RNA and Protein Synthesis

17. During transcription, the enzyme RNA polymerase synthesizes a strand of RNA from one strand of double-stranded DNA, which serves as a template.

18. RNA is synthesized from nucleotides containing the bases A, C, G, and U, which pair with the bases of the DNA strand being transcribed.

19. RNA polymerase binds the promoter; transcription begins at AUG: the region of DNA that is the end point of transcription is the terminator: RNA is synthesized in the 5' - 3' direction.

20. Translation is the process in which the information in the nucleotide base sequence of mRNA is used to dictate the amino acid sequence of a protein.

21. The mRNA associates with ribosomes, which consist of rRNA and protein.

22. Three-base segments of mRNA that specify amino acids are called codons.

23. The genetic code refers to the relationship among the nucleotide base sequence of DNA, the corresponding codons of mRNA, and

the amino acids for which the codons code.

24. The genetic code is degenerate; that is, most amino acids arc coded for by more than one codon.

25. Of the 64 codons, 61 are sense codons (which code for amino acids), and 3 arc nonsense codons (which do not code for amino acids and are stop signals for translation).

26. The start codon, AUG, codes for methionine.

27. Specific amino acids are allached to molecules of tRNA. Another portion of the tRNA has a base triplet called an anticodon.

28. The base pairing of codon and anticodon at the ribosome results in specific amino acids being brought to the site of protein synthesis.

29. The ribosome moves along the mRNA strand as amino acids are joined to form a growing polypeptide; mRNA is read in the 5' - 3' direction.

30. Translation ends when the ribosome reaches a stop codon on the mRNA.

The Regulation of Bacterial

Gene Expression

l. Regulating protein synthesis at the gene level is energy-efficient because proteins are synthesized only as they are needed.

2. Constitutive enzymes produce products at a fixed rate. Examples are genes for the enzymes in glycolysis.

3. For these gene regulatory mechanisms, the control is aimed at

mRNA synthesis.

Repression and Induction

4. Repression controls the synthesis of one or several (repressible) enzymes.

5. When cells are exposed to a particular end-product, the synthesis of enzymes related to that product decreases.

6. In the presence of certain chemicals (inducers), cells synthesize more enzymes. This process is called induction.

The Operon Model of Gene Expression

7. The formation of enzymes is determined by structural genes.

8. In bacteria, a group of coordinately regulated structural genes with related metabolic functions, plus the promoter and operator sites that control their transcription, are called an operon.

9. In the operon model for an inducible system, a regulatory gene codes for the repressor protein.

Positive Regulation

10. Transcription of structural genes for catabolic enzymes

11. The presence of glucose inhibits the metabolism of alternative carbon sources by catabolite repression.

Mutation: Change in the Genetic Material

I . A mutation is a change in the nitrogenous base sequence of DNA; that change causes a change in the product coded for by the

mutated gene.

2. Many mutations are neutral, some are disadvantageous, and others are beneficial.

Types of Mutations:

3. A base substitution occurs when one base pair in DNA is replaced with a different base pair.

4. Alterations in DNA can result in missense mutations (which cause amino acid substitutions) or nonsense mutations (which create stop codons).

5. In a frameshift mutation, one or a few base pairs are deleted or added to DNA.

6. Mutagens are agents in the environment that cause permanent changes in DNA.

7. Spontaneous mutations occur without the presence of any mutagen.

Mutagens:

8. Chemical mutagens include base-pair mutagens, nucleoside analogs, and frameshift mutagens.

9. Ionizing radiation causes the formation of ions and free radicals that react with DNA; base substitutions or breakage of the sugar phosphate backbone results.

10. Ultraviolet (UV) radiation is nonionizing; it causes bonding between adjacent thymines.

II . Damage to DNA caused by UV radiation can be repaired by enzymes that cut out and replace the damaged portion of DNA.

12. Light-repair enzymes repai r thymine dimers in the presence of visible light.

The Frequency of Mutation :

13. Mutation rate is the probability that a gene will mutate when a cell divides; the rate is expressed as 10 to a negative power.

14. Mutations usually occur randomly along a chromosome.

15. A low rate of spontaneous mutations is beneficial in providing the genetic diversity needed for evolution.

Identifying Mutants;

16. Mutants can be detected by selecting or testing for an altered phenotype.

17. Positive selection involves the selection of mutant cells and the rejection of nonmutated cells.

18. Replica plating is used for negative selection- to detect, for example, auxotrophs that have nutritional requirements not possessed by the parent (nonmutated) cell.

Identifying Chemical Carcinogens:

19. The Ames test is a relatively inexpensive and rapid test for identifying possible chemical carcinogens.

20. The test assumes that a mutant cell can revert 10 a normal ceU in the

presence of a mutagen and that many mutagens are carcinogens.

References': 1- Microbiology an introduction TWELFTH EDITION. Gerard. .Tortora.2016

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