

# Unit 3 – Molecular Genetics

## **Chapter 4 - DNA: The Molecular Basis of Life**

1. Review the processes of mitosis and meiosis.
2. List three differences between DNA and RNA. Describe the structure of each and the importance of hydrogen bonds between the complimentary strands of DNA.
3. Describe the experiments of a) Watson and Crick b) Griffith c) Meselson and Stahl
4. Use a series of diagrams and a written explanation to describe the process of DNA replication. Include the action of all enzymes involved in this process.

## **Chapter 5 - Protein Synthesis**

1. Describe the one-gene-one polypeptide hypothesis.
2. Describe the structure and function of each type of RNA (mRNA, tRNA and rRNA)
3. Uses a series of diagrams and a written explanation to describe the process of transcription. Include the action of all enzymes involved in this process. Include a description of posttranscriptional modifications.
4. Identify the ways that the mRNA molecule differs from the DNA strand from which it was transcribed.
5. Describe the action of HIV and relate this to transcription.
6. Define the term codon and describe the connection between codons and the amino acids for which they code
7. Uses a series of diagrams and a written explanation to describe the process of translation. Include the action of all enzymes involved in this process.
8. Describe the *lac* operon and *trp* operon as control mechanisms of gene function.
9. Define the following types of mutation: silent, missense, nonsense, substitution, deletion, insertion and frame shift. Describe the causes and evolutionary significance of mutation.
10. Describe the purpose of histones in chromosome structure.

## **Chapter 6 - Biotechnology**

1. Discuss the importance of restriction endonucleases as a biotechnological tool.
2. What is the natural source of restriction endonucleases and what is their purpose in nature?
3. Distinguish between restriction endonucleases that produce "sticky ends" and those that produce "blunt ends".
4. Describe the use of methylases and DNA ligase as biotechnological tools.
5. Clearly describe the process of gel electrophoresis. What are the uses of this technology?
6. Describe how restriction endonucleases and plasmids can be used in genetic engineering.
7. Describe 3 practical applications of genetic engineering that are presently being used.
8. Discuss the ethical and environmental issues that must be considered before scientist perform "gene splicing"
9. Give a detailed description of the Polymerase Chain Reaction (PCR) and describe in what situations it would be used.
10. Give a detailed description of the Restriction Fragment Length Polymorphism (RFLP) analysis and describe in what situations it would be used
11. Give a detailed description of the Sanger dideoxy method and describe in what situations it would be used
12. Discuss the possible uses and misuses of genetic screening, gene therapy, transgenic plants, stem cell research and cloning.