DNA: Code of life

Scope

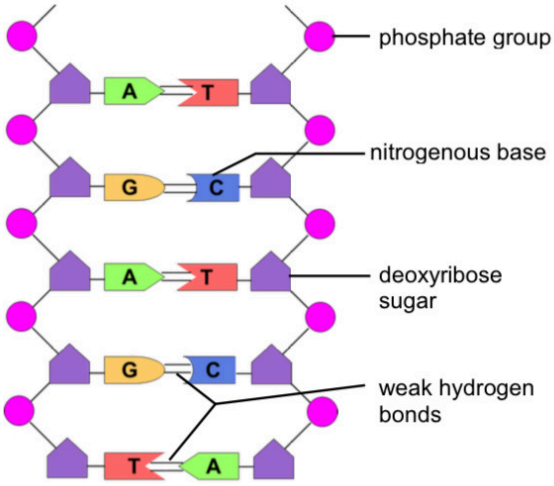
TOPIC	SUBTOPIC	KEY INFORMATION
DNA – THE CODE OF LIFE	Structure of DNA and RNA	• Identify using diagrams with emphasis on the natural shape of each and the arrangement of nucleotides • Brief history of the discovery of the DNA molecule (Watson & Crick, Franklin & Wilkins)
	Differences between DNA & RNA	• Distinguish when asked only nucleotides or the complete structure
	DNA replication	• Describe in the correct sequence
	Protein synthesis	• Role of DNA & RNA in protein synthesis: ✓ Transcription and ✓ Translation as stipulated in Examination Guidelines
	DNA profiling	• Interpretation of diagrams of DNA profiling • Refer to DNA profile bars or DNA bars and NOT just black bars or just DNA • Uses of DNA profile E.g., DNA profile bars of suspect A compare with the DNA profile bars of the blood on the glass

StudySmartly
Enriching minds

Adapted from DBE revision guidelines

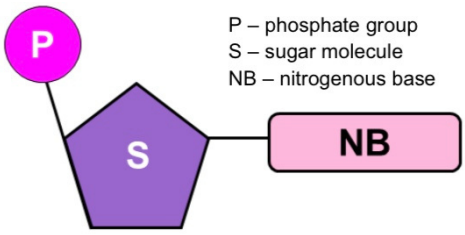
DNA: Code of life

DNA notes



NB- Adenine always pairs with Thymine
- Cytosine always pairs with Guanine
Joined by weak hydrogen bonds
(weak to easily break)

A nucleotide of DNA



The structure of DNA

- Double helix (double stranded and twisted)
- Made of monomers called nucleotides
- nucleotides link to form polymers (long chain)
- each nucleotide has a Deoxyribose sugar, nitrogenous base and phosphate group.
- 4 nitrogenous based in DNA - Adenine, Thymine, Cytosine & Guanine

DNA replication

- The double helix unwinds.
- Weak hydrogen bonds between nitrogenous bases break and two DNA strands unzip (separate).
- Each original DNA strand serves as a template on which its complement is built.
- Free DNA nucleotides in the nucleoplasm build a DNA strand onto each of the original two DNA strands by attaching to their complementary nitrogenous bases (A to T and C to G).
- This results in two identical DNA molecules. Each molecule consists of one original strand and one new strand.

Location of DNA

- Nuclear DNA - Found in the nucleus
- Extra nuclear DNA - Found in Mitichondria & Chloroplast

Function of DNA

- Controls the functioning of cells
- Regulate the functioning of genes
- Passes on hereditary characteristics

Possible terminology

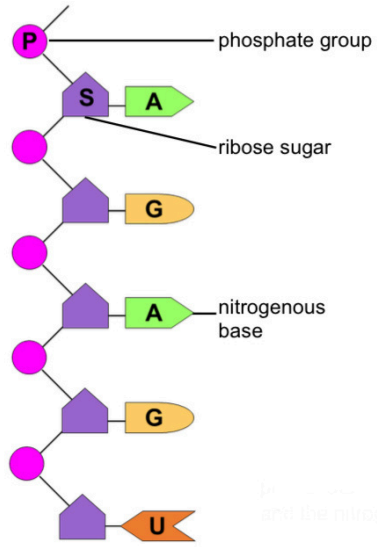
- Deoxyribose
- Double helix
- Nucleotide
- Weak hydrogen bond

Brief history of DNA

Watson and Crick received the Nobel Prize for the discovery of the structure of DNA, and Wilkins received an award for his X-ray photography.

DNA: Code of life

RNA notes



NB - no pairs or bonds in RNA
- Uracil replaces Thymine
- Uracil pairs with Adenine

Protein synthesis

Process whereby proteins are made
Two stages- transcription & translation

Transcription

- DNA double helix unwinds.
- weak hydrogen bonds between the nitrogenous bases of DNA break and the DNA unzips

One strand acts as a template

- This DNA template is used to form a complementary strand of messenger RNA (mRNA) using free RNA nucleotides in the nucleoplasm
- mRNA is now coded for
- mRNA moves out of the nucleus through a nuclear pore into the cytoplasm, where it attaches onto a ribosome

Translation

Transfer RNA (tRNA) in the cytoplasm has three adjacent nitrogenous bases known as the anti-codon

- mRNA's codon will be complementary to a tRNA's anti-codon
- Each tRNA will carry a specific amino acid
- According to the codons on the mRNA, the tRNA will bring the required amino acid to the ribosome
- The amino acids are linked by a peptide bond to form the required protein.

The structure of RNA

- Single stranded
- Made of monomers called nucleotides
- nucleotides link to form polymers (long chain but shorter than DNA)
- each nucleotide has a ribose sugar, nitrogenous base and phosphate group.
- 4 nitrogenous based in DNA - Adenine, Uracil, Cytosine & Guanine

Location of RNA

- Messengar RNA (mRNA) - Nucleus & Ribosome
- Transfer RNA (tRNA) - Cytoplasm
- Ribosimal RNA (rRNA)- Ribosome

Function of RNA

- Messengar RNA - copies code on DNA
- Transfer RNA - carry amino acids to ribosome
- Ribosomal RNA - form part of ribosome

Role of RNA

Plays a role in protein synthesis

DNA VS RNA

Deoxyribose sugar	-	Ribose sugar
Double helix	-	Single stranded
contain Thymine	-	contain Uracil
found only in nucleus	-	found in nucleus, ribosome & cytoplasm

Possible terminology

- Ribose
- Nucleotide
- Uracil
- mRNA
- rRNA
- peptide bond
- Transcription
- Translation
- Codon
- Anti-codon
- Protein synthesis
- Ribosome

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DNA profiling

DNA profiling

A process whereby a bar code pattern is formed from DNA

DNA profile

A DNA profile is bar code a pattern produced on X-ray film.

Uses of a profile

DNA profiles are used to:

- identify crime suspects in forensic investigations
- prove paternity (father) and maternity (mother) (biological parents)
- determine the probability or causes of genetic defects
- establish the compatibility of tissue types for organ transplants
- identify relatives

Refer to DNA profile bars or DNA bars and NOT just black bars or just DNA
E.g., DNA profile bars of suspect A compare with the DNA profile bars of the blood on the glass

Important to note

Humans interpret the results which means mistakes can be made

- The method of profiling may be different in different laboratories producing inconsistencies
- Only a small piece of DNA is used in profiling, so the profile might not be 100% unique to a particular individual
- DNA profiling is expensive and therefore not readily accessible to those who cannot afford it, particularly in criminal cases
- DNA profiles may reveal information about a person which could be used against them in a prejudicial way. For example: being HIV positive or having genetic abnormalities may lead to insurance companies not covering a person or prejudice in the court room

Interpreting a profile

50% DNA is paternal & 50% DNA is maternal meaning half of the DNA bands should match the mother and the other half should match the father

Possible terminology

- DNA profile
- DNA profiling