

1. 說明蛋白質之 4 級結構, 並寫出主要的二次結構。(10%)
2. 組成細胞的三大類巨分子為何? 其基本功能為何?(10%)
3. 說明細胞中利用那些機制將蛋白質之雙硫鍵正常連結。(10%)
4. 免疫細胞在基因層次上如何產生多樣的抗體來對抗數以百萬種不同的抗原?(10%)
5. 請舉出三種與 DNA 作用的 protein motif 及三種蛋白交互作用 protein motif,
並舉出擁有此 motif 的蛋白質(同時擁有二種 motif 之蛋白亦可)。(10%)
6. 說明 channel, pump, gap junction 之異同。(10%)
7. 說明 gel filtration column 分離蛋白質的原理。(10%)
8. 何謂蛋白質二維電泳, 其原理為何?(10%)
9. 解釋名詞: (20%), 20 字內說明
 - a. isozyme,
 - b. t-RNA
 - c. topoisomerase
 - d. telomeres
 - e. apoptosis
 - f. B form DNA
 - g. exon/intron
 - h. non-sense mutation
 - i. SDS PAGE
 - j. Citric acid cycle

國立中山大學九十二學年度碩士班招生考試試題

科目：遺傳學

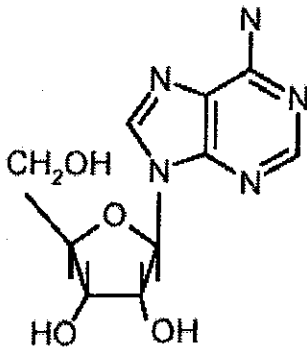
(生物醫學研究所碩士在職專班)

共 7 頁 第 1 頁

九十三年學年度 國立中山大學生物醫學研究所碩士在職專班入學考試 遺傳學

Note: read all questions carefully. Write legibly. Answer all questions on the sheets provided.
A total of 50 questions, two point each, perfect score = 100.

1. Who is the father of Genetics (1) Gregor Mendel (2) Bill Cilton (3) George Washington (4) Thamos Jefferson.
2. Your ABO blood type is B, and your father is A, what is the blood of your mother? (1) O (2) B (3) A (4) AB.



3. The molecule shown on the left is (1) a base (2) an acid (3) a sugar (4) a nucleotide.

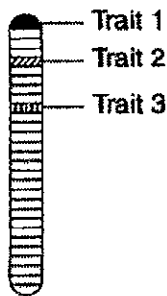
4. This molecule would be found in (1) DNA (2) RNA (3) both of above (4) protein.

5. In bacteria, gene expression is regulated by proteins which bind DNA near the 5'-end of the gene they control. In mammalian cells (1) genes are regulated in much the same way (2) gene on different chromosomes are expressed in different tissues (3) gene expression is primarily controlled by methylation which represses genes (4) gene expression is primarily controlled by differential splicing, the usage of alternative polyadenylation sites and mRNA stability.
6. If three genes are in the same operon, they must be (1) the products of alternative splicing of a single mRNA (2) all encoded on one polycistronic message (3) all encoded by a single open reading frame (4) translated in different reading frames from the same RNA sequence.
7. A bacteria promoter is likely to contain (1) a TATA box which is involved in the binding of RNA polymerase but is at -24 rather than at -10 (2) a Shine-Dalgarno sequence (3) a CCAAT box (4) a region which will be recognized by sigma factors of RNA polymerase.

8. Enhancers usually act (1) *in cis* (2) *in trans* (3) to increase the rate of translation (4) only when placed downstream of the promoter.
9. Which of the following is associated with mutation (1) altered genetic message (2) failure of DNA repair mechanisms (3) insertion of wrong nucleotide during DNA replication (4) all of the above.
10. Amino acids have an average molecular weight of 110 daltons. An open reading frame of 900 bases might encode a protein of (1) 900 daltons (2) 33,000 kDa (3) 33 kDa (4) 99,000 daltons.
11. In DNA replication, two DNA duplexes are formed. What statement describes how they are made? (1) one duplex is completely new and the other contains the two original strands (2) each duplex is a mix of parts of the old strand and new parts (3) each duplex contains one new strand and one original strand (4) none of the above.
12. A woman heterozygous for freckles reproduces with a man without the trait. Freckles are dominant, what are the chances the child will have the trait? (1) 0% (2) 25% (3) 50% (4) 100%.
13. There is certain degeneracy in our three letter code. This degeneracy (1) means that occasionally more than one amino acid is coded by the same codon (2) means that "spare" codons are available for emergencies (3) is a consequence of the fact that there are more codons than biologically utilized amino acids (4) means that suppressor tRNAs only correct a fraction of mutations.
14. What is the genetic disorder that might be when "a minor disturbance in balance and coordination. Develops in middle age and progresses towards severe mental disturbances"? (1) Alzheimer's disease (2) Neurofibromatosis (3) Anemia (4) Huntington's disease.
15. Sickle cell anemia is caused by the mutation of a single codon, GAG to GTG in the beta-globin gene, resulting in a substitution of glutamic acid by valine. If the single anticodon of the Glu tRNA were altered from CTC to CAC (1) this mutation might well suppress the sickle cell mutation and the person would be normal (2) this mutation might correct the specific change in the beta-globin gene but all other valine codons might be similarly misread and the phenotype would be far from normal (3) this tRNA would now be non-functional (4) this tRNA would now be charged with valine rather than glutamine.

16. Which statement best describes the process of crossing over? (1) it takes place between homologous chromosomes and results in new gene combinations (2) it takes place between homologous chromosomes and results in an increased gene mutation rate (3) it takes place between nonhomologous chromosomes and results in an increased gene mutation rate (4) it takes place between nonhomologous chromosomes and results in new gene combinations.

17. A structure found in the nucleus of a cell is shown in the diagram below. The information contained in the diagram best illustrates the (1) law of segregation (2) concept of nondisjunction (3) theory of natural selection (4) gene-chromosome theory.



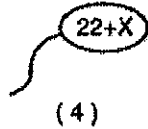
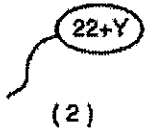
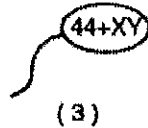
18. Sometimes a section of a chromosome is lost during meiosis. This loss results in a change in genetic material known as (1) deletion (2) replication (3) crossing over (4) polyploidy

19. In which situation could a mutation be passed on to the offspring of an organism? (1) ultraviolet radiation causes skin cells to undergo uncontrolled mitotic division (2) A primary sex cell in a human forms a gamete that contains 24 chromosomes (3) The DNA of a human lung cell undergoes random breakage (4) A cell in the uterine wall of a human female undergoes a chromosomal alteration.

20. Identical twins were born with genes for a genetic disorder that can be controlled by diet. Both twins were placed on this diet, which excludes a certain amino acid. However, one twin chose not to follow the diet and developed the genetic disorder. The other twin followed the diet and did not develop the disorder. This difference between the twins illustrates that (1) gene expression is not influenced by biochemical factors (2) gene expression is influenced by the environment (3) identical twins do not always have the same genotype (4) the genetic disorder is inherited by identical twins only.

21. An allele is (1) another word for a gene (2) a homozygous genotype (3) a heterozygous genotype (4) one of several possible forms of a gene.

22. Which diagram represents a sperm that can unite with a normal egg to produce a zygote that will develop into a normal human male embryo? (1) 1 (2) 2 (3) 3 (4) 4.



23. A woman has a gene that causes a visual disorder. To prevent the gene from appearing in future generations, the defective gene would have to be repaired in the mother's (1) eye (2) uterus (3) nervous system (4) reproductive cells.

24. The idea that for any particular trait, the pair of alleles of each parent separate and only one allele from each parent passes to an offspring is Mendel's principle of (1) independent assortment (2) hybridization (3) segregation (4) transmission.

25. If medical researchers discovered that there is a single human gene responsible for all of the various forms of physical deterioration commonly associated with diabetes, it would be referred to as (1) a modifying gene (2) pleiotropy (3) a regulator gene (4) epistasis.

26. A regulator gene can (1) alter how another gene is expressed (2) change the genetically determined sex or gender of an adult human (3) initiate or block the expression of another gene (4) change the genetic codes of other genes.

27. Incompletely penetrant genes are ones that (1) are only expressed in the phenotype if certain factors in the environment are present (2) results in an apparent blending of parental traits (3) are expressed in heterozygous individuals as both allele unblended (4) are expressed in homozygous individuals as both allele unblended.

28. What technology will determine the location of specific genes within the genome (1) cloning (2) annotation (3) proteomics (4) genomics.

29. An open reading frame (ORF) is (1) the sequence of a complete genome (2) competent cells available for transfection (3) a plasmid vector used in genome sequencing (4) a possible gene predicted by DNA sequencing.
30. The field that is concerned with the management and analysis of biological data using computers (1) statistics (2) genomics (3) bioinformatics (4) proteomics.
31. The minimum set of genes required for life is approximately (1) 50-100 genes (2) 250-350 genes (3) 500-700 genes (4) 1,000-1,500 genes.
32. Proteomics is (1) a branch of quantum physics (2) the study of algal genomes (3) the study of the entire collection of proteins expressed by an organism (4) protein 2-D gel electrophoresis.
33. Alternative splicing is the process whereby (1) introns are removed from the primary transcript to produce mature mRNA which can be used directly to code for protein (2) every second intron is removed from the pre-mRNA (3) introns are removed from proteins (4) mRNAs containing different assortments of exons are generated from a single gene.
34. About how many genes are there in the human genome? (1) 30,000-35,000 (2) 100,000-120,000 (3) 20,000-30,000 (4) 50,000-70,000.
35. Why are stem cells so valuable? (1) they are progenitor cells (2) they are a rich source of nutrients (3) they coordinate the growth of limbs (4) they protect the body from viruses.
36. Griffiths' experiment, the transforming factor that changed a harmless strain of *pneumococci* into a pathogenic strain was (1) toxin (2) a bacterial virus (3) RNA (4) DNA.
37. The experiment of Hershey and Chase using bacteriophage and *E. coli* showed that (1) DNA alone can direct the synthesis of both nucleic acids and proteins (2) that some types of viruses can replicate in bacterial cells (3) heat killed viruses are capable of repairing themselves and causing infection (4) viral proteins are not needed for a virus to infect a cell.
38. The existence of two types of nucleic acid, RNA and DNA, was established by (1) Wilkins & Franklin (2) Waston & Crick (3) Levine & colleagues (4) Mendel & Morgan.

39. Artificial selection is illustrated by (1) random mating taking place in a population (2) a gardener producing a new hybrid by cross-pollinating plants (3) the appearance of a new species on an isolated island (4) wind assisting the pollination of grass in a field.
40. Why was the genome sequencing of yeast (*Saccharomyces cerevisiae*) considered to be important? (1) it was the first genome to be completely sequenced (2) it was the first microbial genome to be completely sequenced (3) it was the first eukaryotic genome to be completely sequenced (4) it was the first genome to be completely sequenced in less than 24 hours.
41. An antisense molecule interferes with protein synthesis by (1) providing a bogus mRNA for the ribosome to bind to (2) when mRNA forms a duplex with a complementary antisense RNA sequence, translation is blocked (3) unraveling proteins as soon as they're assembled (4) binding to amino acids, making them unavailable for use in proteins.
42. The enzyme used to synthesize a molecule of DNA from mRNA is (1) DNA polymerase (2) reverse transcriptase (3) invertase (4) endonuclease.
43. Two genes are 3.8 cM apart means (1) the physical distance between these genes is 3.8 Kb (2) the physical distance between these genes is 380 bp (3) the frequency of recombination between these two genes is 3.8% (4) the frequency of recombination between these two genes is 38%.
44. The function of "high-copy-number DNA" is (1) encoding most genes (2) encoding rRNA (3) encoding a single gene (4) unknown.
45. The genome sequencing of rice is important because (1) the rice genome is very unique and contains genes not found in other plants (2) the rice genome is very large compared to the DNA of other grains and so more genes will be identified (3) it can identify genes associated with disease resistance, growth capacity, etc. (4) it has a rapid life cycle and has many identifiable mutations.
46. What diseases are liable to be cured thanks to the therapeutic cloning? (1) influenza (2) chickenpox (3) Parkinson's disease (4) all of the above.
47. Why did Ian Wilmut decide to call his cloned sheep, Dolly? (1) in memory of the song "Hollo Dolly" frequently played in his laboratory (2) to pay tribute to the generous

forms of the singer, Dolly Parton (3) to form an acronym using the initials of the first names of the different members of his research team (4) None of the above.

48. What country has legalized therapeutic cloning? (1) France (2) the United Kingdom (3) Canada (4) Cuba.

49. If a PROTEIN solution and a DNA solution have the same absorbance at 260 nm, which would be more concentrated on a mass/volume basis? (1) protein (2) DNA (3) the same (4) uncertain.

50. In a nucleic acid hybridization experiment, if you wanted to distinguish the mRNA product of a single gene from those of related genes in a gene family, what kind of hybridization conditions would you use? (1) relatively low salt concentration conditions (2) relatively high salt concentration conditions (3) no stringency conditions (3) very low hybridization temperature.