

系所組別： 分子醫學研究所

考試科目： 分子生物學

考試日期：0226，節次：1

## 一、選擇題：(單選題，20 分，每題 4 分)

1. Which statement is incorrect regarding Homologous recombination (HR)?
  - (A) HR can occur at any point along the lengths of two homologous DNAs.
  - (B) HR takes place in Meiosis and late S-G2 phases.
  - (C) Chromosomes must synapse in order for chiasmata to form.
  - (D) Synapsis describes the association of the two pairs of sister chromatids.
  - (E) During cross over, nucleotide sequences are altered at the site of exchange.
  
2. Which statement is incorrect regarding Non-Homologous End Joining (NHEJ)?
  - (A) NHEJ takes place throughout the cell cycle.
  - (B) NHEJ is also initiated by double-stranded DNA breaks.
  - (C) NHEJ involves a copying process to restore the loss of nucleotides after DNA breakage.
  - (D) Ku heterodimers, DNA-PKcs, Artemis, and DNA ligase IV are the key enzymes participated in the NHEJ.
  - (E) During NHEJ, no Holiday Junction structures can be observed.
  
3. Which statement is incorrect regarding Holliday junction?
  - (A) The so called Holliday junction is occurred during the homologous recombination event.
  - (B) The Patch recombinant DNA and the Splice recombinant DNA are two possible structural outcomes after resolution of the Holliday junction
  - (C) Resolution of the holliday junction requires Ruv complex.
  - (D) Patch recombination results in reciprocal recombination and crossover of the genomes.
  - (E) A common sequence ATTG provides a host spot for RuvC to resolve the holliday junction.
  
4. Which statement is incorrect regarding site specific recombination (SSR)?
  - (A) Integration and excision of genes from a bacteria require SSR with excision and integration enzymes.
  - (B) Inverted repeats are two sites that are oriented oppositely to one and another.
  - (C) In the E.coli and bacteriophage SSR model, staggered cleavages of attP and attB allow crosswise reunion to generate reciprocal recombinant junctions.
  - (D) SSR is a type of control in the regulation of gene expression in differentiating cells.
  - (E) Pairwise coiling from directed repeats will result in gene inversion.
  
5. Which statement is incorrect regarding gene transposition?
  - (A) The movement of a transposon to a new site is a rare case of sequence change within a genome.

(背面仍有題目,請繼續作答)

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- (B) Direct repeats are identical sequences present in two or more copies in the same orientation in the same molecule of DNA.
- (C) An insertion sequence (IS) is a small bacterial transposon that carries only the genes needed for its own transposition.
- (D) Inverted terminal repeats are the short related or identical sequences present in reverse orientation at the ends of some transposons.
- (E) Two copies of a transposon at different locations or on different chromosomes may provide sites for reciprocal recombination, and which may result in deletions, insertions, inversions, or translocations.

**二、問答題：(80 分)**

1. **Describe what is Copy-Choice Recombination? How is it important in virus evolution? (10%)**
2. **The scientists have gained lots of new and useful information from the human genome project.**
  - (a) Please describe how many genes are contained in the human genome. (2 %)
  - (b) Please describe how many base pairs are there in your genome. (2 %)
  - (c) Please describe what percentage of human genome sequence codes for proteins. (2 %)
  - (d) Please describe the health benefits of sharing the information obtained from the human genome project. (2 %)
  - (e) Please name a database in which you can find or search the human genome sequence. (2 %)
3. **Gene transcription is a complex process involving many enzymes, factors and cis-elements.**
  - (a) Please name an enzyme that is essential for catalyzing transcription? (2 %)
  - (b) Please describe the four stages of transcription. (6 %)
  - (c) Gene transcription is regulated by transcription factors and *cis*-elements. Please name (2 %) and describe (8 %) a method frequently used to define a DNA sequence that interacts with a protein or transcription factor.
  - (d) In addition to a genetic control, transcription is also affected by epigenetics. Please name an epigenetic process in the promoter that regulates gene transcription. (2 %)
4. (a) **Describe the cap structure of a typical mRNA in a mammalian cell. (5%)**  
(b) **What is the mechanism by which the cap structure affects the translation? (5%)**
5. **Compare the roles of the Shine-Dalgarno sequence to the Kozak sequence. (10%)**
6. (a) **Compare the origins of short interfering RNAs (siRNAs) to that of microRNAs (miRNAs). (5%)**  
(b) **Compare the actions between siRNAs and miRNAs. (5%)**  
(c) **Describe the roles of Dicer and Ago2 in the processing or actions of siRNAs or miRNAs. (10%)**