

系所組別： 分子醫學研究所

考試科目： 分子生物學

考試日期： 0307， 節次： 1

※ 考生請注意：本試題 可 不可 使用計算機

一、選擇題：(15分，每題3分)

- Which of the following statements about the bacterial sigma factor is NOT correct?
 - It is required in the initiation stage of transcription
 - It is not a part of the core enzyme of bacterial RNA polymerase
 - A bacterium usually has several sigma factors to mediate transcription of different genes.
 - It is not required for transcription termination
 - Sigma factor alone can easily recognize the promoter DNA
- Which is the name of a protein that is able to bind to incompletely folded proteins in order to assist their folding or prevent them from aggregating?
 - helicase
 - chaperone
 - Condensin
 - haptin
 - intein
- Which is the type of point mutation in which a purine is replaced by a pyrimidine or vice versa?
 - transition
 - transversion
 - transformation
 - transduction
 - transfection
- Transposon is a DNA fragment able to insert itself at a new position in a genome. Which of the following statements regarding transposon is NOT correct?
 - Insertion of a transposon to a new position in a genome requires homologous recombination.
 - The movement of a transposon to a new site within the genome is called transposition.
 - Transposase is usually encoded in a transposon and is required for the movement of the transposon in a genome.
 - Transposons could be found in both prokaryotes and eukaryotes.
 - Transposons usually contain inverted repeat sequences at their ends.

(背面仍有題目請繼續作答)

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5. What is called a plasmid vector able to replicate in different hosts (e. g. *E. coli* and Yeast)?
- Suicide vector
 - cloning vector
 - shuttle vector
 - Reporter vector
 - Expression vector

二、簡答題: (15 分, 每題 3 分)

- Analysis of a DNA sample from a bacterium indicates that 16% of the bases are Adenine. What fraction is Cytosine?
- Can DNA be directly labeled with ^{32}P using labeled ATP and polynucleotide Kinase? Please give your rationale.
- Why is the activity of most polymerases inhibited by the addition of chelating agents such as EDTA?
- A protein has a molecular weight of 7000 Da. Can you estimate how many amino acids residues the protein has? A double strand DNA has a molecular weight of 132000 Da. How long is the DNA molecule in basepairs?
- What is CAP dependent translation and what is CAP independent translation? What do you know about IRES?

三、問答題: (70 分)

- Describe your understanding about messenger RNA (mRNA) synthesis, trafficking, and metabolism (including the mechanisms associated with nuclear export, translational control and degradation) (15 %)
- Please describe the initiation stage of protein synthesis in bacteria (e.g. how the 50S and 30S ribosome subunits, tRNA, initiation factor (IF) 1, IF-2, IF-3 work together to start translation)? (15 %)

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3. What is microRNA? What is short interfering (si)RNA? Please describe the differences and similarity between these two RNA species in terms of biogenesis, mechanism of action and properties. (10 %)
4. Protein-protein interactions occur in almost every aspect cellular physiology. Please describe four different methods that can be used to detect protein-protein interaction in vitro or in vivo. (10 %)
5. An eukaryotic functional gene is able to transcribe into mRNA, which can subsequently be able to be translated into a functional protein. Please describe the minimal genetic requirements and features for a functional gene from the genomic structure's point of view. (10 %)
6. One student is assigned to study the regulatory elements within the promoter of a gene. Through various molecular genetic methods including Western blot, Northern blot and reporter gene assay, he is able to identify a short DNA sequence motif within the promoter is capable of regulating the promoter activity. Please describe how he would be able to identify and demonstrate the transcription factor that binds to this DNA motif clearly. (10 %)