**Topic 2.7: DNA Replication, Transcription & Translation**

**Essential Idea: Genetic information in DNA can be accurately copied and can be translated to make the proteins needed by the cell.**

**Statements & Objectives:**

**2.7.U1 The replication of DNA is semi-conservative and depends on complimentary base pairing.**

Describe the meaning of “semi-conservative” in relation to DNA replication.

(**Describe:** Give a detailed account)

Explain the role of complementary base pairing in DNA replication.​

(**Explain**: Give a detailed account including reasons or causes)

**2.7.U2 Helicase unwinds the double helix and separates the two strands by breaking hydrogen bonds.**

State why DNA strands must be separated prior to replication.

**(State**: Give a specific name, value or other brief answer without explanation or calculation)

Outline two functions of helicase.

​**(Outline**: Give a brief account or summary)

State the role of the origin of replication in DNA replication.

**(State**: Give a specific name, value or other brief answer without explanation or calculation)

Contrast the number of origins in prokaryotic cells to the number in eukaryotic cells.​

(**Contrast** Give an account of the differences between two (or more) items or situations, referring to both (all) of them throughout.)

**2.7.U3 DNA polymerase links nucleotides together to form a new strand, using a pre-existing strand as a template.**

Describe the movement of DNA polymerase along the DNA template strand.

(**Describe:** Give a detailed account)

Describe the action of DNA polymerase III in pairing nucleotides during DNA replication.​

(**Describe:** Give a detailed account)

**2.7.U4 Transcription is the synthesis of mRNA copied from the DNA base sequences by RNA polymerase.**

Define transcription.

**(Define**: Give the precise meaning of a word, phrase, or physical quantity.)

Outline the process of transcription, including the role of RNA polymerase and complementary base pairing.

​**(Outline**: Give a brief account or summary)

Identify the sense and antisense strands of DNA given a diagram of translation.​

(**Identify:** Find an answer from a given number of possibilities)

**2.7.U5 Translation is the synthesis of polypeptides on ribosomes.**

Define translation.

**(Define**: Give the precise meaning of a word, phrase, or physical quantity.)

State the location of translation in the cell.​

**(State**: Give a specific name, value or other brief answer without explanation or calculation)

**2.7.U6 The amino acid sequence of polypeptides is determined by mRNA according to the genetic code.**

Outline the role of messenger RNA in translation.

​**(Outline**: Give a brief account or summary)

**2.7.U7 Codons of three bases on mRNA correspond to one amino acid in a polypeptide.**

Define codon, redundant and degenerate as related to the genetic code.

**(Define**: Give the precise meaning of a word, phrase, or physical quantity.)

Explain how using a 4 letters nucleic acid “language” can code for a “language” of 20 amino acid letters in proteins.

(**Explain**: Give a detailed account including reasons or causes)

**2.7.U8 Translation depends on complimentary base-pairing between codons on mRNA and anti codons on tRNA.**

Outline the role of complementary base pairing between mRNA and tRNA in translation.

​**(Outline**: Give a brief account or summary)

**2.7.A1 Use of Taq DNA polymerase to produce multiple copies of DNA rapidly by the polymerase chain reaction (PCR).**

Outline the process of the PCR.

​**(Outline**: Give a brief account or summary)

Explain the use of Taq DNA polymerase in the PCR.

(**Explain**: Give a detailed account including reasons or causes)

**2.7.A2 Production of human insulin in bacteria as an example of the universality of the genetic code allowing gene transfer between species.**

Outline the source and use of pharmaceutical insulin prior to the use of gene transfer technology.

​**(Outline**: Give a brief account or summary)

Outline the benefits of using gene transfer technology in the production of pharmaceutical insulin.

​**(Outline**: Give a brief account or summary)

**2.7.S1 Use a table of the genetic code to deduce which codons corresponds to which amino acids.**

Use a genetic code table to deduce the mRNA codon(s) given the name of an amino acid.

(**Deduce:** Reach a conclusion from the information given)

**2.7.S2 Analysis of Meselson and Stahl’s results to obtain support for the theory of semi-conservative replication of DNA.**

Compare dispersive, conservative and semi-conservative replication.

(**Compare:** Give an account of similarities and differences between two (or more) items, referring to both (all) of them throughout.)

Predict experimental results in the Meselson and Stahl experiment if DNA replication was dispersive, conservative or semi-conservative.

(**Predict:** Give an expected result)

**2.7.S3 Use a table of mRNA codons and their corresponding amino acids to deduce the sequence of amino acids coded by a short mRNA strand of known base sequence.**

Use a genetic code table to determine the amino acid sequence coded for by a given antisense DNA sequence or an mRNA sequence.

(**Determine:** Find the only possible answer)

**2.7.S4 Deducing the DNA base sequence for the mRNA strand.**

Deduce the antisense DNA base sequence that was transcribed to produce a given mRNA sequence.

(**Deduce:** Reach a conclusion from the information given)

**2.7.NOS Obtaining of evidence for scientific theories- Meselson and Stahl obtained evidence for the semi-conservative replication of DNA.**

Describe the procedure of the Meselson and Stahl experiment.

(**Describe:** Give a detailed account)

Explain how the Meselson and Stahl experiment demonstrated semi-conservative DNA replication.

(**Explain**: Give a detailed account including reasons or causes)

**Key Terms**

3'

5'

DNA polymerase I

DNA polymerase III

base pair ruling

​ribosomes

​rRNA

​nucleic acid

gene transfer

​parent strand

helicase

hydrogen bond

lagging strand

leading strand

​transcription

​nucleus

​tRNA

amino acids

​genetic code

anti condons

ligase

nucleotide

triphosphates

​semi-conservative

​translation

cytoplasm

condon

Taq DNA polymerase

​Sense

Okazaki fragment

origin of replication

primase

primer

RNA polymerase

endoplasmic reticulum

​redundant

​PRC

Meselson and Stahl

replication bubble

replication fork

single stranded

binding proteins

​polypeptides

​mRNA

degenerate

insulin

​antisense