

Fig. 19.6. A polynucleotide chain.

Watson and Crick's Model of DNA

WATSON and CRICK suggested that in a DNA molecule there are two such polynucleotide chains arranged antiparallel or in opposite directions i.e. one polynucleotide chain runs in 5'-3' direction, the other in

JAMES WATSON and FRANCIS CRICK



Watson and Crick deduced the double helical structure of DNA and shared the Nobel Prize in 1962 with Maurice Wilkins. Watson, at present, is Director of the Laboratory of Molecular Biology at Cambridge. He has worked on RNA synthesis, protein synthesis and the role of viruses in cancer.

3'-5' direction. It means the 3' end of one chain lies beside the 5' end of other. In such a structure the phosphate groups of nucleotides in each the nitrogenous bases are directed inward. The nitrogenous bases of the two chains are linked through hydrogen bonds formed between oxygen and nitrogen atoms of the adjacent bases. The unique feature of pairing between bases is :-

1. Purine (adenine and guanine) pairs with pyrimidine (cytosine and thymine), and
2. Adenine pairs with thymine and cytosine pairs with guanine.

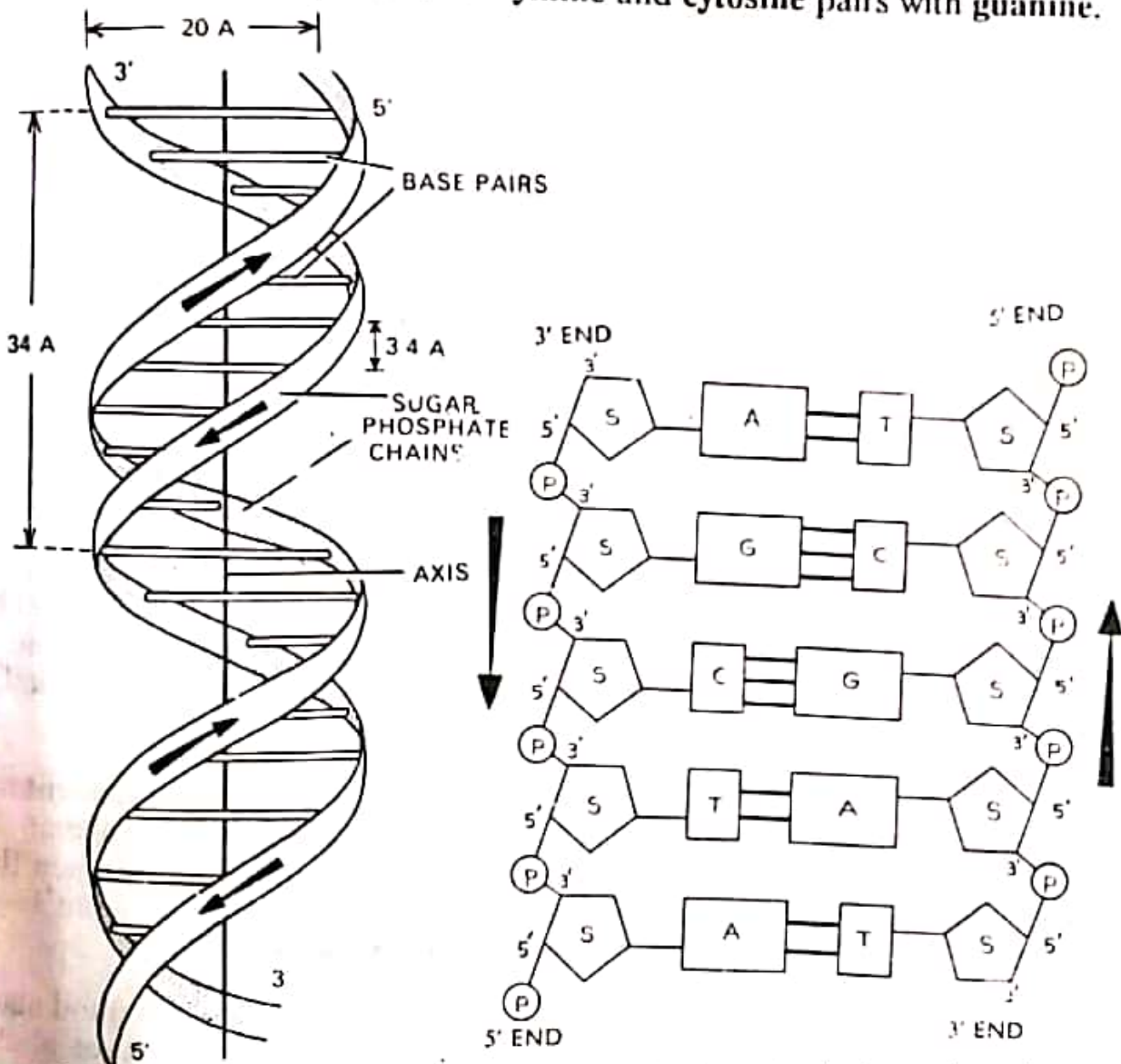


Fig. 19.7. Double helical structure of a part of DNA molecule. On left are shown two polynucleotide chain of DNA twisted spirally in a helical fashion. On the right are shown four nucleotides of a strand linked through deoxyribose and phosphoric acid molecules to form polynucleotide chain.

There are definite reasons for such a specific pairing-(1) Such pairing forms a perfect match between hydrogen donor and hydrogen acceptor sites on the two molecules. Adenine and thymine share two hydrogen atoms, whereas cytosine and guanine are joined by three hydrogen bonds. (2) Such a pairing is further supported by the occurrence

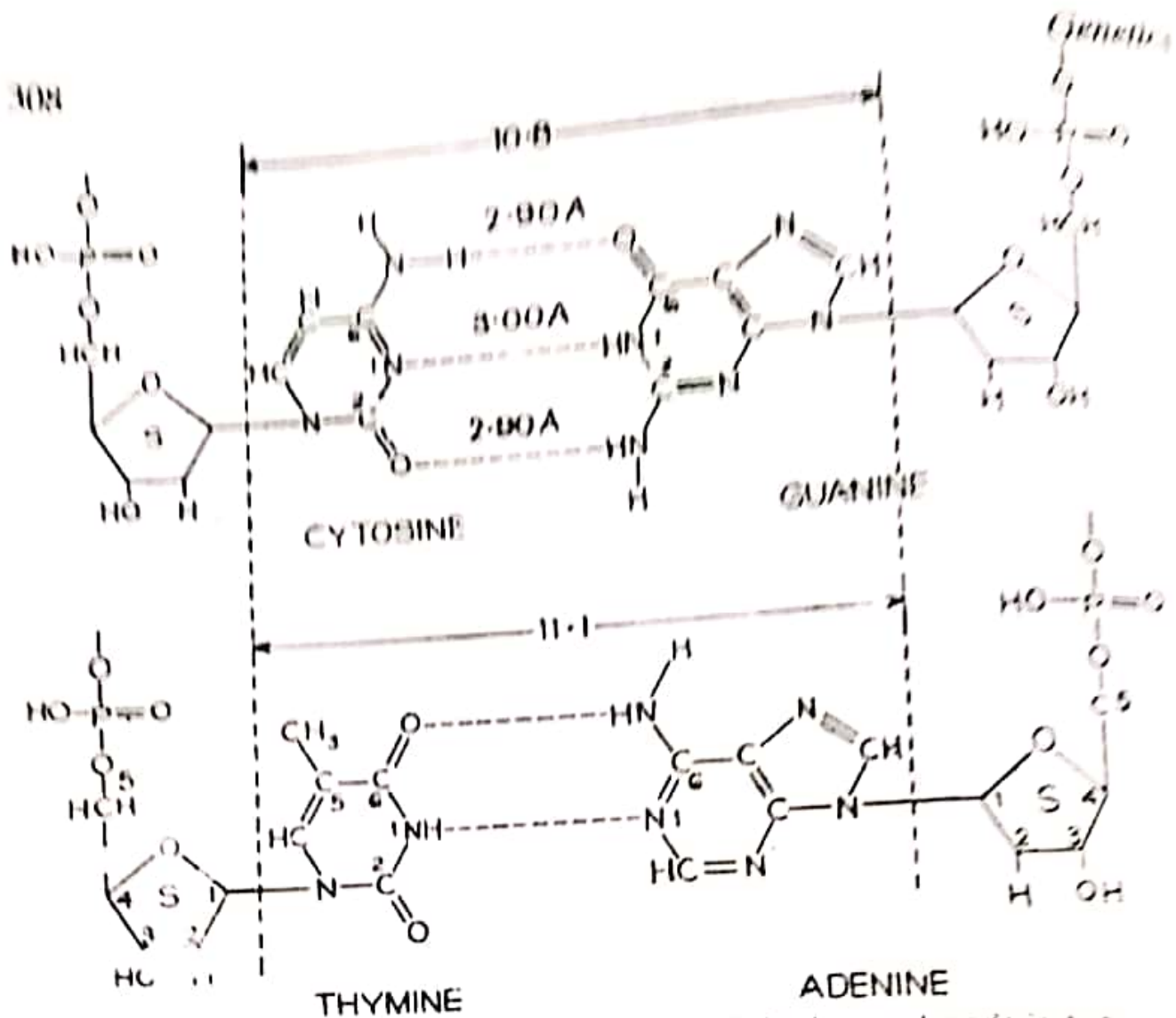


Fig. 19.8. Association of base pairs through hydrogen bonds in two nucleotides of DNA.

of constant diameter of DNA. In a limited area a two-ringed molecule (purine) joins a single-ringed molecule maintaining a constant and roughly equal distance. The distance between the different bonds are indicated in the Fig. 19.8. A and G pair will be rather too large to fit inside the helix and C and T would appear to be far apart.

Due to this type of base pairing the two strands are complementary to each other. It means if a chain has a region with a sequence of nitrogenous bases, **thymine-cytosine-adenine-cytosine-guanine**, then the corresponding region in the complementary chain will have the base sequence **adenine-guanine-thymine-guanine-cytosine**.

DNA consists of two complementary chains twisted around each other forming a **right handed helix**. One turn of helix measures about 3.4 Å. It contains 10 paired nucleotides placed at regular intervals of 3.4 Å. The diameter of the helix is roughly 20 Å. A narrow helical groove and a wide helical groove run along the length of DNA helix. The narrow groove is the distance between the paired molecules while the wide groove is the space between successive turns when the pair is wound into a helix.