

Nucleotides:

- 0 Are linked together by a phosphodiester bond between the phosphate of one nucleotide and the sugar of another.
- 0 Consecutively linked by a phosphodiester bonds form a polymer in which the bases project out from a backbone of repeating e.co.uk sugar-phosphate groups.
 - This phosphodiester bond creates the sugar-phosphate "backbone" of DNA. .

0 Structure:

- Each has a nitrogenous base, a pentose sugar, and a
- When attached together, the polymore prime") and a 3' ("three prime") end. aS
- Nucleic acids are always m the ection, which means the **5' end** represents the **beginning** of a nucleic acid strand dded to the 3' end.





Sequence read/written as 5'- ACGT -3' no matter the direction it "faces"

- Directionality is like a LEGO brick, which has a **bumpy** side and a side **with holes** when it is a single brick (monomer) or when several bricks are in a stack (polymer).
- The same DNA strand can be shown in different directions. DNA strands are often written in the 5' to 3' direction (as shown above left), but the same exact DNA molecule can also be written with its 3' end on the left (as shown above right). Turning it doesn't change the identity of the molecule.

DNA is a Double Helix:

How Bases Pair Together in DNA:

- Once RNA is finished being made, the newly synthesized RNA is released as a single-stranded molecule.
- Both during and after transcription, RNA is is processed to generate a mature, functional form of RNA.
 - This includes putting a "cap" on the 5' end and a polyadenylated (poly-A) "tail" at the 3' end.
 - The 5' cap is added to the 5' end of the nascent RNA during transcription, but the poly-A tail is added to the 3' end of the RNA only after transcription termination.
- Splicing:
 - Allows cells to increase variation in gene expression through alternative splicing.
 - <u>Alternative splicing</u>: skipping particular exons or retaining an intron, causing certain exons present in the gene may or may not be included in the mature RNA transcript.
 - Causes:
 - A given gene to generate more than one protein product.
 - Gene expression can be finely tailored to suit the needs of different types of cells.

DNA DAMAGE AND REPAIR

Key Concepts:

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- DNA damage:
 - Can block essential processes including <u>DNA replication</u> and <u>transcription</u> and can lead to mutations.
- Types of Mutations:
 - C They can result from **replication errors**, from **damage to the SNA reservors introduced during repair of damage.** Mutations are heritable changes in the DNA sequence. 0 Point Mutations: 0 **Missense mutation** AUUUUAAUGUC CUGACGUCUUUUAAUGUCATG--euThrSerPheAsnValMet--revie GUAUUUUAAUGUCATG--- 🛶 ---CUGACGUAAUUUAAUGUCATG---hrTyrPheAsnValMet--- 📫 ---LeuThr***stop Insertions and Deletions: Insertion (of A): -----CUGACGUAUUUUAAUGUCATG--- ----CUGAACGUCUUUUAAUGUCATG------LeuThrTyrPheAsnValMet--- ----LeuAsnValPhe***stop
 - Deletion (of first C):

---CUGACGUAUUUUAAUGUCATG--- 🛶 ---UGACGUCUUUUAAUGUCATG------LeuThrTyrPheAsnValMet--- 📫 ---***stop

- Point mutations. (a) A missense mutation changes a single amino acid in the encoded polypeptide. (b) A nonsense mutation changes a codon for an amino acid into a stop codon, terminating synthesis of the encoded polypeptide. Insertion/deletion mutations. (c) Insertion of a single nucleotide changes the reading frame of all codons beyond the point of insertion; this usually leads to formation of a new stop codon that terminates synthesis. (d) Deletion of a single nucleotide changes the reading frame of all codons beyond the point of insertion; this usually leads to formation of a new stop codon that terminates synthesis.
- Frameshift mutation:
 - Once the initiation codon is determined, successive triplets are read as codons. Therefore, whereas addition (or deletion) of a multiple of three base pairs in a coding region would add (or subtract) amino acids to (or from) a protein, the addition of other numbers of base pairs shifts the reading frame from that point onward.
 - Some chemicals can insert themselves between adjacent base pairs (known as **intercalating**) with the DNA, which can lead to insertions or deletions of a single base pair, and thus a frameshift.