

一、單選題 (每題 3 分，共 60 分) ※ 本大題請於試卷內之「選擇題作答區」依序作答。

1. In humans, the Barr body is an
 - (A) active X chromosome in males
 - (B) active X chromosome in females
 - (C) inactive Y chromosome in males
 - (D) inactive X chromosome in females
2. In *E. coli*, the inability of the lac repressor to bind an inducer would result in
 - (A) no substantial synthesis of beta-galactosidase
 - (B) constitutive synthesis of beta-galactosidase
 - (C) inducible synthesis of beta-galactosidase
 - (D) synthesis of inactive beta-galactosidase
3. If a cell has one chromosome in excess of the normal number of chromosomes present in the nucleus, it is referred to as
 - (A) aneuploid
 - (B) polyploid
 - (C) tetraploid
 - (D) haploid
4. Which of the following statements about retrotransposons is correct?
 - (A) They transpose via an RNA intermediate
 - (B) They contain genes for ribosomal proteins
 - (C) They possess a gene that encode proteins that integrate RNA in chromosomes.
 - (D) They are found only in bacteria
5. Approximately what fraction of the human genome encodes proteins?
 - (A) 2%
 - (B) 25%
 - (C) 50%
 - (D) 95%
6. A DNA strand with the sequence 5' GGATTC 3' would be complementary to the sequence
 - (A) 5' CCTAAG 3'
 - (B) 5' GAATCC 3'
 - (C) 5' CCUAAG 3'
 - (D) 5' GGAUUC 3'
7. Which of the following contain DNA sequences required for the segregation of chromosomes in mitosis and meiosis?
 - (A) Telomeres
 - (B) Centromeres
 - (C) Nucleosomes
 - (D) Spliceosomes
8. How many genetically different eggs could be formed by women with the genotype of *Aa Bb cc Dd*?
 - (A) 2
 - (B) 4
 - (C) 8
 - (D) 16

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9. Which of the following provides visual evidence of genetic recombination during meiosis?
- (A) Centromeres
 - (B) Haploid nuclei
 - (C) Chiasmata
 - (D) Disappearance of nuclear membrane
10. Which of the following is a reason that geneticists use mitochondrial DNA (mtDNA) to study the relatedness of animal populations?
- (A) mtDNA mutates at a slower rate than nuclear DNA
 - (B) mtDNA is passed from mother to child and is free from recombination that occurs between pairs of chromosomes.
 - (C) All mitochondrial proteins are coded in mitochondrial genes
 - (D) mtDNA genes never mutate.
11. Hardy-Weinberg equilibrium generally assumes all of the following EXCEPT
- (A) a large population
 - (B) genetic drift
 - (C) random mating
 - (D) absence of selection
12. Which of the following could not be found as the genetic materials in organism?
- (A) double stranded DNA
 - (B) double stranded RNA
 - (C) single stranded RNA
 - (D) protein
13. Which of the following mutations will not cause the change of protein sequence?
- (A) Nonsense mutation
 - (B) Missense mutation
 - (C) Silent mutation
 - (D) Deletion in the coding region
14. The beadlike structure consisting of DNA wound around histone proteins is called
- (A) ribosome
 - (B) nucleosome
 - (C) spliceosome
 - (D) nucleolus
15. The technique that uses double-stranded RNA to suppress the gene expression is called
- (A) ChIP (B) RNAi (C) FISH (D) CRISPR
16. The mutant bacterial strain that requires supplements in medium for growth is called
- (A) auxotroph
 - (B) lysogeny
 - (C) episome
 - (D) conjugation

17. Which of the following is correct for paternally imprinted gene?
- (A) It is never expressed in the somatic cells of male
 - (B) It is never expressed in the somatic cells of female
 - (C) Only the maternal allele is transcribed
 - (D) Only the paternal allele is transcribed
18. What is the possible major function of a tumor suppressor gene?
- (A) control progress in the cell cycle in response to DNA damage
 - (B) stimulate cell growth
 - (C) block apoptosis
 - (D) promote cell differentiation
19. The AUG sequence in the mRNA could be used as
- (A) 5'-cap
 - (B) start codon
 - (C) stop codon
 - (D) polyadenylation signal
20. What is a "charged-tRNA"?
- (A) a tRNA just release from ribosome during translation
 - (B) a tRNA connected with an amino acid at its 3' end
 - (C) a tRNA that transports to cytoplasm
 - (D) a tRNA with ATP

二、解釋名詞 (每題 4 分，共 20 分) ※ 本大題請於試卷內之「非選擇題作答區」標明題號依序作答。
請說明以下遺傳學中的專有名詞

1. Genetic linkage
2. Epistasis
3. Frameshift mutation
4. Inversion
5. Heterochromatin

三、問答題 (共 20 分) ※ 本大題請於試卷內之「非選擇題作答區」標明題號依序作答。

1. (A) 請問什麼是基因體(genome)? (4 分)
(B) 請問基因體的研究在生物學上有什麼重要性或是應用的方向? (4 分)
(C) 近年來對基因體的研究常會使用的方法或策略有哪些? (4 分)
2. 請計算並寫出以下兩種親代的組合所產生子代的表型 (phenotypes) 可能數目。A B C D 基因皆為完全顯性。(各 4 分)
(A) $Aa Bb Cc Dd \times aa bb cc dd$
(B) $Aa Bb Cc Dd \times Aa Bb Cc DD$

試題隨卷繳回