

系所組別：生命科學系乙組

考試科目：遺傳學

考試日期：0220，節次：2

※ 考生請注意：本試題 可 不可 使用計算機

1. Please define the following biological terms.

- A. Microsatellite fingerprinting (4%)
- B. Hardy-Weinberg equilibrium (4%)
- C. Gene duplication (4%)
- D. Genome (4%)
- E. Balancing selection (4%)

2. In general, what is the effect of histone acetylation and DNA methylation on gene expression? (10%)

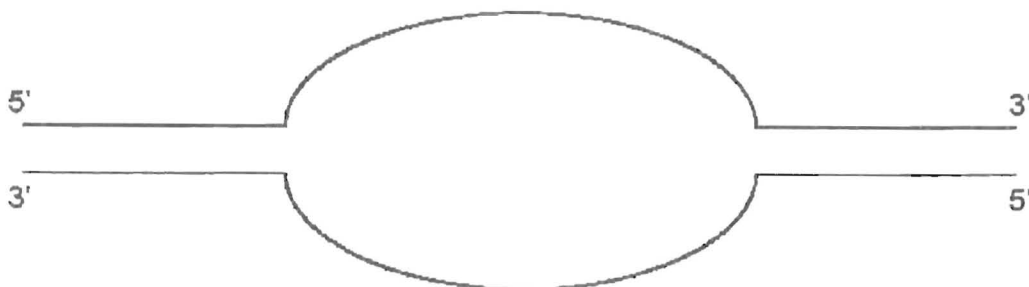
3. Please define the following biological terms.

- A. Cyclin-dependent Kinase (CDK) (5%)
- B. microRNA (miRNA) (5%)

4. Please explain "End replication problem" and how do cells overcome this problem. (5%)

5. Using the DNA replication bubble as a model (see the picture below) to indicate the following components: (5%)

- A. leading strand
- B. lagging strand
- C. origin
- D. Okazaki fragments
- E. Helicase



6-30. Multiple choice (only one answer; 2% of each question and total 50%)

6. Which of the following chemical modifications is associated with increased gene activity?

- A. acetylation of histones
- B. methylation of K9 of histone H3
- C. methylation of K27 of histone H3
- D. phosphorylation of histones
- E. methylation of DNA

(背面仍有題目,請繼續作答)

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7. Which of the following is *not* consistent with Erwin Chargaff's findings?
- A. $(A + G) = (C + T)$
 - B. $(A + C) = (G + T)$
 - C. $A = T$
 - D. $(C + G) = (A + T)$
 - E. $(A + G) / (C + T) = 1$
8. The most precise modern definition of a gene is a segment of genetic material that:
- A. codes for one polypeptide.
 - B. codes for one polypeptide or RNA product.
 - C. determines one phenotype.
 - D. determines one trait.
 - E. that codes for one protein.
9. Which statement *best* describes human sex determination?
- A. Females are heterogametic.
 - B. Individuals with a Y chromosome are male.
 - C. Individuals with two X chromosomes are female.
 - D. Individuals with at least twice as many X chromosomes as Y chromosomes are female.
 - E. Individuals with one X chromosome are male.
10. A human individual with 45 chromosomes is an example of
- A. monosomy.
 - B. trisomy.
 - C. monoploidy.
 - D. diploidy.
 - E. triploidy.
11. Nucleic acid blotting is widely used in recombinant DNA technology. In a Southern blot one generally
- A. hybridizes filter-bound DNA with a DNA probe.
 - B. hybridizes filter-bound RNA with a DNA probe.
 - C. examines amino acid substitutions with radioactive probes.
 - D. cleaves RNA with restriction endonucleases.
 - E. ligates DNA with DNA ligase.

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12. It is common to use ddNTPs (dideoxynucleoside triphosphates) in which of the following biochemical reactions?

- A. citric acid cycle
- B. DNA sequencing
- C. restriction digestion
- D. electron transport
- E. plasmolysis

13. A bacterial operon

- A. contains information for one protein product.
- B. contains information for more than one protein product.
- C. is capped at the 5' end and carries a poly-A tail at the 3' end.
- D. is void of start (AUG) and termination (UAA, UGA, UAG) triplets.
- E. none of the above

14. In general, the organization of genes in bacteria is different from that in eukaryotes. In *E. coli*, approximately 27 percent of all genes are organized into contiguous, functionally related units containing multiple genes under coordinate control that are transcribed as a single unit. Such contiguous gene families are called

- A. transcriptomes
- B. proteomes
- C. contigs
- D. operons
- E. pseudogenes

15. RFLPs and minisatellites are commonly used in recombinant DNA technology to

- A. cleave DNA of interest.
- B. generate pharmaceutical products of interest.
- C. serve as recombinant DNA vectors.
- D. identify alleles and generate DNA fingerprints.
- E. substitute for oligonucleotides.

(背面仍有題目,請繼續作答)

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16. A DNA microarray (also called a DNA chip) can be used to
- A. mutate genes of interest.
 - B. isolate genes from eukaryotic cell nuclei.
 - C. assay protein output from a genomic database.
 - D. trap genes that are both active and inactive.
 - E. scan a population of nucleic acids for abundance and mutations.
17. Development appears to occur as a result of successive subdivisions of anatomical/functional domains. Segments are formed in some embryos, and each segment is determined to form either anterior or posterior regions. What term is often applied to such regions (see Figure 20.12)?
- A. segmental fracture
 - B. gap faction
 - C. compartment
 - D. homeodomain
 - E. transdetermined aspect
18. The gene-first approach to the study of behavior refers to
- A. the generation of mutations and their impact on behavior.
 - B. using ring-X chromosomes to generate developmental mosaics.
 - C. mapping to a primary focus of a gene's expression and correlating it with a specific behavior.
 - D. using autosomal inversions to generate behavioral variations.
 - E. fate mapping a given behavior.
19. A number of behavioral mutations have been described in *Drosophila* in which nerve transmission is affected. What ion channels are primarily involved?
- A. calcium and sodium
 - B. calcium and potassium
 - C. sodium and potassium
 - D. boron and carbon
 - E. carbon and sodium

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20. Humans are relatively unavailable as experimental subjects in genetic investigations, yet considerable interest surrounds intelligence, language, personality, and emotion behaviors. One difficulty in studying such behaviors is the high likelihood that
- A. they are strongly influenced by birth order and diet.
 - B. they are affected by the environment.
 - C. they follow non-Mendelian patterns of inheritance.
 - D. they follow extranuclear patterns of inheritance.
 - E. no genetic influence is likely.
21. The horse (*Equus caballus*) has 32 pairs of chromosomes, whereas the donkey (*Equus asinus*) has 31 pairs of chromosomes. How many chromosomes would be expected in the somatic tissue of a mule (the hybrid of horse and donkey)?
- A. 31
 - B. 32
 - C. 63
 - D. 64
22. What is the outcome of synapsis in meiosis?
- A. Monad movement to opposite poles
 - B. Chiasma segregation
 - C. Side-by-side alignment of homologous chromosomes
 - D. Side-by-side alignment of non-homologous chromosomes
23. What parent genotype is always used in the testcross for determining the genotype of a dominant phenotype individual?
- A. Homozygous dominant individual
 - B. Homozygous recessive individual
 - C. Heterozygous individual
 - D. Haploid dominant individual
24. The chi-square test involves a statistical comparison between observed and expected values. You can generally determine degrees of freedom as
- A. The number of categories being compared
 - B. One less than the number of classes being compared
 - C. One more than the number of classes being compared
 - D. The sum of the two categories

(背面仍有題目,請繼續作答)

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25. In the ABO blood system, AB blood phenotype exhibits what kind of inheritance?
- A. Complete dominance
 - B. Incomplete dominance
 - C. Co-dominance
 - D. Epistasis
26. A heterozygous A-type blood ($I^A i$) individual shows what kind of inheritance?
- A. Complete dominance
 - B. Incomplete dominance
 - C. Co-dominance
 - D. Epistasis
27. If a cross is made between $CcDd$ and $ccdd$ plants and the offspring occur in the numbers of 105 $CcDd$, 48 $Ccdd$, 52 $ccDd$ and 95 $ccdd$. These results are consistent with the following circumstance:
- A. Sex-linked inheritance with 30% crossing over
 - B. Linkage with approximately 33 map units between the two gene loci
 - C. Linkage with 50% crossing over
 - D. 100% recombination
28. What methods are mostly involved in determining the linkage group and genetic map in humans?
- A. Syntenic testing and lod score determination
 - B. Twin spots and tetrad analysis
 - C. Zygotene and pachytene DNA synthesis
 - D. Chiasmatype and classical analyses
29. What two forms of recombination were found in bacteria?
- A. Insertion and replication
 - B. Auxotrophic and prototrophic
 - C. Conjugation and transduction
 - D. Lytic and lysogenic
30. What two interactive cycles are engaged between Bacteriophages and bacteria?
- A. Negative and positive
 - B. Auxotrophic and prototrophic
 - C. Heteroduplex and homoduplex
 - D. Lytic and lysogenic