一、單選題 (each 2%)

1. Which is true about expression of the *lac* operon in *E. coli*?
   (a) High glucose, high cAMP, no lactose, transcription turns on.
   (b) Low glucose, low cAMP, lactose presents, repressor binds to operator, no transcription.
   (c) High glucose, low cAMP, no lactose, and repressor doesn't bind operator, transcription turns on.
   (d) Low glucose, high cAMP, lactose presents, repressor doesn't bind operator, transcription turns on.
   (e) Low glucose, low cAMP, no lactose, repressor binds operator, no transcription.

2. Which of following is incorrect about *RNA polymerases in eukaryotes.*
   (a) Eukaryotes have 3 kinds of RNA polymerases and each can recognize promoter region.
   (b) RNA polymerase I is localized in nucleoplasm, transcribes 28S, 18S, and 5.8S rRNAs.
   (c) RNA polymerase II is localized in nucleolus, transcribes mRNA and snRNAs.
   (d) RNA polymerase III is localized in nucleoplasm and transcribes tRNA, U6 snRNA, and 5S rRNA.
   (e) RNA polymerase copies anti-sense (-) strand of DNA template and requires an oligo RNA primer.

3. Which of the followings is not eukaryotic class II core promoter?
   (a) TATA box.
   (b) GC box.
   (c) Downstream promoter element (DPE).
   (d) Initiator.
   (e) TFIIB recognition element (BRE).

4. Which method can be used for analysis of DNA-protein interaction?
   (a) Southern blot.
   (b) Northern blot.
   (c) Western blot.
   (d) RNA interference.
   (e) Electrophoretic mobility shift assay.

5. Which one belongs to epigenetic change?
   (a) DNA methylation.
   (b) DNA deletion.
   (c) DNA mutation
   (d) DNA duplication.
   (e) DNA knockout.

6. Which one is transcription-activating domain?
   (a) Zinc fingers.
   (b) Glutamine-rich domains.
   (c) Homeodomains.
   (d) Leucine zippers
   (e) Greek key β-barrel domain.

7. Which is true about "Insulator"?
   (a) Actions as an enhancer.
   (b) Actions as a transcriptional activator.
   (c) Actions as an enhancer-blocker.
   (d) Actions as a promoter.
   (e) Actions as a reporter.

8. Which transcription factor can bind RNA polymerase II and then direct it to class II promoter?
   (a) TFIIA.
   (b) TFIIB.
   (c) TFIID.
   (d) TFIIE.
   (e) TFIIF.

9. Which is not true about initiation of translation in prokaryotes?
   (a) The initiation codon is usually AUG, but it can also be GUG, or more rarely, UUG.
   (b) The initiating aminoacyl-tRNA is N-formyl-methionyl-tRNAfMet.
   (c) Methionine is the first amino acid incorporated into a polypeptide.
   (d) The first amino acid is frequently removed from the protein during maturation.
   (e) The initiation factors are required in formation of the initiation complex.

10. Which is not a component of the complete 30S initiation complex of prokaryotic translational initiation?
   (a) 50S ribosomal subunit.
   (b) 30S ribosomal subunit.
   (c) mRNA.
   (d) GTP.
   (e) Initiation factors 1, 2, and 3.

11. Which is not correct about the functions of eukaryotic initiation factors?
   (a) eIF1 and eIF1A aid in scanning to the initiation codon.
   (b) eIF2 is involved in binding Met-tRNAiMet.
   (c) eIF3 binds to the 60S subunit and blocks its reassociation with the 40S subunit.
   (d) eIF4F is a cap-binding protein that allows the 40S ribosomal subunit to bind to the 5’-end of an mRNA.
   (e) eIF5 encourages association between the 60S ribosomal subunit and the 48S complex.

12. Which statement is not correct about tRNA?
   (a) All tRNAs share a common secondary structure represented by a cloverleaf.
   (b) All tRNA have four base-paired stems that include the D loop, anticodon loop, T loop, and the acceptor stem.
   (c) All tRNA have the same three bases UAA at their 3’-ends.
   (d) tRNA charging was catalyzed by aminoacyl-tRNA synthetase.
   (e) tRNA was required for translation.

13. The double helix of DNA is which level of structure?
   (a) primary
   (b) secondary
   (c) tertiary
   (d) quaternary
   (e) The answer is indeterminate

14. Quaternary structure for nucleic acids is shown in all, **except**:
   (a) Mammalian chromosomes
   (b) Messenger RNA
   (c) Tobacco Mosaic Virus
   (d) Ribosomes
   (e) All of these

15. The linkage between the sugar and base in nucleic acids is best described as:
    (a) Glycoside
    (b) N-glycoside
    (c) O-glycoside
    (d) Thio-glycoside
    (e) Ester

16. The fundamental differences between RNA and DNA are
    (a) the organic bases only
    (b) bases, ribose units, and the phosphodiester linkage
    (c) bases, ribose units, and the glycosidic bond type
    (d) bases and the ribose units only

17. Nucleosides contain all of the following **except**:
    (a) Phosphates
    (b) Purines
    (c) Pyrimidines
    (d) Sugars
    (e) All of these are found in nucleosides

18. The backbone of nucleic acids consists of
    (a) a phosphodiester bond between the 2' and 5' hydroxyl groups of neighboring sugars
    (b) a phosphodiester bond between the 3' and 5' hydroxyl groups of neighboring sugars
    (c) a glycosidic bond between a pyrimidine and a sugar
    (d) a glycosidic bond between a purine and a sugar

19. Which of the following sequences of DNA is most likely to form Z-DNA?
    (a) 5'-ATATATATATATATATATAT-3'
        3'-TATATATATATATATATATA-5'
    (b) 5'-AAAAAAAAAAAAAAAAAAAA-3'
        3'-TTTTTTTTTTTTTTTTTTTT-5'
    (c) 5'-GCGCGCGCGCGCCGCGCGCG-3'
        3'-CGCGCGCGCGCGCGCGCGCG-5'
    (d) 5'-GGGGGGGGGGGGGGGGGGGG-3'
        3'-CCCCCCCCCCCCCCCCCCCC-5'

20. Histones contain large amounts of which of the following amino acids?
    (a) histidine
    (b) glutamic acid
    (c) lysine
    (d) leucine
    (e) tryptophan

21. The human genome has 3 X 10^9 base pairs (bp) of DNA If this were one continuous molecule and extended such that each nucleotide was separated from the adjacent nucleotide by 4 Å, as proposed in the Watson and Crick model, what would the end-to-end distance be?
    (a) 1 meter
    (b) 1 centimeter
    (c) 1000 centimeters
    (d) 1014 Å

22. Histones are proteins that
    (a) are frequently associated with eukaryotic DNA
    (b) are frequently associated with prokaryotic DNA
    (c) are never found in association with DNA
    (d) contain a high percentage of residues with carboxylic acid side chains

23. Which of the following modifications is likely to happen to the mRNA in a eukaryotic cell?
    (a) capping of the 5' end
    (b) addition of a poly-A tail to the 3' end
    (c) removal of intervening sequences (introns)
    (d) All of the above occur in eukaryotic cells.

24. Which of the following RNAs is noted for having a cloverleaf structure?
    (a) mRNA
    (b) rRNA
    (c) snRNA
    (d) tRNA

25. The following types of RNA are common to all organisms, **except**:
    (a) mRNA
    (b) rRNA
    (c) snRNA
    (d) tRNA
    (e) All types are found in all organisms.

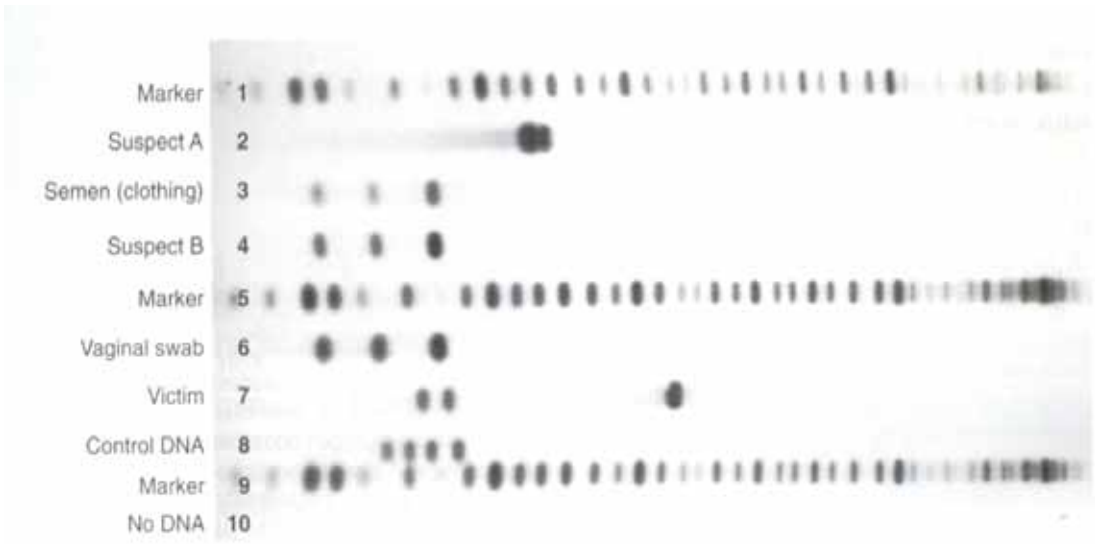
26. Protein synthesis can occur while the mRNA molecule is being synthesized in:
    (a) Prokaryotes only.
    (b) Eukaryotes only.
    (c) Unicellular organisms only.
    (d) Multicellular organisms only.
    (e) All organisms can do this.

27. The following phrases all describe small nuclear RNA **except**:
    (a) This RNA is usually found in snurps.
    (b) The RNA is involved in removing exons from the RNA.
    (c) This RNA was the first RNA shown to have catalytic activity.
    (d) This RNA is small in size.
    (e) All of these describe small nuclear RNA.

二、問答題：

1. Please describe in detail about the elongation of translation in prokaryotes. (6 %)

2. Pease read the figure carefully, and answer the following 2 questions? (Source: Courtesy Lifecodes Corporation, Stamford, CT.)



Two suspects have been accused of attacking and raping a woman. The DNAs were collected and analyzed from the suspects and the woman. Lanes 1, 5 and 9 are DNA markers. Lane 2 was suspect A's DNA. Lane 3 contains DNA from a semen sample found on the woman's clothing. Lane 4 was suspect B's DNA. Lane 6 contains DNA obtained by swabbing the woman's vaginal canal. Lane 7 was the woman's DNA. Lane 8 was a control DNA. Lane 10 without any DNA.

a. What is the method we call about? (2%)

b. According to the figure, who is the criminal? Please explain your result. (3%)

3. Describe the Sanger's method to sequence DNA. (Suppose that the sequence of DNA template is 5'-TGATTAACATTGTCTACGCAT-3').
(15%)

4. Design an experiment to clone a full-length cDNA clone of X gene from *Drosophila melanogaster*. The preliminary data you have are:

(a) The X protein can only be detected in larval stages.

(b) The X protein has been purified and partial amino acid sequence (30 amino acids) has been determined.

(c) The molecular weight of X protein is 55 KD.

(20%)