Chapter 5
DNA and Chromosome

S-strain cells
fractionation of cell-free extract into classes of molecules
RNA protein DNA lipid carbohydrate
molecules tested for transformation of R-strain cells

CONCLUSION: The molecule that carries the heritable information is DNA.
A DNA Molecule Consists of Two Complementary Chains of Nucleotides

A DNA molecule consists of two long polynucleotide chains known as DNA chains or DNA strands. Each of these chains is composed of four types of nucleotide subunits, and the two chains are held together by hydrogen bond between the base portions of the nucleotides.

A nucleotide contains a five-carbon sugar attached to one or more phosphate groups and a nitrogen-containing base (in the case of DNA base can adenine, guanine, cytosine, and thymine). The nucleotides are covalently linked together in a chain through the sugars and phosphates, which thus form a “backbone” of alternating sugar-phosphate-phosphate. The way in which the nucleotides subunits are linked together gives a DNA strand a chemical polarity. This polarity in a DNA is indicated by referring to one end as the 3’end and the other as the 5’end.

The two polynucleotides chains in DNA double helix are held together by hydrogen-bonding between the bases on the different strands. The bases do not pair random, however: A always pair with T, and G with C.
The Structure of DNA Provides a Mechanism for Heredity

Genes carry biological information that must be copied and transmitted accurately when a cell divides to form daughter cells. DNA encodes information in the order or sequence of the nucleotides along each strand. Each base can be considered as a letter of alphabet that is used to spell out biological massages in the chemical structure of DNA. Genes contain the instructions for producing proteins. The DNA massages, therefore, must somehow encodes proteins.

Eucaryotic DNA Is Packaged into Chromosome

In eucaryotes, the DNA in the nucleus is distributed among set of different chromosomes. The human genome, for example, contains approximately $3.2 \times 10^9$ distributed over 24 chromosomes. Each chromosome consists of a single, enormously long, linear DNA molecules associated with proteins that fold and pack the fine thread of DNA into a more compact structure. The complex of DNA and Protein is called CHROMATIN.

With the exception of germ cells (egg and sperm) and highly specialized cells lack DNA entirely (such as red blood cell), and human cell cells contain two copies of each chromosome, one inherited from the mother and one inherited from the father; the maternal and paternal chromosome of a pair are called homologue chromosomes.
Chromosomes Contain Long Strings of Genes

The most important function of chromosome is to carry out genes. A gene usually defined as a segment of DNA that contains the instructions for making particular protein. As one might expect, a correlation exists between the complexity of an organism and the number of genes in its genome.

A simple bacterium has 500 genes
Human have 30,000 genes
Chromosomes Exist in Different States Throughout the Life of a cell

To form a functional chromosome, a DNA molecule must do more than simply carry genes: it must be able to replicate, and the replicated copies must be separated and partitioned reliably into daughter cells at each cell division. These processes occur through an ordered series of stages, known collectively as the cell cycle.

Specialized DNA sequences found in all eukaryotes ensure that the interphase chromosome replicate efficiently. One type of nucleotide sequence acts as a replication origin. It is the location where replication begins. Another DBA sequences forms the telomeres found at each of the two ends of chromosome. The third a specialied DNA sequence, the centromere, that allows one copy of each duplicated chromosome to be apportioned to each daughter cell.
Chromosomes Are Organized Within the Nucleus

The DNA in Chromosomes Is Highly Condensed

Nucleosomes Are the Basic Units of Chromatin Structure

The proteins that bind to the DNA to form eukaryotic chromosomes are traditionally divided into two general classes: The histones and nonhistones chromosomal proteins. The complex of both classes of protein with nuclear DNA is called CHROMATIN.
Interphase Chromosomes Contain Both Condensed and More Extended Forms of Chromatin

The most highly condensed form of interphase chromatin is called heterochromatin. Most DNA that is fold into heterochromatin does not contain genes.

The rest of interphase chromatin is called euchromatin.