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編號: E 86

系所: 生物科技研究所甲組, 乙組

科目: 分子生物學

I. 單選題: (每題 2 分, 共 50 分)

1. What is the percentage of human genome coding for proteins?
 - A. 1
 - B. 10
 - C. 100
 - D. 50
2. What is the anti-sense RNA for a template DNA of ATGCCGTTA?
 - A. ATGCCGTTA
 - B. AUGCCGUUA
 - C. TACGGCAAT
 - D. UACGGCAAU
3. The genome of *E. coli* has about _____ nucleic acids?
 - A. 10^6
 - B. 10^7
 - C. 10^8
 - D. 10^9
4. Which species does not contain an interrupted gene?
 - A. human
 - B. fly
 - C. yeast
 - D. *E. coli*
5. Which of the following base changes is happened in the spontaneous deamination?
 - A. C → U
 - B. T → U
 - C. G → U
 - D. A → U
6. Which subunit is not a component in the core enzyme of DNA polymerase III?
 - A. α
 - B. β
 - C. ϵ
 - D. θ
7. Which statement is not correct regarding transposon?
 - A. It usually encodes a transposase.
 - B. It usually has terminal repeats at the ends.
 - C. It can promote the arrangement of the genome.
 - D. It is only present in bacteria.

(背面仍有題目, 請繼續作答)

8. Which statement is not correct about nucleosome?
- A. Nucleosome consists of ~200 bp of DNA and an octamer of histone proteins, which is organized into a bead-like structure.
 - B. The size of RNA polymerase (~500 kD) is larger than nucleosome (~300 kD).
 - C. Nucleosome disassembles when transcription proceeds.
 - D. Nucleosome relocates to a new position after transcription.
9. Which statement is correct regarding excision-repair systems in *E. coli*?
- A. It requires an enzyme called photolyase.
 - B. It requires enzymes of endonuclease, exonuclease, polymerase and ligase.
 - C. The *uvr* A, B, C genes encode the subunits of photolyase.
 - D. This system can only repair intrastrand pyrimidine dimer.
10. Which statement is not correct regarding DNA recombination?
- A. DNA recombination is initiated by a double-strand break in DNA.
 - B. DNA recombination requires topological manipulation of DNA.
 - C. Hotspots of DNA recombination are the sites where double-strand DNA breaks are initiated.
 - D. In *E. coli*, RecA is the only enzyme required for DNA recombination.
11. Which statement is true regarding allelic exclusion in B cell for antibody production?
- A. The genes of homologous chromosomes are expressed in a single cell; the alleles on the other cells are not expressed.
 - B. The genes of only one of the homologous chromosomes are expressed; the alleles on the other chromosome are not expressed in the same cells.
 - C. The genes of homologous chromosomes are expressed in a B cell; the alleles on the other T cells are not expressed.
 - D. The genes of homologous chromosomes are expressed in a T cell; the alleles on the other B cells are not expressed.
12. Which is not the possible mechanism in the regulation of transposition in transposon?
- A. DNA methylation.
 - B. RNA splicing.
 - C. Selection pressure for antibiotic resistance.
 - D. Target gene sequence.

13. Which function is played by chaperones during protein synthesis?
- A. Protein folding
 - B. Protein glycosylation
 - C. Protein degradation
 - D. Protein phosphorylation
14. The phases of the cell cycle are controlled by discrete events that happen at G1, S phase, and mitosis. Which following stage is not in the cell cycle progression?
- A. G2 phase
 - B. G0 phase
 - C. M phase
 - D. None of the above
15. Which function is played by proteasome system in eukaryotic cells?
- A. Protein degradation
 - B. Lipid degradation
 - C. Protein dephosphorylation
 - D. mRNA cleavage
16. Which kinase is a cytosolic enzyme that phosphorylates targeted proteins on either tyrosine or serine/threonine?
- A. Tyrosine kinase
 - B. Serine/threonine kinase
 - C. Dual specificity kinase
 - D. All of the above
17. What kind of changes can activate protooncogenes in human genome?
- A. Insertion
 - B. Translocation
 - C. Amplification
 - D. All of the above
18. Which function is never found for G protein?
- A. stimulate adenylyl cyclase by Gs
 - B. inhibit adenylyl cyclase by Gi
 - C. close Ca^{2+} channels by Go
 - D. inhibit cGMP phosphodiesterase by Gt

(背面仍有題目,請繼續作答)

19. Which statement about the mRNA 5' cap is FALSE?
- Contains a methylated guanosine residue.
 - Interacts with fMet-tRNA during translational initiation.
 - Ribosomal RNAs do not have caps.
 - Aids in ribosome-mRNA association.
20. Which of the following is TRUE for eukaryotic gene expression?
- Enhancers only work when they are located immediately upstream of the promoter.
 - The promoters of actively regulated genes often lack the TATA box.
 - CG islands near housekeeping genes interact with enhancers.
 - Enhancers may be located downstream of the genes which they regulate.
21. A strain of *E. coli* has a mutation eliminating the 3' to 5' exonuclease activity of DNA polymerase III. This strain is expected to show ____.
- an increased mutation frequency
 - a decreased mutation frequency
 - an inability to join Okazaki fragments together
 - leading strand synthesis only
22. Which of the following is TRUE for cDNA?
- It represents an exact copy of a eukaryotic gene.
 - It contains the upstream regulatory sequences for a eukaryotic gene.
 - It contains a poly A sequence on the 3' end of its sense strand.
 - It is a normal intermediate in the splicing of introns.
23. Which of the following describes the function of factor *rho*?
- rho* directs catabolite repressor protein to the promoter region.
 - rho* increases the rate of elongation of the growing RNA chain.
 - rho* is required for correct termination of transcription of some mRNA's.
 - rho* helps RNA polymerase bind to the promoter region.
24. How are DNA synthesis and RNA synthesis different?
- Release pyrophosphate as a reaction product.
 - Synthesis proceeds in the 5' to 3' direction.
 - Proofreading helps eliminate errors.
 - First nucleotides incorporated are RNA.

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25. Which of the following could be a result of a mutation at a prokaryotic promoter site?
- A. Inability of the inducer molecule to bind to the repressor protein.
 - B. All the proteins of such an operon could be synthesized but would be structurally altered.
 - C. Failure to initiate transcription of the operon.
 - D. Only the first gene in the operon would be transcribed.

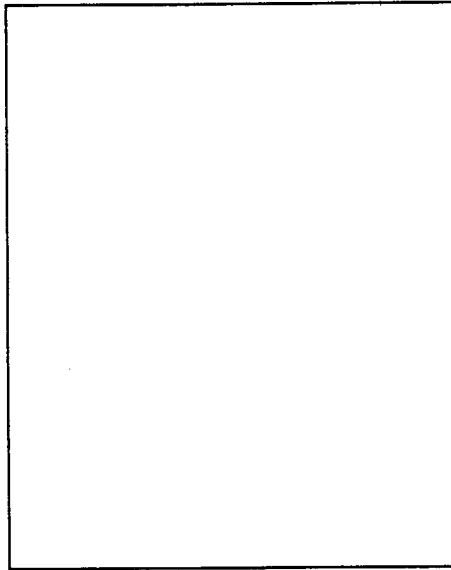
II、簡答題：(每題 5 分，共 50 分)

1. Please draw and explain how the termination of replication is caused in *E. coli* genome.
2. Please use one model to explain the rolling circle replication. Draw and briefly describe it.
3. What are common and difference between retrovirus and retrotransposon in terms of their reproductive cycle?
4. What are the minimum features required for existence as a chromosome? Why?
5. How can gene arrangement be used to control gene expression in nature? Please give an example, and briefly describe it.
6. What is the function of a stop codon during protein translation? How many stop codons have been founded?
7. How do proteins enter and leave membranes after protein synthesis, please describe them in detail?
8. What is programmed cell death? Please describe how the Bcl-2 family members regulate the apoptotic cell death?

(背面仍有題目,請繼續作答)

9. You have managed to isolate a Group I self-splicing intron. You decide to run a time course for the *in vitro* splicing reaction. Draw the bands that would appear on your gel over time as the self-splicing reaction progresses. Please draw the nature of the products represented by each band next to the gel. Don't use words except for labels.

Fig. 1: Your Gel



Draw the products here

10. You are now rotating in a transcription lab and once again studying a new species of bacteria called NEWA. Luckily for you, your rotation advisor has already purified an *E. coli*-like RNA polymerase. How can he assay for RNA polymerase activity? Since this is a novel species, what assumption did he have to make in order for him to assume that his assay would work?