

題號: 352  
科目: 分子生物學(E)  
節次: 4

國立臺灣大學 106 學年度碩士班招生考試試題

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一、Basic concepts of molecular biology (20 分; 除非要求以英文答題, 皆可用中文或英文簡答; 若要有需要, 可佐以簡圖回答之)

- (1) Write down the full spelling of "mRNA" in English. (RNA 全名也請寫出; 2%)
- (2) Please define "intron" and "exon", respectively. (4%)
- (3) Write down the full spelling of UTR in English, and indicate that the UTR sequences are located in an intron or exon? (4%)
- (4) Please define what a "gene" is. (2%)
- (5) Please explain whether DNA codes for UTRs can be characterized as genes or not. (4%)
- (6) Please define "chromatin". (2%)
- (7) Is "chromatin" equivalent to "chromosome"? If not, please indicate their difference. (2%)

二、DNA replication, repair, transcription, and RNA processing (26 分; 除非要求以英文回答, 皆可用中文或英文簡答; 若要有需要, 可佐以簡圖回答之)

- (1) Please explain what is the semi-conservative mode of DNA replication. (4%)
- (2) During synthesis of DNA, if a DNA polymerase functions without the aid of a sliding clamp, what will happen? (4%)
- (3) If a mismatch of base pairing occurs during DNA replication and it is not proofread by the DNA polymerase. Please answer the following questions: (6%)
  - (i) Is the mismatched nucleotide located in the parental or newly synthesized strand (2%)?
  - (ii) How does the DNA repair machinery discriminate the parental strand from the newly synthesized strand? (4%)
- (4) Please define "enhancer". (2%)
- (5) How does an enhancer activate the transcription in eukaryotes? (4%)
- (6) Please define "spliceosome". (2%)
- (7) Why a splice site is usually recognized by more than one spliceosome? (4%)

三、Translation and gene regulation (14 分; 除非要求以英文回答, 皆可用中文或英文簡答; 若要有需要, 可佐以簡圖回答之)

- (1) Describe functions of the small and large subunits of ribosome during translation, respectively. (4%)
- (2) Please define "operon". (2%)
- (3) In a *lac* operon, why does the elevation of glucose concentration largely slow down the transcription? (4%)
- (4) Describe how a chromatin remodeling complex functions in transcriptional regulation in eukaryotes. (4%)

四、Molecular cloning (10 分; 除非要求以英文回答, 皆可用中文或英文簡答; 若要有需要, 可佐以簡圖回答之)

- (1) After electrophoresis, it is common to stain a DNA gel using Ethidium Bromide. Why? (2%)
- (2) Why is Ethidium Bromide a mutagen? (2%)
- (3) Restriction enzymes are applied to the digestion of DNA fragments. What does "restriction" mean? (2%)
- (4) Write down the full spelling of "PCR" in English. (2%)
- (5) PCR products have to be kept in a separate box that does not contain primers, Taq enzymes, dNTPs, and ddH<sub>2</sub>O. Why? (2%)

五、The CRISPR/Cas9 gene editing technology has in the last few years become a powerful technique with multiple applications in molecular biology. Explain the principle behind the CRISPR/Cas9 method and why this is a great improvement over previous gene editing methods. (10 分)

六、What is RNAi? How does it suppress gene expression? (10 分)

七、What are the differences between RNAi and CRISPR/Cas? (10 分)

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