Nucleic acids

Refer to DNA or RNA compose of pentose sugar, nitrogen base & phosphate group.

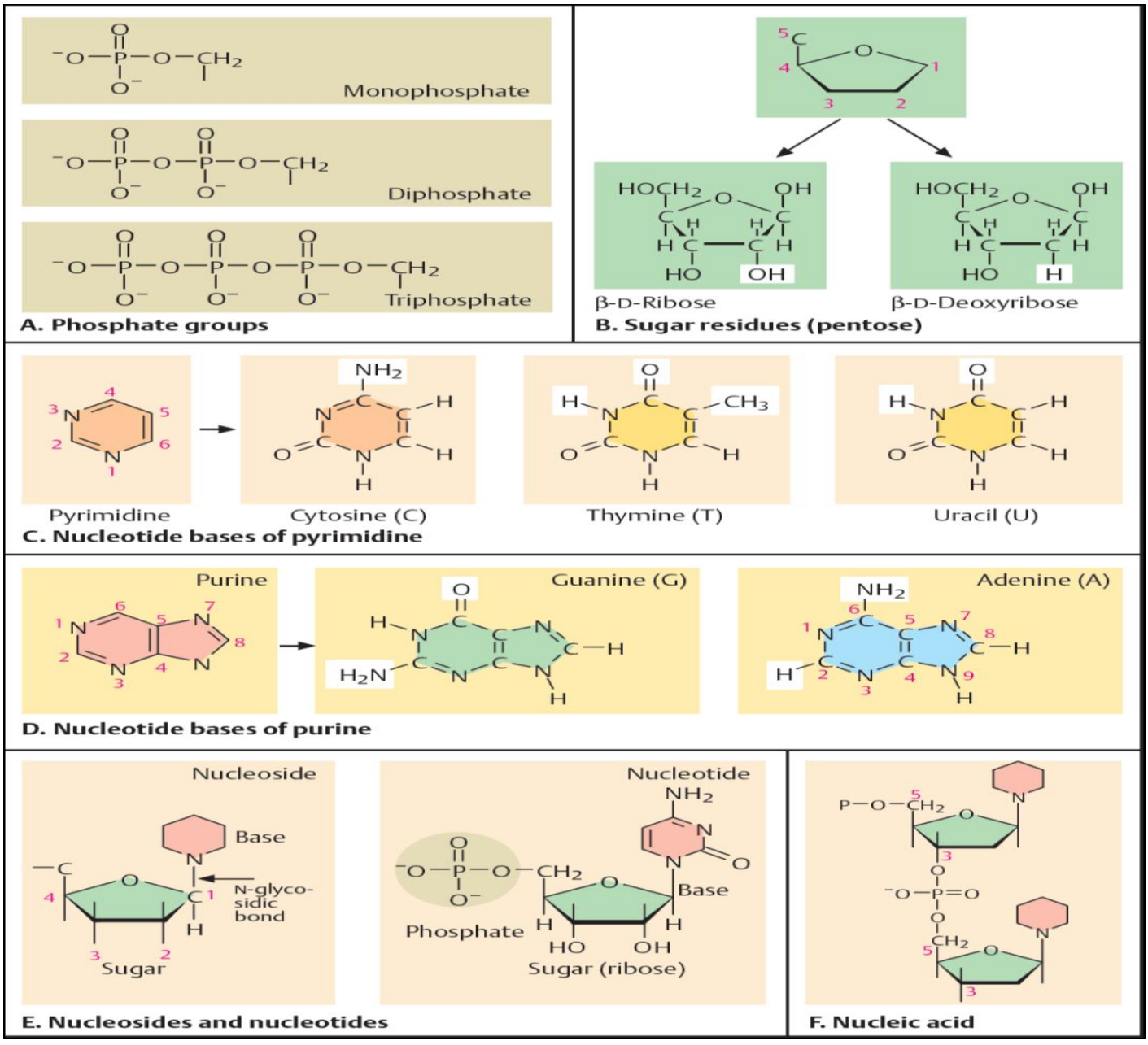
The nitrogen-containing bases in nucleic acid are derivative of pyrimidin or purine

Nucleosides & Nucleotide

Nucleosides = sugar (Ribose or deoxyribose) + nitrogen base

Nucleotide = Nucleosides + phosphate group

Pyrimidin	**Purine**
Cytosine C	Adenine A
Thymine T in DNA only	Guanine G
Uracil U in RNA only	



Double-helix structure of DNA (Watson &Crick's model)

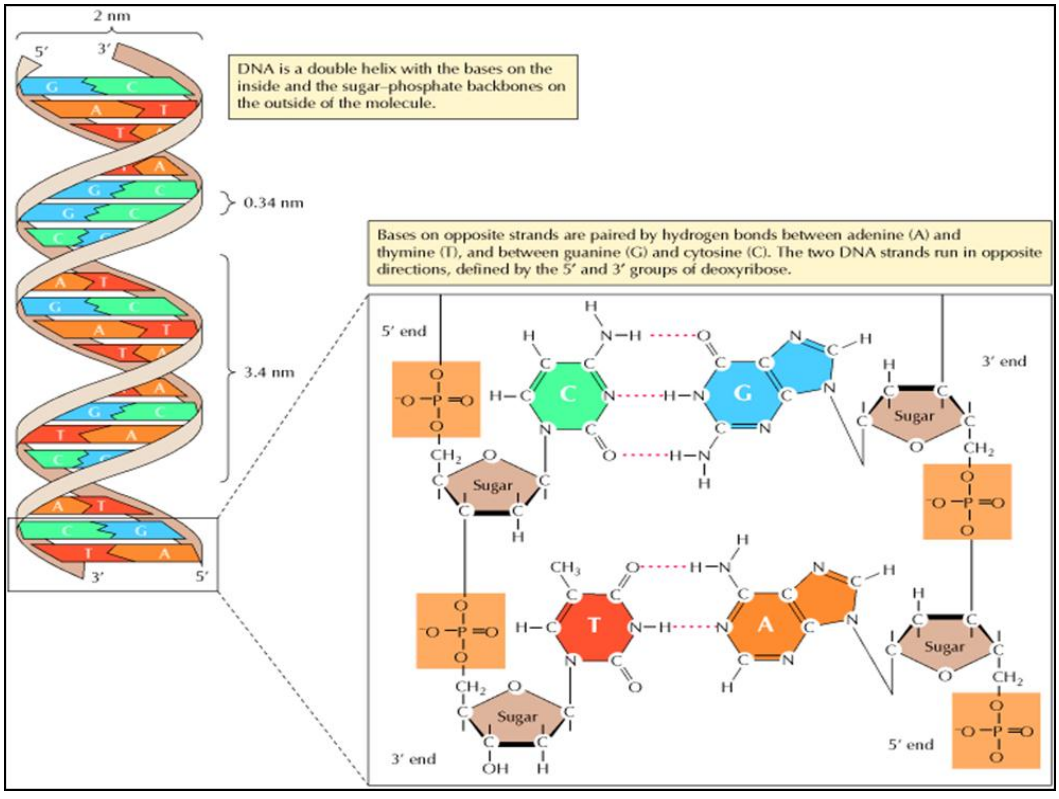
It is exist as aright handed double helix in which the tow polynucleotide chains are coiled about one another in spiral. Each polynucleotide chain consists of:

1. Sequences of nucleotides linked together by phosphodiester bond.
2. The polynucleotide chains held to gather by H-bonds between bases.
3. Bases are stacked between the two chains perpendicular to the axis of the molecule.
4. Base paring is specific (A is always paired with T & G always paired with C) the specific results from H-bonds A=T, G≡C.
5. The two strands of DNA are complementary
6. The base pair in DNA are stacked about 0.34 nm, with 10bp/turn (360^{o}).
7. Sugar phosphate back bone antiparallel
8. The phosphodiester bond in one strands go from 3^{-} (carbon of one nucleotide) to 5^{-} (carbon of adjacent nucleotide)
9. The opposite polarity play important role in DNA replication, transcription & recombination.

The stability of DNA

10. Large no. of H-bonds
12. Hydrophobic bonding (the stacked bases provides hydrophobic core) insolubility in water or aqueous.

DNA has 2 grooves major & minor grooves.



Chromosome Structure

Each chromosome is made up of two longitudinal strands called chromatids. Each chromatid has a double helical DNA molecule.

Properties of Bacterial Chromosome

1. Monoploid (have one set of genes) ; one copy of genome
2. Circular
3. Diameter 1-2 nm
4. Organized in 50 -100 loops each of which is –ve super coil
5. Genome size in bacteria is about $10^6 – 10^7$ bp/cell
6. *E.coli* has 4000 genes ; 4×10^6 ntp/cell

Properties of Eukaryotic Chromosome

1. Most eukaryotes are diploid (having 2 complete sets of genes) one from each parent.
2. Some flowering plants are polyploid, that they carry several copies.
3. Much of DNA in Eukaryotes do not code for proteins or RNA molecules
4. The counter length of human chromosomal DNA is about 15-85 mm
4. Genome size of mammals contain 3×10^9 bp/cell

Anatomy of eukaryotic chromosome

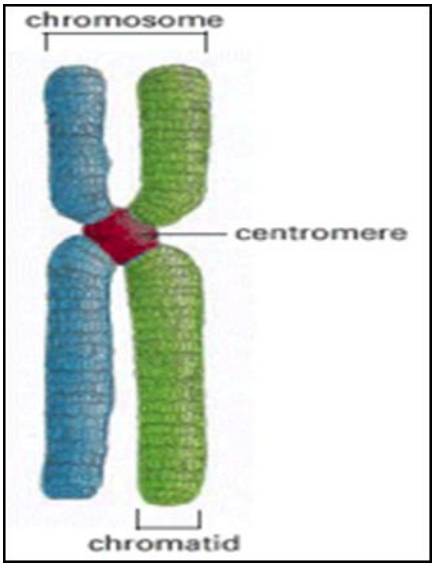
It consist of

1. DNA (double strand of DNA) with diameter 2mm
2. Protein , there are 2 kinds of protein

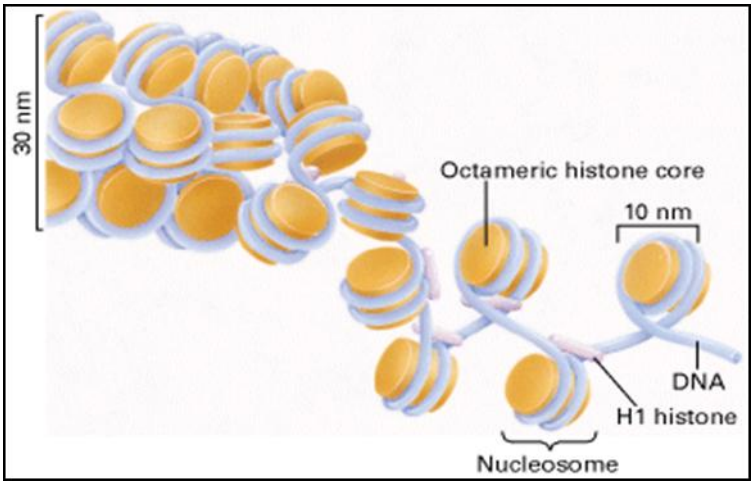
-Basic protein (histone)

-Acidic protein (non histone)

3. Nucleosome: it consist of octamere of histone & DNA
4. Telomere that has a unique sequences contain 500-3000 TTAGGG repeats; so it has G-rich end on 3-oH
5. Centromere: it can recognize as construction region to which the microtubules of spindle attach to it.



Chromosome



Nucleosome

DNA Replication

DNA replication is the process where an entire double-stranded DNA is copied to produce a second, identical DNA double helix. It occurs in the nucleus. DNA is replicated by a process called semiconservative replication. This means one-half of each new molecule of DNA is old (template strand) one-half of new molecules of DNA are new (complementary strand).

1-DNA Rep. begins at Ori. C when helicase, unwinds a segment of the DNA and breaks the hydrogen bonds between the two complementary strand of DNA. SSBP react with single – stranded region of the DNA and stabilize it.

2-DNA polymerase can only add new nt to free 3` OH end of growing chain. Synthesis of one strand of DNA, called the leading strand, proceeds continuously in the 5` to 3` direction.

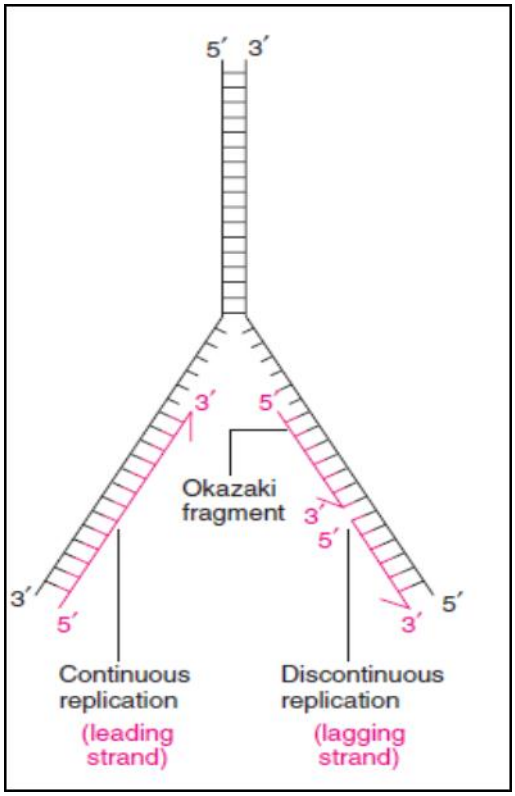
3-Synthesis of complementary strand, called the lagging, is more complex. DNA polymerase can add new deoxyribonucleotides only to a free 3`OH .

4-To provide free 3` OH starting point on the lagging strand , RNA polymerase attaches to the DNA and synthesized a short RNA primer . DNA polymerase III then adds new deoxyribonucleotides to the 3`end of RNA primer. (Okazaki fragments).

5-DNA polymerase I replace DNA polymerase III, remove the RNA and replace it with DNA.

6-Finally the enzyme DNA ligase form phosphodiester bonds between the 3` OH of the growing strand and 5` phosphate in front of it.

7-During DNA Rep., the leading strand is synthesized continuously while the lagging strand is synthesized discontinuously.



DNA Replication