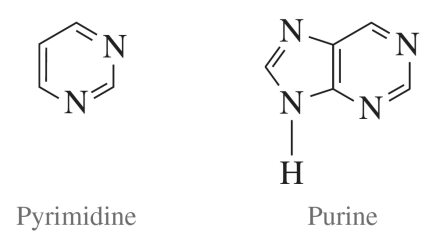
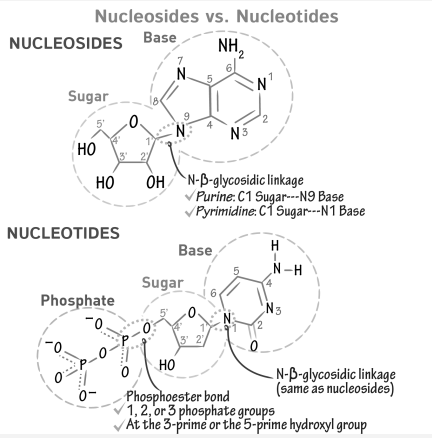
BASES OF NUCLEIC ACIDS



- PYRIMIDINE: single ring with two nitrogen atoms
- PURINE: two rings each with two nitrogen atoms.

BASIC because the nitrogen atoms are H+ acceptors.

BONDS

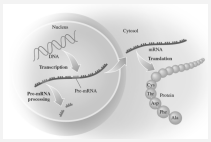


- PHOSPHODIESTER BOND: the bond between the 3' OH of a sugar (nucleotide) and a phosphate group attached to the 5' C of another sugar.

- HYDROGEN BOND: Weak, noncovalent linkages with favorable electrostatic interactions.

- N-GLYCOSIDIC BOND: In DNA, refers to the N-C linkage between the 9' N of purine bases or 1' N of pyrimidine bases and the 1' C of the sugar group.

TYPES OF RNA



There are 3 major types of RNA:
- messenger RNA (mRNA - 5%): carries genetic info copied from DNA to the ribosomes --> TRANSCRIPTION phase.

- transfer RNA (tRNA - 15%): translates the genetic info in mRNA into the AA sequence for the protein --> TRANSLATION phase.

-ribosomal RNA (rRNA - 80%): most abundant type of RNA; combined with proteins to form ribosomes.

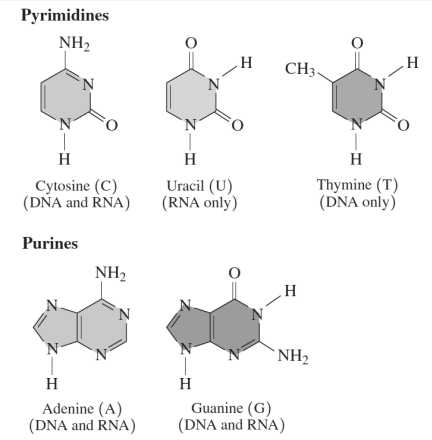
RNA & TRANSCRIPTION

The three types of RNA differ by function in the cell:
- ribosomal RNA makes up most of the structure of the ribosomes,
- messenger RNA carries genetic information from the DNA to the ribosomes
-transfer RNA places the correct amino acids in a growing peptide chain.
TRANSCRIPTION is the process by which RNA polymerase produces mRNA from one strand of DNA.
- Transcription factors at the promoter region bind RNA polymerase to DNA, which activates the transcription of a gene.
- The bases in the mRNA are complementary to the DNA, except A
in DNA is paired with U in RNA.
- The production of mRNA occurs when certain proteins are needed
in the cell.

Genetic Code & Protein Synthesis

The genetic code consists of a series of codons (sequences of 3 bases that specify the order for the amino acids in a protein).
- AUG codons signals the start of transcription
- codons UAG, UGA, and UAA signal it to stop the transcription.
Proteins are synthesized at the ribosomes in a translation process that includes 3 steps: initiation, chain elongation, and termination.
- During TRANSLATION, tRNAs bring the appropriate amino acids to the ribosome, and peptide bonds form to join the amino acids in a peptide chain.
- When the polypeptide is released, it takes on its secondary and tertiary structures and becomes a functional protein in the cell.

PYRAMIDINE & PURINE BASES



DNA contains the bases A, G, C, and T
RNA contains A, G, C, and U.

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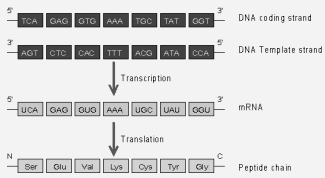
Base Pairs



-Template Strand (ANTI-SENSE): info that codes for genes; contains anti-codons.

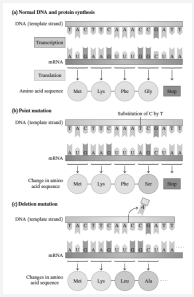
-Coding Strand (SENSE): complementary to anti-sense; contains codons (decoded by tRNA, which interacts with ribosome-bound mRNA).

-mRNA: made from template strand; has the same info as coding strand except T is replaced by U.

PROTEIN SYNTHESIS

Step	Site: Materials	Process
1. DNA Transcription	Nucleus: nucleotides, RNA polymerase	A DNA template is used to produce mRNA.
2. Translation of mRNA	Ribosome: mRNA	mRNA binds to ribosomes where translation begins.
3. Activation of tRNA	Cytosol: amino acids, tRNAs, aminoacyl–tRNA synthetase	Molecules of tRNA pick up specific amino acids according to their anticodons.
4. Initiation and Chain Elongation	Ribosome: Met–tRNA, mRNA, aminoacyl–tRNAs	A start codon binds the first tRNA carrying the amino acid methionine to the mRNA. Successive tRNAs bind to and detach from the ribosome as they add an amino acid to the polypeptide.
5. Chain Termination	Ribosome: stop codon on mRNA	The protein is released from the ribosome.

TYPES OF MUTATIONS



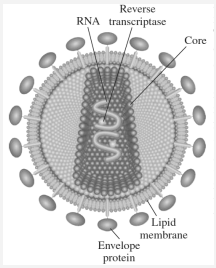
- POINT MUTATION: the replacement of one base in the template strand of DNA with another, causing a change in AA.

- SILENT MUTATION: when a point mutation does not change the amino acid.

- DELETION MUTATION: a base is deleted from codon, changing all that follow and producing a different sequence of AA.

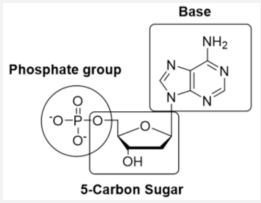
- INSERTION MUTATION: a base is inserted into the normal order of bases, changing all the codons that follow and

REVERSE TRANSCRIPTION



In reverse transcription:
- a retrovirus, which contains viral RNA but no viral DNA, enters a cell.
- the viral RNA uses reverse transcriptase to produce a viral DNA strand.
- the viral DNA strand forms a complementary DNA strand.
- the new DNA uses the nucleotides and enzymes in the host cell to synthesize new virus particles.

NUCLEOSIDES VS NUCLEOTIDES



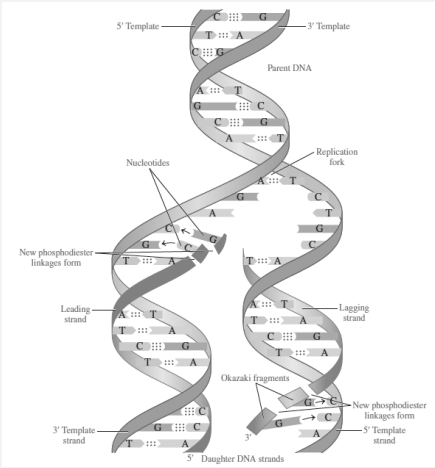
NucleoSide = Base + Sugar
NucleoTide = Base + Sugar + Phosphate group(s)

In nucleoside, the nitrogen atom of the base is connected by a b-N-glycosidic bond to the C1 of the sugar.

A nucleotide forms a phosphoester bond with the C5 OH group of the sugar.

SUGAR BASES

DNA REPLICATION



-helicase unwinds the parent DNA at several sections.

-DNA polymerase catalyzes the replication process at each of the open DNA sections called replication forks.

-polymerase moves in the 3′–5′direction, catalyzing the formation of new phosphodiester linkages.

-lagging strand (growing in the 5′–3′ direction) is synthesized in short sections called Okazaki fragments.

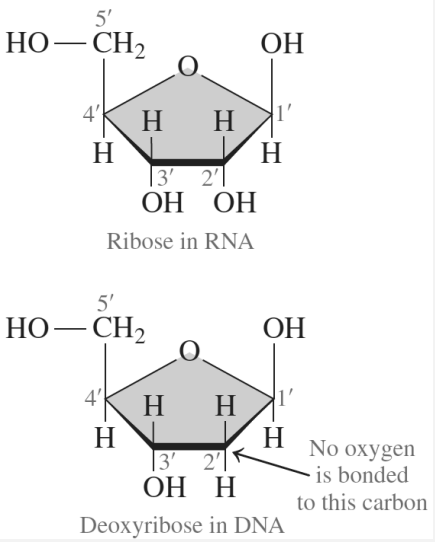
-DNA ligase joins the Okazaki fragments.

DNA Replication

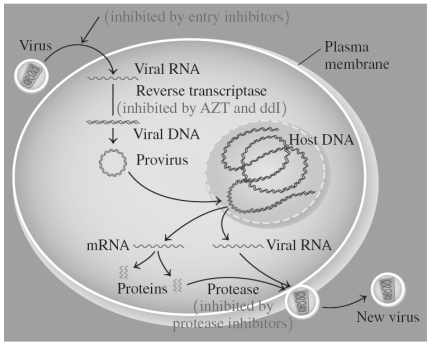
- During DNA replication, DNA polymerase makes new DNA strands along each of the original DNA strands that serve as templates.
- Complementary base pairing ensures the correct pairing of bases to give identical copies of the original DNA.

RETRO VIRUS

producing a different sequence of AA.



Pentose sugars in Nucleic Acids
- RNA: ribose
- DNA: deoxyribose; no hydroxyl group in C2



After a retrovirus injects its viral RNA into a cell, it forms a DNA strand by reverse transcription. The single-stranded DNA forms a double-stranded DNA called a provirus, which is incorporated into the host cell DNA. When the cell replicates, the provirus produces the viral RNA needed to produce more virus particles.

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