

IBDP Biology HL

Topic 7: Nucleic acids

Revision List - Syllabus Topics

7.1: DNA structure and replication

1. Nucleosomes help to supercoil the DNA.
2. DNA structure suggested a mechanism for DNA replication.
3. DNA polymerases can only add nucleotides to the 3' end of a primer.
4. DNA replication is continuous on the leading strand and discontinuous on the lagging strand.
5. DNA replication is carried out by a complex system of enzymes.
 - a. Proteins and enzymes involved in DNA replication should include helicase, DNA gyrase (topoisomerase), single strand binding proteins, DNA primase and DNA polymerases I and III.
6. Some regions of DNA do not code for proteins but have other important functions.
 - a. The regions of DNA that do not code for proteins should be limited to regulators of gene expression, introns, telomeres and genes for tRNAs.

7.2: Transcription and gene expression

1. Transcription occurs in a 5' to 3' direction.
 - a. RNA polymerase adds the 5' end of the free RNA nucleotide to the 3' end of the growing mRNA molecule.
2. Nucleosomes help to regulate transcription in eukaryotes.
3. Eukaryotic cells modify mRNA after transcription.
 - a. Students should understand the action of introns and exons.
4. Splicing of mRNA increases the number of different proteins an organism can produce.
5. Gene expression is regulated by proteins that bind to specific base sequences in DNA.
6. The environment of a cell and of an organism has an impact on gene expression.

7.3: Translation

1. Initiation of translation involves assembly of the components that carry out the process.
 - a. tRNA-activating enzymes illustrate enzyme-substrate specificity and the role of phosphorylation.
 - i. Phosphorylation is the addition of a phosphate group that turns many enzymes on and off.
2. Synthesis of the polypeptide involves a repeated cycle of events.
 - a. Names of the tRNA binding sites are expected as well as their roles.
 - i. E site, P site, A site
3. Disassembly of the components follows termination of translation.
4. Free ribosomes synthesize proteins for use primarily within the cell.
5. Bound ribosomes synthesize proteins primarily for secretion or for use in lysosomes.
6. Translation can occur immediately after transcription in prokaryotes due to the absence of a nuclear membrane.
7. The sequence and number of amino acids in the polypeptide is the primary structure.
8. The secondary structure is the formation of alpha helices and beta pleated sheets stabilized by hydrogen bonding.
9. The tertiary structure is the further folding of the polypeptide stabilized by interactions between R groups.
 - a. Polar and non-polar amino acids are relevant to the bonds formed between R groups.
10. The quaternary structure exists in proteins with more than one polypeptide chain.
 - a. Quaternary structure may involve the binding of a prosthetic group to form a conjugated protein.