

國立中山大學 106 學年度碩士暨碩士專班招生考試試題

科目名稱：生態學【生科系碩士班甲組】

題號：421002

※本科目依簡章規定「不可以」使用計算機(問答申論題)

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一、問答題(共 100 分)

1. What is the river continuum concept? This concept did not applied so well to tropical rivers. Why? (15 points)
2. (A) Explain how a metapopulation can become extinct while suitable habitat remains. (B) Imagine that human actions create a metapopulation from what was once continuous habitat. If many small and two large habitat patches remain, what arrangement of those patches would make it most likely that the metapopulation would persist? or not persist? (20 points)
3. (A) In Africa, savannas are most common with big Acacia trees scattered within grasslands, why not all trees or all grasses? (B) Savanna is suspected as the natural biome in Kaohsiung area in the past, why? (15 points)
4. What is the primary difference between interaction webs and food webs? (10 points)
5. What is the Shannon index? (10 points)
6. What is succession? How does ecological succession begin? Please describe how to proceed. (15 points)
7. Describe the alpha, beta, and gamma species diversity. (15 points)



# 國立中山大學 106 學年度碩士暨碩士專班招生考試試題

科目名稱：普通生物學【生科系碩士班甲組】

題號：421004

※本科目依簡章規定「不可以」使用計算機(問答申論題)

共 1 頁第 1 頁

答題時請同時使用文字與圖示綜合回答來表達你的理念與知識架構

一、請說明釐清以下議題所需要的生物科學與非生物科學的基礎知識與技術為何？以及這些知識與技術彼此之間的關聯性與角色(100分)

- (A) 因應氣候變遷，台灣是否需要進行作物的分子育種，或是引進已經具備該氣候適應特質的外來作物即可？(35分)
- (B) 市面上標示不清或仿冒的生鮮產品極多，如何確認產品原料標示與該生物是吻合的？(35分)
- (C) 基改作物是否有害人體？(30分)



國立中山大學 106 學年度碩士暨碩士專班招生考試試題

科目名稱：生物化學【生科系碩士班乙組】

題號：421001

※本科目依簡章規定「不可以」使用計算機(問答申論題)

共 1 頁第 1 頁

1. Describe the levels of protein structure and how each level of protein structure is stabilized. (10%)
2. Discuss the significance of chemical differences between DNA and RNA molecules. (5%)
3. Discuss the metabolic role of ATP. (5 %)
4. Describe the steps of glycolysis and Krebs cycle, (10%)
5. Describe how ATP is synthesized in mitochondria. (10%)
6. Describe (A) the structure (B) the composition (C) function of biological membranes (10 %)
7. What are the fundamental types of biological macromolecules and the functions of each type of macromolecule in a cell?(10%)
8. Describe the theory and application of the following methods or tools in biochemical research.(20%)
  - (A) Gel filtration chromatography
  - (B) SDS-Polyacrylamide gel electrophoresis (SDS-PAGE)
  - (C) Two-dimensional electrophoresis
  - (D) Western blotting
10. Explain the following terms (15%)
  - (A) Photophosphorylation
  - (B) Entropy
  - (C) Allosteric regulation
  - (D) G protein
  - (E) Gluconeogenesis
11. Matching the genetic diseases with their respective biochemical defects:(5 %)

<u>Genetic diseases:</u>	<u>Biochemical defects:</u>
(1) Phenylketonuria(PKU)	(A) Absence or dysfunction of LDL receptors
(2) Gout	(B) Lactase deficiency
(3) familial hypercholesterolemia	(C) Hypoxanthine-guanine phosphoribosyltransferase deficiency
(4) Lesch-Nyhan Syndrome	(D) Phenylalanine hydroxylase deficiency
(5) Lactose intolerance	(E) Excess uric acid



國立中山大學 106 學年度碩士暨碩士專班招生考試試題

科目名稱：分子生物學【生科系碩士班乙組】

題號：421003

※本科目依簡章規定「不可以」使用計算機(混合題)

共 5 頁第 1 頁

選擇題：每題 2 分，合計 50 分。

1. Which of the following is NOT true of the interaction of TBP with DNA?
  - A. TBP is able to bind DNA non-specifically with respect to sequence.
  - B. TBP binds the TATA box through minor groove DNA contacts.
  - C. A helix-turn-helix motif in TBP makes the DNA contacts.
  - D. The DNA bound by TBP is bent.
2. What is the correct order of general transcription factor assembly at an RNA polymerase II promoter?
  - A. TFIIB, TFIID, TFIIF, TFIIH
  - B. TFIIB, TFIIH, TFIID, TFIIF
  - C. TFIID, TFIIB, TFIIF, TFIIH
  - D. TFIID, TFIIF, TFIIH, TFIIB
3. Which of the following processes is least likely to be coupled to eukaryotic transcription?
  - A. DNA repair
  - B. DNA replication
  - C. RNA processing
  - D. mRNA transport
4. Which of the following sigma factors is essential for general transcription in exponentially growing cells?
  - A.  $\sigma 28$
  - B.  $\sigma 32$
  - C.  $\sigma 54$
  - D.  $\sigma 70$
5. Which of the following is true of  $\rho$ -independent termination of transcription?
  - A. It relies on the production of an RNA transcript with self-complementary sequences.
  - B. It utilizes a hexameric helicase.
  - C. RNA polymerase stalls at a specific sequence of GC base pairs.
  - D. It occurs when the sigma subunit dissociates from the polymerase.
6. Which of the following proteins is NOT associated with the C-terminal domain of RNA Polymerase II?
  - A. Cap Binding Complex
  - B. Aminoacyl-tRNA synthetase
  - C. Guanylyltransferase
  - D. Polyadenylation factors
7. Poly(A) site choice:
  - A. is a mechanism to determine the length of the poly(A) tail.
  - B. leads to polyadenylation of the 5' end of the mRNA.

背面有題

國立中山大學 106 學年度碩士暨碩士專班招生考試試題

科目名稱：分子生物學【生科系碩士班乙組】

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- C. can generate multiple protein products from a single gene.  
D. is catalyzed by small nucleolar ribonucleoproteins.
8. The nucleophile of the first step of spliceosome-mediated pre-mRNA splicing is the:  
A. 2' hydroxyl of the branch point adenosine.  
B. 3' hydroxyl of a free guanine nucleotide.  
C. 3' hydroxyl of the 5' splice site exon.  
D. 2' hydroxyl of the 3' splice site intron.
9. In spliceosome-mediated pre-mRNA splicing:  
A. U2 snRNA base-pairs to both sides of the splice junction.  
B. U2 and U6 snRNAs base-pair during the two transesterification reactions.  
C. U6 snRNA base-pairs to the 3' end of the intron.  
D. U5 snRNA base-pairs to the 3' end of the intron.
10. Which of the following is NOT an enzymatic function of the editosome?  
A. Uridyltransferase  
B. Ligase  
C. Deaminase  
D. Ribonuclease
11. The ribonucleoprotein, RNase P, catalyzes the:  
A. exonucleolytic removal of the 3' end of tRNA molecules.  
B. endonucleolytic removal of the 5' end of tRNA molecules.  
C. ATP-independent removal of tRNA introns.  
D. degradation of the poly(A) tail.
12. What is the sequence of the last three nucleotides of all mature tRNA molecules?  
A. 5' ACC  
B. 5' CCA  
C. 5' TGG  
D. 5' GGT
13. Which one of the following describes a tRNA molecule that specifically recognizes the codon for amino acid "histidine" but is covalently bound (charged with) to the amino acid "serine" ?  
A. histinyl-tRNASer  
B. histinyl-tRNAHis  
C. seryl-tRNASer  
D. seryl-tRNAHis
14. Which one of the following polypeptide sequences will be made from the RNA sequence shown, translating from the first start codon to the stop codon?  
5' - CGACAUGCCUAAAAUCAUGCCAUGGAGGGGGUAACCUUUU



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- A. Arg-His-Ala  
B. Met-Pro-Lys-Ile-Met-Pro-Trp-Arg-Gly-Tyr-Pro-Phe  
C. Met-Pro-Lys-Ile-Met-Pro-Trp-Arg-Gly  
D. Met-Pro-Lys-Ile
15. Which one of the following statements about the use of synthetic polynucleotides in cracking the genetic code is NOT true?  
A. Poly(A) RNA directs the synthesis of only polylysine in vitro.  
B. Particular codons are generated in predictable ratios with random RNA polymers containing specific ratios of different nucleotides.  
C. Three different amino acids are incorporated into peptides when synthetic polymers of only one nucleotide are used to synthesize the RNA polymer.  
D. The codon table was completed by using RNA polymers of defined sequences.
16. Which one of the following experimental results does NOT support the hypothesis that the ribosome is a ribozyme?  
A. There are no proteins observed within 18Å of the peptidyl transferase active site in the crystal structure.  
B. Peptidyl transferase activity is not inactivated by treating the ribosome with detergent.  
C. Peptidyl transferase activity can be inactivated by base changes in the rRNA.  
D. Ribosomes from thermophilic organisms are more stable than from Escherichia coli.
17. The difference between a Class I and a Class II tRNA synthetase is:  
A. the Class I synthetase requires ATP cofactor and the Class II does not.  
B. the Class I synthetase uses the 2' -OH of 3' end of the tRNA as a nucleophile and the Class II uses the 3' -OH.  
C. the Class II synthetase reaction requires a transesterification reaction not necessary in the Class I reaction.  
D. the Class II synthetases are typically monomeric, whereas the Class I enzymes frequently function as multimeric protein complexes.
18. Which of the following is NOT an essential component of the eukaryotic initiation stage of translation?  
A. 40S ribosome  
B. eIF2  
C. GTP  
D. N-Formylmethionyl-tRNA<sup>fmet</sup>
19. Which of the following events do NOT occur in non-stop mRNA decay?  
A. A string of lysine residues are added at the C-terminus of the polypeptide.  
B. The stalled ribosome recruits Ski7 protein.  
C. Ski7 protein degrades the defective protein by recognizing the C-terminal poly(Lys) tag.

背面有題

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- D. An exosome ribonuclease degrades the mRNA.
20. Which of the following is NOT a function of EF-G in bacterial translation?
- A. The hydrolysis of GTP
  - B. The mediation of elongation
  - C. The separation of the ribosome from the mRNA at termination
  - D. The hydrolysis of the terminal peptidyl-tRNA bond
21. A large amount of satellite DNA is found .
- A. in euchromatin
  - B. around the centromeres of chromosomes
  - C. in loosely packed forms of chromatin
  - D. in Alu elements.
22. Type II topoisomerases
- A. break both strands of DNA
  - B. include DNA gyrase, for example
  - C. change the linking number in steps of two
  - D. are all of the above
23. Which of the following sequences would have the highest melting temperature relative to the others listed?
- A. 5' -ATATATAT-3'
  - B. 5' -GAGAGAGA-3'
  - C. 5' -GCGCGCGC-3'
  - D. 5' -AAAAAAAA-3'
24. The form of DNA that consists of a triple helix promoted by acid conditions and runs of purine bases is called .
- A. H-DNA
  - B. Z-DNA
  - C. A-DNA
  - D. B-DNA
25. An A260/A280 ratio of less than 1.8 indicates .
- A. pure DNA
  - B. pure RNA
  - C. protein contamination of DNA
  - D. RNA contamination of DNA

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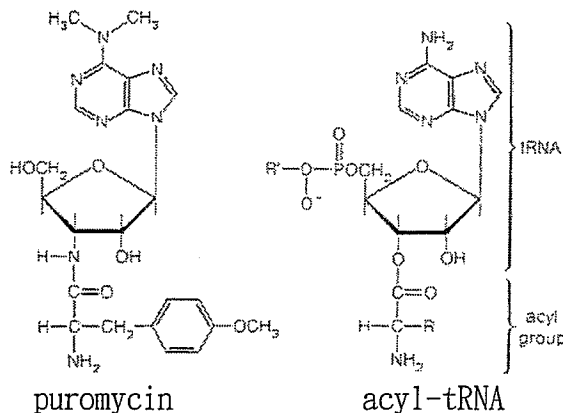
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問答題：

1. 請說明真核細胞 RNA polymerase II 之 C-terminal domain (CTD) 之特徵及其重要性。(10 分)
2. 請說明何謂 TATA box? 其在真核及原核細胞轉錄作用之重要性。並說明在真核生物中 TATA box 結合蛋白 TBP 之結構及功能。(10 分)
3. 抗生素 P (puromycin) 具有與 acyl-tRNA 的 3' 端類似的結構 (參見下圖)，為一種很有效的細胞內蛋白質合成之抑制劑。某研究生在進行試管內轉譯作用 (in vitro translation) 時，不小心將抗生素 P 誤加到正在進行反應的試管內，當反應結束後，反應產物經過分析後，發現所轉譯的蛋白質產物為一些不完整的蛋白質片段，且其一端皆與抗生素 P 形成共價鍵結。



依據上述結果，請回答下列問題：(每題 5 分)

- A. 請解釋為何有此結果? 並推測抗生素 P 抑制蛋白質合成之可能機制。
  - B. 請問在進行試管內轉譯實驗時，試管內需要有哪些參與反應的組成份?
  - C. 請說明抗生素 P 結合在這些不完整的蛋白質片段產物的那一端?
  - D. 請問抗生素 P 會與試管內那一個反應組成份結合? 結合在那個部位?
4. Define a reporter gene and state its application. (5 分)
  5. Draw a graph depicts the melting curve of a double stranded DNA whose melting temperature is 60 °C. Also. indicate the  $T_m$  with a broken line in the graph. (5 分)

