

題號： 182  
科目： 生化學  
節次： 2

國立臺灣大學 109 學年度碩士班招生考試試題

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1. Please determine the pI of below peptide.

$\text{NH}_3^+$ -Glu-His-Trp-Ser-Gly-Leu-Arg-Pro-Gly-COOH (4%)

| Amino acid | pK <sub>1</sub> | pK <sub>2</sub> | pK <sub>R</sub> |
|------------|-----------------|-----------------|-----------------|
| Glu        | 2.19            | 9.67            | 4.25            |
| His        | 1.82            | 9.17            | 6.00            |
| Trp        | 2.38            | 9.39            |                 |
| Ser        | 2.21            | 9.13            |                 |
| Leu        | 2.36            | 9.60            |                 |
| Arg        | 2.17            | 9.04            | 12.48           |
| Pro        | 1.99            | 10.96           |                 |
| Gly        | 2.34            | 9.60            |                 |

2. Please define below two terms, the activity and specific activity, of an enzyme? (4%)

3. Please draw the shared common structure of amino acids. (4%)

4. Please draw how two amino acids form peptide bond and describe where are the -H and -OH from in the condensation process. (4%)

5. Describe the following questions regarding lactose (*lac*) operon:

A. Describe how *lac* operon is regulated in the transcription level (7%)

B. The genotype of a bacterial strain is [ $i^-Z^+/i^+Z^-$ ]. Please predict the expression level of beta-galactosidase when glucose is absent and IPTG (isopropyl-beta-D-1-thiogalactopyranoside) is present. (3%)

6. Briefly describe the following terms (2.5% for each; 10% of total):

A. DNA-dependent RNA polymerase II and alpha-amanitin

B. *cis*-elements in eukaryotic transcription

C. Small nuclear ribonucleoproteins (SnRNPs) in post-transcriptional regulation

D. DNA microarray

7. Please describe what is the oxidative phosphorylation? (4%)

8. What downstream molecular mechanisms of insulin are responsible for regulating the functions of phosphorylase and glycogen synthase? (4%)

9. What is the importance of Cori cycle in the metabolism of human beings? (4%)

10. What do hepatocytes and intestinal bacteria in human play roles in heme catabolism? (4%)

11.(A)What is the "Central Dogma of Molecular Biology"? (2%)

(B) According to the "Central Dogma of Molecular Biology", the functional products of most known genes are "proteins". In your opinion, why are proteins the most suitable end products of the flow of genetic information? (4%)

12.(A)What is the definition of "protein quaternary structure"? (3%)

(B) Please give two examples to illustrate how protein quaternary structure affects protein function. (3%)

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13. Please describe an experimental procedure that allows you to determine the  $V_{max}$  (maximum velocity) and  $K_M$  (Michaelis constant) of an enzyme. (4%)

Questions 14-17 refer to the following enzymes

- (A) Aconitase
- (B) Allantoinase
- (C) Amylases
- (D) Argininosuccinase
- (E) Asparaginase
- (F) Aspartate transcarbamoylase

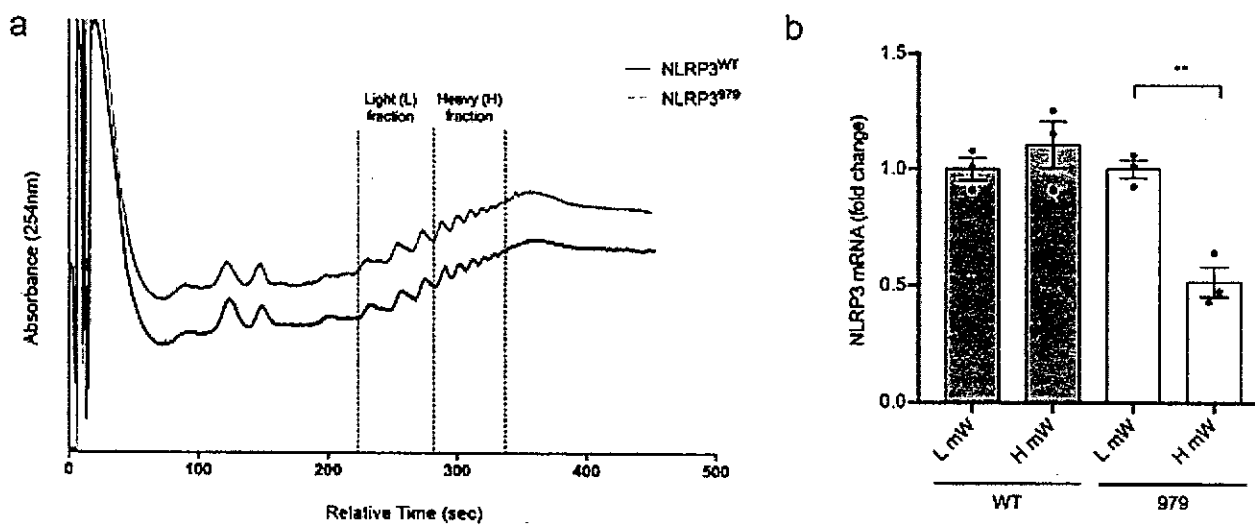
14. An enzyme in the pyrimidine biosynthetic pathway (2%)

15. A citric acid (Krebs) cycle enzyme (2%)

16. A urea cycle enzyme (2%)

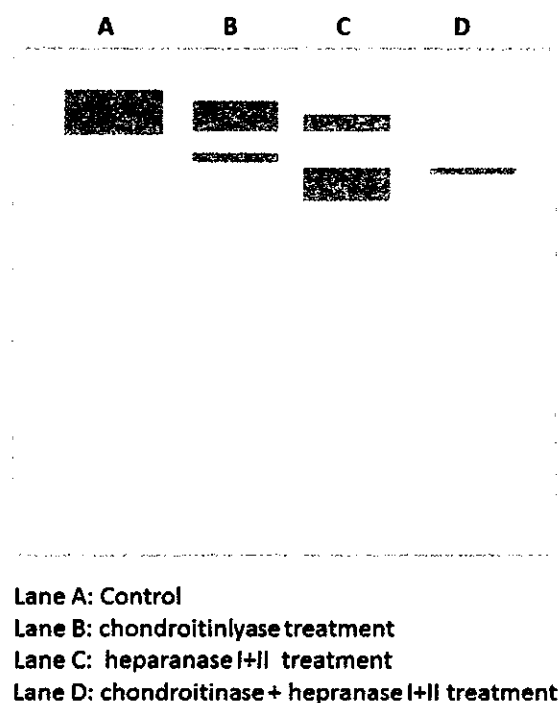
17. An enzyme of purine nucleotide catabolism (2%)

Polyribosome (polysome) fractionation is a technique that is used to assess the association of mRNAs with ribosomes and allows monitoring of translation activity of mRNAs in cells and tissues. Once each polysome fractions are collected, the translation activity of each mRNA is analyzed. In the following figure, a polysome fractionation was analyzed to compare cells expressing NLRP3<sup>WT</sup> or NLRP3<sup>979</sup> (absorbance was measured at 254 nm, tracings are offset to improve visualization) (left panel) and the relative NLRP3 mRNA transcript levels were quantified by real-time PCR, in the light and heavy polysome fractions as indicated in the left panel (right panel).



18. According to the figure, which of the following proteins has a better translation efficiency?  
(A) NLRP3<sup>WT</sup> (B) NLRP3<sup>979</sup> (2%). And why? (6%)

The following figure is a western blot for anti-syndecan-1 by using anti-syndecan-1 mono clonal antibodies, each lanes are the different treatment preparations for the samples. Please analyze the data and answer the questions: ( 8 questions, 2% for each )



19. The band in lane A is
- A) Non-glycosaminoglycan protein core
  - B) Only heparin sulfate attached protein core
  - C) Only chondroitin sulfate attached protein core
  - D) Both heparin sulfate and chondroitin sulfate attached protein core
  - E) o-link glycosylated protein
20. The upper bend in lane B is
- A) Non-glycosaminoglycan protein core
  - B) Only heparin sulfate attached protein core
  - C) Only chondroitin sulfate attached protein core
  - D) Both heparin sulfate and chondroitin sulfate attached protein core
  - E) o-link glycosylated protein
21. The lower bend in Lane B is
- A) Non-glycosaminoglycan protein core
  - B) Only heparin sulfate attached protein core
  - C) Only chondroitin sulfate attached protein core
  - D) Both heparin sulfate and chondroitin sulfate attached protein core
  - E) o-link glycosylated protein

22. The upper bend in Lane C is
- A) Non-glycosaminoglycan protein core
  - B) Only heparin sulfate attached protein core
  - C) Only chondroitin sulfate attached protein core
  - D) Both heparin sulfate and chondroitin sulfate attached protein core
  - E) o-link glycosylated protein
23. The lower bend in Lane C is
- A) Non-glycosaminoglycan protein core
  - B) Only heparin sulfate attached protein core
  - C) Only chondroitin sulfate attached protein core
  - D) Both heparin sulfate and chondroitin sulfate attached protein core
  - E) o-link glycosylated protein
24. The single bend in Lane D is
- A) Non-glycosaminoglycan protein core
  - B) Only heparin sulfate attached protein core
  - C) Only chondroitin sulfate attached protein core
  - D) Both heparin sulfate and chondroitin sulfate attached protein core
  - E) o-link glycosylated protein
25. This experiment results indicate Syndecan-1 is :
- A) N-link glycosylated protein
  - B) Containing only chondroitin sulfate
  - C) Containing only heparan sulfate
  - D) Containing both chondroitin sulfate and heparan sulfate
  - E) Called proteoglycan
26. Which descriptions about Syndecan-1 are right:
- A) A basement membrane components
  - B) A membrane bound receptor
  - C) Function as co-receptor
  - D) Important for ligands dimerization, such as FGF
  - E) All of the above are right