

المستوي الرابع / البيولوجيا الجزيئية  
مقرر: بيولوجيا جزيئية (2) (403ح)

Date: 05-01-2025

Time: 2 Hours

Marks: 90

الإمتحان في صفحتين:

Answer ALL the following questions:

QUESTION (1):

(20 Marks)

Which of the following statements are probably true (✓) and which are probably false (×).

**DO NOT copy the sentences to your answer sheet**

- 1- Histone spH2B is found at the telomeres in sperm cells.
- 2- *Xeroderma pigmentosum* is characterized by an increased sensitivity to sunlight because of an inability to repair UV-induced lesions.
- 3- Proflavin can intercalate between adjacent base pairs, thereby distorting the helical structure.
- 4- CG methylation may slow down the movement of RNA polymerase along a gene.
- 5- For inactive genes, the core promoter is found in a nucleosome-free region.
- 6- AU-rich element is a destabilizing element that is found in many long-lived mRNAs.
- 7- Gene regulation in eukaryotes occurs only at certain steps in the pathway of gene expression.
- 8- All regulatory elements are orientation-dependent.
- 9- About 30% of all human pre-mRNAs are alternatively spliced.
- 10- Enzymes that carry out ubiquitination travel with RNA polymerase II during the elongation phase of transcription.
- 11- Chromatin that is in an open conformation is more easily accessible to transcription.
- 12- The re-formation of nucleosomes behind RNA polymerase II is thought to be critical to maintaining the fidelity of transcription.
- 13- Mutations are essential to the continuity of life.
- 14- The presence of toxic heavy metals can lead to a shutdown of protein synthesis.
- 15- In mammals, over 50 different enzymes selectively modify amino-terminal tails of histones.
- 16- General transcription factors regulate the rate of transcription of target genes.
- 17- Regulatory transcription factors are required for controlling the switch from the initiation to the elongation stage of transcription.
- 18- The nucleosome-free region is required for gene transcription, and it is sufficient for gene activation.
- 19- Having a patch of white hair in your head could be due to germ line mutation.
- 20- 5BU is a cytosine analogue that can incorporate into DNA instead of C.

QUESTION (2):

(20 Marks)

(A) Complete the following with suitable words:

**DO NOT copy the sentences to your answer sheet**

- Histone variants have been identified for all histone genes, except for the \_\_\_\_\_ (1) \_\_\_\_\_ gene.
- The leucine zipper motif mediates protein \_\_\_\_\_ (2) \_\_\_\_\_.



- In yeast, the transcriptional start site is usually at the boundary between the \_\_\_\_\_(3)\_\_\_\_\_ and the +1 nucleosome.
- When a missense mutation has no detectable effect on protein function, it is referred to as a \_\_\_\_\_(4)\_\_\_\_\_ mutation.
- Mutations in \_\_\_\_\_(5)\_\_\_\_\_ junctions in eukaryotic genes can affect the order or number of exons contained within mRNA.
- \_\_\_\_\_(6)\_\_\_\_\_ is a term that refers to a heritable change in the genetic material.
- \_\_\_\_\_(7)\_\_\_\_\_ mutations addition or deletion of a number of nucleotides that is not divisible by 3.
- Deamination of methylcytosine results in \_\_\_\_\_(8)\_\_\_\_\_, which is a normal constituent of DNA.
- The recognition of hemimethylated DNA by methyltransferase and conversion into fully methylated DNA is called \_\_\_\_\_(9)\_\_\_\_\_.
- 8-oxoG base pairs with \_\_\_\_\_(10)\_\_\_\_\_ during DNA replication.
- A \_\_\_\_\_(11)\_\_\_\_\_ mutation can occur directly in a sperm or egg cell, or in a precursor cell that produces the gametes.
- Protein remodelers may evict histones from the DNA, thereby creating gaps where \_\_\_\_\_(12)\_\_\_\_\_ are not found.
- \_\_\_\_\_(13)\_\_\_\_\_ are enzymes that cleave the bond between the base and the sugar in the DNA backbone, creating an apurinic or apyrimidinic site.
- A mediator is a protein complex that mediates the interaction between \_\_\_\_\_(14)\_\_\_\_\_ and regulatory transcription factors.
- Most newly made mRNAs contain a polyA tail that averages \_\_\_\_\_(15)\_\_\_\_\_ nucleotides.

(B) What are the structural motifs found in transcription factors? (5 marks)

**QUESTION (3):** (25 Marks)

Answer the following:

- 1- Explain the mechanism of RNAi. (8 marks)
- 2- Demonstrate how the regulation of iron assimilation regulates translation of specific mRNAs. (8 marks)
- 3- List and define the types of mutations that may occur in the coding sequence within a gene. (9 marks)

**QUESTION (4):** (25 Marks)

Answer the following:

- 1- Define DNA methylation and explain how it can affect transcription. (7 marks)
- 2- Outline ChIP-Seq approach. (8 marks)
- 3- Discuss the various ways the mutagens use to alter the structure of DNA. (10 marks)

**Best Wishes,,,,,**

Examiner: *Prof. Ahmed M. Ghoneim*