國立彰化師範大學 97 學年度碩士班招生考試試題

系所：生物技術研究所碩士班　　科目：分子生物學

☆☆請在答案紙上作答☆☆　　

一、單選擇題 (每題 2%，共 8%)

1. Which statement about "antibiotic/toxin functions" is **not** correct?
   (a) Tetracycline inhibits aminoacyl-tRNA binding to the A site (b) chloramphenicol blocks correct positioning of the A site aminoacyl-tRNA for peptidyl transfer reaction (c) Puromycin prevents activation of translation factor GTPase (d) Hygromycin B prevents translocation of A-site tRNA to P site (e) Cycloheximide inhibits peptidyl transferase activity

2. Which is **not** correct about prokaryotic translational initiation?
   (a) The first amino acid was N-formyl methionine (b) Initiation factors include IF1, IF2, and IF3 (c) IF1 prevents tRNAs from binding to the portion of the small subunit that will become part of the A site (d) IF2 is a GTPase (e) IF3 binds to the small subunit and promotes large subunit binding

3. Which is correct about prokaryotic transcription?
   (a) The holoenzyme of RNA polymerase contained $\alpha_2\beta\beta'$ (b) DNA template strand also called the sense strand (c) The upstream promoter contained TATA box and CAAT box (d) The σ factor mediates binding of polymerase to the promoter (e) Transcription is initiated by RNA polymerase with the need for a primer

4. Which is **not** true about eukaryotic RNA splicing ?
   (a) Single gene can produce multiple products by alternative splicing (b) To most eukaryotic genes, nuclear pre-mRNA splicing is carried out by a large complex called the splicesome (c) There are two group of self-splicing introns (d)In the case of the group I intron, the RNA folds in a way that forms a Guanine-binding pocket, which allows the molecule to bind a free Guanine nucleotide and use that to initiate splicing (e) Group II introns release a linear intron rather than a lariat

二、問答題(共 92%)

1. RNA 與 DNA 分子在化學結構上有何差異？請以條列式作簡要說明。 (10%)

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2. 分子生物學的發展過程中，重要的實驗、發現與假說包括：
   a. 基因位於染色體上
   b. DNA 的複製方式為半保留式(semi-conservative)
   c. 染色體的化學成份為蛋白質與核酸
   d. DNA 的雙螺旋結構
   e. 遺傳物質的化學成份為 DNA

   請將它們依照時間上發生的先後順序排列。 (5%)

3. 一段基因的序列為 5'-ATACGGTTCACTGCTAACAC(N_{200})CTGACGGTATAAATAGCAAA-3' (N_{200})代表片段中間序列不詳的 200 個鹼基。若要設計一對各長 20 個鹼基的引子(primer)以進行 PCR，放大這一段全長為 240 個鹼基對(bp)的 DNA 片段，則這兩個引子的序列為何？請註明引子序列的 5'端與 3'端。 (5%)

4. 進行 DNA 雜交實驗(DNA hybridization)時經常需要製作帶有放射性的 DNA 探針(probes)，放射性 DNA 的原料可以是[α-^{32}P] dATP 或是[γ-^{32}P]dATP。 [α-^{32}P] dATP 與[γ-^{32}P]dATP 的差別為何？又以哪一種方法標定 DNA 時需使用[α-^{32}P] dATP？以哪一種方法標定 DNA 時需使用[γ-^{32}P] dATP？ (10%)

5. Please describe the comparison of the gene knockout and knockdown. (10%)

6. Please describe the principle and application of the Real-time PCR. (10%)

7. Suppose a researcher wished to clone the human *HOXA10* gene and produce the product in the laboratory. Please describe the experimental approaches that might be to do. (15%)

8. How to create a full-length cDNA from eukaryotes? (5%)
   Please design an experiment to identify its transcriptional start site. (5%)

9. Please describe the step-wise assembly of the RNA polymerase II pre-initiation complex during transcription. (6%)

10. If you try to over-express a specific protein (name as SOD) only in the muscle of zebrafish, how to do it? (6%) Please describe detail.

11. What is the "chromatin immunoprecipitation"? (5%)