

Lecture 5

Nucleic acids

1. In a double helix

(a) The individual strands are not helical

(b) Hydrogen bonds form between a purine and pyrimidine base on the same strand

©Adenine on one strand is hydrogen bonded to thymine on the opposite strand

(d) Phosphodiester bonds are oriented towards the interior of the helix

Answer: C. Adenine on one strand is hydrogen bonded to thymine on the opposite strand.

2. How the DNA-B helix is differ form DNA-Z helix?

Answer:

Geometry attribute	B DNA	Z DNA
Helix sense	right-handed	left-handed
Repeating unit	1 bp	2 bp
Base pair per turn	10.5	12
Rise base pair along axis	0.332 nm	0.38 nm
Diameter	20 Å	18 Å

3. Distinguish between DNA and RNA?

Answer: (1) RNA is single-stranded while DNA is a double-stranded helix. (2) RNA also has uracil as its base while the DNA base is thymine. However, even with the differences in their structures, DNA and RNA have cooperating roles in the field of Cell Biology.

DNA contains the genetic information of an organism, and this information dictates how the body's cells would construct new proteins according to the genetic code of the organism. Within the cell structure, DNA is organized into structures called chromosomes, which are duplicated during cell division.

These chromosomes would then release the genetic codes that will be transcribed and carried by the RNA (specifically the messenger RNA) to the ribosome. The ribosome will then synthesize new proteins that will help the body grow. This is how the DNA and RNA work together in the body.

4. Briefly describe the structures of tRNA?

Answer: The structure of tRNA can be decomposed into its primary structure, its secondary structure, and its tertiary structure.

- The 5'-terminal phosphate group.
- The acceptor stem is a 7-base pair (bp) stem made by the base pairing of the 5'-terminal nucleotide with the 3'-terminal nucleotide (which contains the CCA 3'-terminal group used to attach the amino acid). The acceptor stem may contain non-Watson-Crick base pairs.

- The CCA tail is a cytosine-cytosine-adenine sequence at the 3' end of the tRNA molecule. This sequence is important for the recognition of tRNA by enzymes critical in translation. In prokaryotes, the CCA sequence is transcribed in some tRNA sequences. In most prokaryotic tRNAs and eukaryotic tRNAs, the CCA sequence is added during processing and therefore does not appear in the tRNA gene.
- The D arm is a 4 bp stem ending in a loop that often contains dihydrouridine.
- The anticodon arm is a 5-bp stem whose loop contains the anticodon.
- The T arm is a 5 bp stem containing the sequence TΨC where Ψ is a pseudouridine.
- Bases that have been modified, especially by methylation, occur in several positions outside the anticodon. The first anticodon base is sometimes modified to inosine (derived from adenine) or pseudouridine (derived from uracil).

5. Distinguish between nucleotide and nucleoside?

Answer: Nucleoside contains a sugar group and a base whereas phosphorylation of nucleosides by kinases (addition of phosphate in the sugar's primary alcohol group) produces nucleotides.

Nucleoside = sugar + base

Nucleotide = sugar + base + phosphate