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One of the finest triumphs of modern science has been the elucidation of the chemical nature of chromatin and its role in the transfer of information from nucleic acids into proteins. This work, which outlined the fundamental unit and chemical composition of the complex molecule composing chromatin—deoxyribonucleic acid (DNA)—briefly stated the central dogma “overlives” the mechanism whereby the chemical message held in DNA is transferred to ribonucleic acid (RNA) through transcription and this RNA blueprint is translated into protein. DNA → RNA → protein. Other proteins associated with DNA contribute to its structure and many play roles in regulating functions. In its simplest form, chromatin is composed of DNA and histone proteins.

Histones are small, highly conserved, positively charged proteins that bind to DNA and to other histones. The five major histones are H1, H2A, H2B, H3, and H4. The presence of 20% to 30% lysine and arginine accounts for the positive charge of histones and distinguishes them from most other proteins. All histones except H1 are highly conserved among eukaryotes.

DNA is packaged into the nucleus by winding the double helix twice around an octamer of histones; this DNA-histone complex is called a nucleosome (Fig. 1-1). Each nucleosome is composed of two of each histone except H1 and

A DNA molecule comprises two long chains of nucleotides joined by phosphodiester bonds in the form of a double helix. The two parallel sugar-phosphate backbones are held together by specific hydrogen bonds. Hydrogen bonds are weak bonds, however, the total number—4 hydrogen bonds between the two strands—ensures that the strands of the double helix are firmly associated with each other under conditions commonly found in living cells.

DNA Configuration

There are three basic three-dimensional configurations of DNA. The most common is the B form in which DNA is a right-handed helix with a 3.4-nm pitch (one full turn) and a 2.0-nm width. Within the turned structure are a major groove and a minor groove where proteins can bind. The A form also has a right-handed turn and is composed of 11 bp (base pairs) per turn. The Z form is a left-handed helix with a 3.6-nm pitch and a 1.8-nm width. The Z form is a left-handed helix with a 3.6-nm pitch and a 1.8-nm width. The Z form is a left-handed helix with a 3.6-nm pitch and a 1.8-nm width.

The molar concentration of adenine equals thymine and that of guanine equals cytosine. This information is best accommodated in a stable structure if the double-ring purines (adenine or guanine) lie opposite the smaller, single-ring pyrimidines (thymine or cytosine). The combination of one purine and one pyrimidine to make up each cross-connection