

單選題，共 40 題，每題 2.5 分。考生應作答於答案卡。

1. Who developed the effective mRNA vaccines against COVID-19 and earned 2023 Nobel Prize?
(A) Barbara McClintock
(B) Gerty Cori
(C) Carol W. Greider
(D) Katalin Karikó
2. What is the name given to the specific location of a gene on a chromosome?
(A) operon
(B) locus
(C) element
(D) allele
(E) box
3. To replicate DNA, which of the following is NOT required?
(A) DNA primer
(B) DNA template
(C) DNA polymerase
(D) dNTPs (deoxynucleotide triphosphates)
4. DNA polymerase III synthesizes the leading strand as a continuous strand. The lagging strands are synthesized in segments, called
(A) telomeres.
(B) TATA box.
(C) Shine-Dalgarno sequence.
(D) Okazaki fragments.
5. If adenine makes up 20% of the bases in a DNA helix, what percent of the bases is guanine?
(A) 20%
(B) 30%
(C) 60%
(D) 80%
6. As the two strands of DNA are unraveled, an enzyme relieves the strain on the two strands. The enzyme is
(A) DNA polymerase III.
(B) DNA polymerase I.
(C) DNA helicase.
(D) DNA gyrase.
(E) DNA ligase.
7. Gel electrophoresis separates DNA fragments primarily on the basis of differences in their _____.
(A) methylation
(B) mutation
(C) A : C ratio
(D) length
8. Which of the following enzymes removes the primers used for DNA replication?
(A) DNA polymerase I
(B) DNA polymerase II
(C) DNA polymerase III
(D) DNA polymerase, DNA pol II, and DNA pol III can all remove primers

9. Which of the following are removed from mRNAs during processing?
- (A) exons
 - (B) noncoding sequences
 - (C) RNA cap structure
 - (D) poly(A) tail
10. Consider the following sequence:
5'AUGGCUACAGAUAGCUGGGGCUGAAAAAAAAAAAAAAAAAAAAA3'
- The given sequence
- (A) is from a prokaryote.
 - (B) is from a eukaryote.
 - (C) encodes 13 amino acids.
 - (D) encodes 8 amino acids.
11. The "central dogma" for gene expression cannot describe which of the following phenomena?
- (A) one-gene/one-polypeptide
 - (B) transcription
 - (C) translation
 - (D) miRNAs
12. Which of the following factors recognizes the UAG, UAA, and UGA codons?
- (A) RNA polymerase
 - (B) initiation factors
 - (C) termination factors
 - (D) elongation factors
13. Which nucleic acid structure has its bases methylated after synthesis?
- (A) DNA
 - (B) mRNA
 - (C) tRNA
 - (D) rRNA
 - (E) cDNA
14. Which of the following is not required for both DNA replication and RNA transcription?
- (A) DNA
 - (B) primers
 - (C) RNA
 - (D) proteins
15. Proximity-ligation assays are used to detect a specific
- (A) DNA.
 - (B) RNA.
 - (C) protein-protein interaction.
 - (D) carbohydrate.
16. Which method(s) can be used to functionally inactivate a gene without altering its sequence?
- (A) gene knockout
 - (B) CRISPR
 - (C) RNA interference
 - (D) dominant negative mutation
 - (E) C and D

17. Which of the following is not a mobile DNA element?
(A) transposon
(B) long terminal repeats (LTR)
(C) long interspersed elements (LINES)
(D) insertion sequence (IS) elements
18. Sorting of protein to mitochondria and chloroplasts is
(A) co-translational.
(B) post-translational.
(C) pre-translational.
19. Open reading frame (ORF) analysis is not effective in identifying genes in higher eukaryotes because of the presence of
(A) promoters.
(B) enhancers.
(C) introns.
(D) repetitious DNA.
20. All of the following can be found in chromatin except
(A) DNA.
(B) histones.
(C) RNA.
(D) transcription factors.
21. Telomeres
(A) consist of repetitive sequences with high G content.
(B) are a few hundred base-pairs long in vertebrates.
(C) have specific proteins bound at the DNA ends.
(D) A and C
(E) All of the above
22. Which of the following sequential order for the secretory pathway is false?
(A) Rough endoplasmic reticulum (ER) → ER-to-Golgi transport vesicles → Golgi cisternae → secretory vesicles.
(B) Rough ER → ER-to-Golgi transport vesicles → Golgi cisternae → Mitochondria.
(C) Plasma membrane → Early endosome → Late endosome → Lysosome.
(D) Rough ER → ER-to-Golgi transport vesicles → Golgi cisternae → Late endosome → Lysosome.
23. Most eukaryotic genes are controlled at the level of
(A) transcription initiation.
(B) transcription elongation.
(C) transcription termination.
(D) translation initiation.
24. An enhancer
(A) is a protein that binds to RNA polymerase and stimulates transcription.
(B) interacts with repressor proteins to enhance transcriptional repression.
(C) binds to RNA polymerase and stimulates transcription.
(D) is a DNA element that increases transcription.

25. Which of the following sequences functions as a promoter for transcription?
(A) TATA box.
(B) initiator.
(C) CpG islands.
(D) all of the above
(E) none of the above
26. Which of the following statements regarding RNA splicing is correct?
(A) initiation of transcription, splicing, addition of 5' cap, addition of poly-A tail, transport to cytoplasm
(B) initiation of transcription, addition of 5' cap, splicing, addition of poly-A tail, transport to cytoplasm
(C) initiation of transcription, addition of poly-A tail, addition of 5' cap, splicing, transport to cytoplasm
(D) initiation of transcription, addition of 5' cap, addition of poly-A tail, splicing, transport to cytoplasm
27. Which of following events does not occur within the nucleus?
(A) protein phosphorylation
(B) RNA capping
(C) polyadenylation
(D) splicing
28. Which of the following is not used in the electrophoretic mobility shift assay (EMSA)?
(A) a radiolabeled DNA fragment
(B) a polyacrylamide gel
(C) a DNA binding protein
(D) DNase I
29. RNA editing is
(A) post-transcriptional alteration of sequences in mRNAs.
(B) pre-transcriptional alteration of sequences in RNAs.
(C) post-transcriptional joining of two RNA molecules.
(D) none of the above
30. Which of the following is most likely to lead to a loss of gene function?
(A) A sequence change in the 3' untranslated region.
(B) A change from a TAA codon to a TAG codon in the coding region.
(C) A change from T to C in the promoter region.
(D) A frameshift mutation in the coding region.
31. A cDNA library differs from a genomic library in that
(A) the cDNA was constructed from introns only.
(B) genomic libraries are only stored in bacterial cells.
(C) cDNA libraries are more stable.
(D) cDNA libraries only contain information from genes that have been transcribed.
32. Protein sorting of anterograde cargo to different destinations within the Golgi complex occurs in the
(A) *cis*-Golgi.
(B) *medial*-Golgi.
(C) *trans*-Golgi.
(D) *trans*-Golgi network.

33. The only cells that can correctly attach sugars to proteins to form glycoprotein products are
(A) yeast cells.
(B) *E. coli* cells.
(C) mammalian cells.
(D) algal cells.
34. Which type of RNA participates in nuclear export of mRNA?
(A) snRNA
(B) miRNA
(C) tRNA
(D) hnRNA
35. Synthesis of pre-rRNA occurs in the
(A) cytoplasm.
(B) endoplasmic reticulum.
(C) extranucleolar area of the nucleus.
(D) nucleolus.
36. Steroid hormones activate transcription by
(A) binding to a nuclear receptor.
(B) phosphorylating a protein kinase.
(C) binding to specific cell-surface receptors.
(D) inhibiting a histone deacetylase.
37. Transcriptionally inactive genes
(A) are not located within nucleosomes.
(B) often are methylated.
(C) are not resistant to DNase I.
(D) are always located within euchromatin.
38. What is the function of TFIIF in the transcription initiation complex?
(A) binding to the TATA box
(B) unwinding the DNA duplex
(C) catalyzing the synthesis of RNA
(D) all of the above
39. Protein X contains 7 transmembrane domains, with a short N-terminus and a long C-terminus. Following protein synthesis, the N-terminus of the protein faces the lumen (the inside) of endoplasmic reticulum (ER). After protein X is transported to the cell surface via exocytosis, you would expect the C-terminus of the protein X to be
(A) extracellular.
(B) cytoplasmic.
(C) in the lumen of ER.
(D) in the lipid bilayer of the plasma membrane.
40. The first step in the secretory pathway that should be inhibited by a dominant-negative mutant of SNARE proteins is
(A) rough endoplasmic reticulum to Golgi transport.
(B) intra Golgi transport.
(C) trans Golgi network (TGN) transport to the plasma membrane.
(D) TGN transport to the late endosome.