Double helix structure of DNA discovered in 1953 by James D Watson, Francis Crick and Rosalind Franklin.

Erwin Chargaff discovered the 1:1 ratio between purine and pyramidine. (Chargaff's rule)

- Nucleotide
  - Each nucleotide contains one pentose sugar, one phosphate and a nitrogenous base.
  - Sugar can be ribose or deoxyribose depending on the O/OH group attached to the 2' carbon
  - Purine nitrogenous base have two rings (A, G), pyramidine have one ring (C, T, U)
  - Phosphoester/diester covalent bond between phosphate and C3/C5 of the pentose sugar
  - Glycosidic bond between C1 on pentose and N1(Pyrimidine)/N9(Purine) on nitrogenous base
  - Nucleotide = phosphate + pentose + base, nucleoside = pentose + base

- DNA configuration
  - Linear sequence of nucleotides joined by phosphodiester bonds
  - Sugar and phosphate act as repeating unit
  - Nitrogenous base is the side group
  - Held together by hydrogen bonds and Van der Waal forces
  - Complementary base pairing: A-T (3 H-bond), C-G (2 H-bond)
  - Antiparallel structure: 5'-3', 3'-5'
  - Each helical turn contains 10.5 bp, vertical rise of 34Å (3.4nm), each base pair approx 3.4Å, diameter of 20Å (2nm)
  - Nitrogenous base stacked up with hydrophobic interaction
  - Major groove and Minor groove with vertical height of 13Å and 9Å.

- Alternative DNA configurations

	B-DNA	A-DNA	Z-DNA
Formation condition	Normal	Dehydrated	Salt/stress/methylation
Helix direction	Right	Right	Left
Major Groove	Wide and deep	Narrow and deep	Flat
Minor Groove	Narrow and shallow	Wide and shallow	Narrow and deep
Bp vertical rise	3.4Å	2.6Å	3.7Å
Bp per turn	10.5	11	12
Vertical rise per turn	34Å	28.6Å	44.4Å
Central core	solid	hollow	solid
Diameter	20Å	26Å	18Å

DNA packaging:

- In eukaryotes DNA are organised with protein histones. Eukaryotic chromatin fibre is 50% chromosome 50% histone
- Euchromatin: decondensed DNA, transcriptionally active, lightly stained. Abundant during interphase
- Heterochromatin: condensed DNA, transcriptionally inactive, darkly stained. Found in pole of nucleus during interphase, centromeres and telomeres.
- Histone: 2*H2A + 2*H2B + 2*H3 + 2*H4. H3 and H4.
  - Rich in positive amino acid arginine and lysine, attract negative DNA
  - 1.8 turns of DNA (147 bps) around the histone octamer, with 20~60bp linker sequence, left handed.
  - 11nm diameter
  - H2A and H2B expose C and N terminal tail, H3 and H4 expose N terminal only.

- H1 linker protein binds to linker sequence, interact with histone protein allow condensation

- Chromatin organistion and diameter
  - DNA - ~ 3nm
  - Nucleosome - 11nm
  - Nuclear filament ~30nm
  - Stretched out chromosome ~300nm
  - Mitotic chromosome ~1400nm

Who discovered structure what year

1:1 ratio ___rule

Difference b/w ribose & deoxy

Glycosidic bond between

Phosphodiester bond between

Purine vs pyrimidine

Forces holding DNA

Number of H-bonds for pairs

Three types of DNA

- Environment
- Handedness
- Diameter
- Major Groove (exact data for B)
- Minor Groove
- Bp per turn
- Rise per nucleotide
- Rise per turn
- Central core

DNA packaging

Euchromatin vs heterochromatin

Histone composition, tails

How is chromatin compacted

Diameter of different compositions.