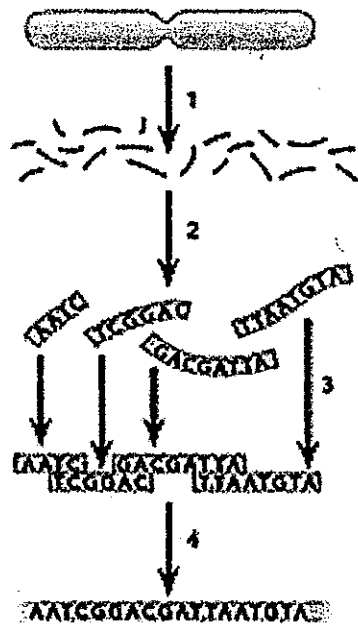
7) According to this figure, heterozygotes for this form of hypercholesterolemia suffer from the disease because they



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- A) produce an abnormally shaped LDL receptor.
 - B) don't produce any LDL receptors.
 - C) produce too many LDL receptors.
 - D) don't produce enough LDL receptors.
- 8) The genes for the enzymes of glycolysis
- A) are active in all metabolizing cells, but the genes for specialized proteins are expressed only in particular cell types.
 - B) are inactive in all metabolizing cells, but the genes for specialized proteins are expressed in all cell types.
 - C) and the genes for all specialized proteins are expressed in all metabolizing cells.
 - D) and the genes for all specialized proteins are expressed in all embryonic cells.
- 9) A homeotic gene
- A) determines which end of the egg will become the head and which end will become the tail.
 - B) serves as a master control gene that functions during embryonic development by controlling the developmental fate of groups of cells.
 - C) represses gene transcription and promotes mRNA translation.
 - D) is found only in adult somatic cells.
- 10) Below is a figure depicting the whole-genome shotgun method. Which step is most similar to a step used when preparing a genomic library?

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- A) step 1
- B) step 2
- C) step 3
- D) step 4

11) Researchers are trying to make a genetically modified (GM) pig that expresses bovine (cow) growth hormone to make it grow bigger. They isolated the bovine growth hormone gene, cut it and a plasmid with the same restriction enzyme, and mixed them together. They inserted the mixture into pig zygotes, but only normal pigs, not GM pigs, grew. What did they likely do wrong?

- A) They are trying to make a GM animal, which is impossible.
- B) They forgot to add DNA ligase after mixing the plasmid and gene together.
- C) They should have used different restriction enzymes to cut the plasmid and the gene.
- D) They forgot to use PCR and make multiple copies of the growth hormone gene.

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12) A cell is initially diploid, but it has a unique cell cycle in that this cell goes through two S phases instead of one. What would the remainder of its cell cycle consist of if this cell is to produce four identical diploid daughter cells at the end of its cell cycle?

- A) two rounds of mitosis and one round of cytokinesis
- B) one round of mitosis and one round of cytokinesis
- C) one round of mitosis and two rounds of cytokinesis
- D) two rounds of mitosis and two rounds of cytokinesis

13) Cancer is not usually inherited because

- A) the chromosomal changes in cancer are usually confined to somatic cells.
- B) people with cancer usually die before reproducing.
- C) the causes of cancer are not usually genetic.
- D) the cancerous cells usually interfere with the ability to produce gametes.

14) Which of the following statements regarding DNA is false?

- A) Long stretches of repetitive DNA are prominent at centromeres and ends of chromosomes.
- B) Human and E. coli genomes contain approximately the same proportions of noncoding DNA.
- C) Current estimates are that there about 21,000 genes in the human genome.
- D) Telomeres seem to have a structural function.

15) Where do transcription and translation occur in prokaryotic cells?

- A) on the plasma membrane
- B) in the nucleus
- C) in the cytoplasm
- D) in chromatophores

16) In giraffes, long necks (N), long legs (L), dark spots (D), and the ability to digest meat (M) are all dominant traits. What possible genotype could

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國立臺灣大學111學年度碩士班招生考試試題

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a long-necked, short-legged, light-spotted, meat-digesting giraffe have?

- A) NnllddMM
- B) NNLLDdMm
- C) NNllddmm
- D) nnLLddMM

簡答題 (22%)

17. (12%)

最近科技報導出現器官移植的突破，將豬心移植到人類的心臟病患者。試從遺傳學的角度探討這項突破所牽涉到的議題。

18. (10%)

進入 21 世紀，人類族群依然繼續增長，試論述遺傳學科技如何應用在未來糧食生產上。

試題隨卷繳回