

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

Date: 28-12-2025

Time: 2 Hours

Marks: 90

الإمتحان في صفتين:

Answer ALL the following questions:

QUESTION (1):

(25 Marks)

Answer the following:

- 1- Define chromatin remodeling and explain how chromatin remodelers change chromatin structure. (10 marks)
- 2- Write on "Insulators" and explain how the effects of a nearby enhancer are blocked. (10 marks)
- 3- Outline a method to determine if an agent is a mutagen. (5 marks)

QUESTION (2):

(20 Marks)

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

DO NOT copy the statements to your answer sheet

- 1- General transcription factors are required for binding of RNA polymerase to the core promoter and are necessary for a basal level of transcription.
- 2- 2-3% of the human genome encode regulatory transcription factors.
- 3- Methylated CG sequences facilitate the binding of an activator protein to an enhancer element.
- 4- Most regulatory transcription factors bind directly to RNA polymerase.
- 5- CREB protein is modulated by non-covalent modification.
- 6- Histone variants have been identified for all histone genes, except for H3
- 7- Histone macroH2A is found at the telomeres in sperm cells.
- 8- In mammals, over 50 different enzymes selectively modify carboxy-terminal tails of histones.
- 9- Core histone proteins consist of a globular domain and a charged carboxy-terminal tail.
- 10- A tautomeric shift can cause a mutation if it occurs long time before DNA replication.
- 11- Double strand breaks can be caused by non-ionizing radiation.
- 12- DNA methylation usually inhibits the transcription of eukaryotic genes.
- 13- In housekeeping genes, cytosine bases in CpG islands are unmethylated.
- 14- Glucocorticoid hormones enter the cytosol and specifically bind to glucocorticoid receptors.
- 15- The insertion of multiple copies of a gene into the genome can result in dsRNA.
- 16- Victor Ambros and his colleagues were the first to discover that the transcription of a particular gene can produce a small RNA that does not encode a protein.
- 17- If nonmethylated DNA is introduced into a cell, it will remain nonmethylated in the daughter cells.
- 18- When cloned genes are introduced in multiple copies, the expression of that gene is often silenced.
- 19- If the chromatin is in a closed conformation, transcription may be difficult or impossible.
- 20- In housekeeping genes, cytosine bases in CpG islands are unmethylated.

QUESTION (3):

(20 Marks)

Complete the following with suitable words:

DO NOT copy the statements to your answer sheet

- _____(1)_____ is defined as number of new mutations in a given gene per cell generation.
- Regulatory elements that serve to stimulate transcription are called _____(2)_____.
- Lysines within the core histone proteins can be acetylated by enzymes called histone _____(3)_____.
- An _____(4)_____ is a segment of DNA that protects a gene from the regulatory effects of a neighboring gene.
- At a low rate, G and T can interconvert to an _____(5)_____ form, and A and C can interconvert to an _____(6)_____ form.
- DNA _____(7)_____ is an enzyme that attaches a methyl group to the cytosine base forming 5-methylcytosine.
- Certain mRNAs contain destabilizing elements located between the stop codon and the _____(8)_____.
- In 1998, Fire and Mello investigated the effects of gene called _____(9)_____, which had already been shown to be highly expressed in early embryos.
- _____(10)_____ are usually a perfect match to specific mRNAs and cause mRNAs degradation.
- _____(11)_____ are DNA segments that have the capacity to move throughout the genome.
- The activated adenylyl cyclase catalyzes the synthesis of cAMP, which activates a second enzyme called _____(12)_____.
- _____(13)_____ repair can be error-free if it occurs during S and G2 phases of the cell cycle.
- _____(14)_____ mutation reverses the phenotypic effects of another mutation.
- _____(15)_____ is a phenomenon in which a repeated sequence of 3 nucleotides can readily increase in number from one generation to the next.
- Examples for mutagens that alkylate nitrogenous bases include _____(16)_____ and _____(17)_____.
- _____(18)_____ radiation penetrates deeply into biological materials, where it produces free radicals that can alter DNA structure.
- _____(19)_____ repair system recognizes an abnormal base and cleaves the bond between the base and the sugar in the DNA backbone, creating an apurinic or apyrimidinic site.
- The amount of _____(20)_____ in a sample of DNA is measured to determine the extent of oxidative stress.

QUESTION (4):

(25 Marks)

Answer the following:

- 1- "Regulatory transcription factors affect the function of RNA polymerase II by 3 ways, and the functions of the transcription factors themselves are also modulated" explain. (10 marks)
- 2- With an example, define "alternative splicing" and explain the underlying mechanism. (8 marks)
- 3- Write on the nomenclature of mutations based on their effects relative to the wild-type genotype and wild-type phenotype. (7 marks)

Best Wishes,,,,,

Examiner: Prof. Ahmed M. Ghoneim