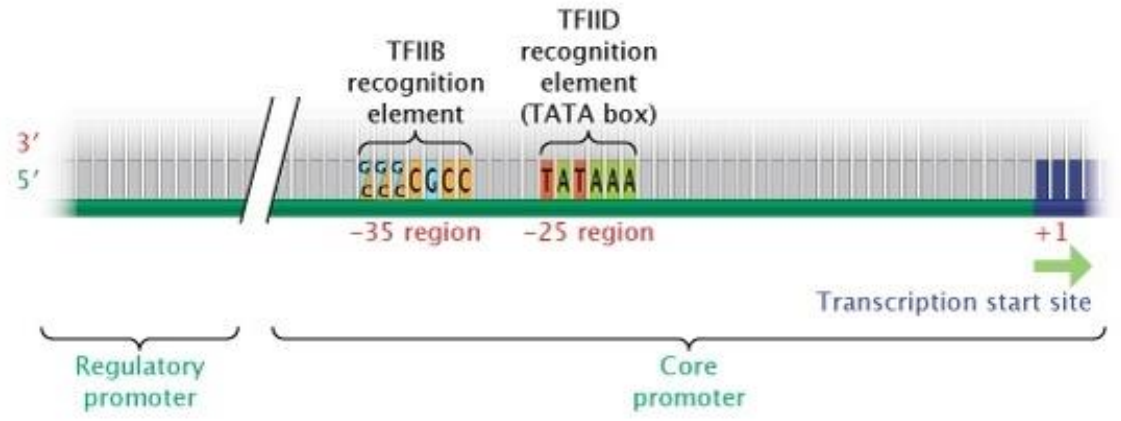

Figure 4: Eukaryotic core promoter region.

In eukaryotes, genes transcribed into RNA transcripts by the enzyme RNA polymerase II are controlled by a core promoter. A core promoter consists of a transcription start site, a TATA box (at the -25 region), and a TFIIB recognition element (at the -35 region).

The terms "strong" and "weak" are often used to describe promoters and enhancers, according to their effects on transcription rates and thereby on gene expression. Alteration of promoter strength can have deleterious effects upon a cell, often resulting in disease. For example, some tumor-promoting viruses transform healthy cells by inserting strong promoters in the vicinity of growth-stimulating genes, while translocations in some cancer cells place genes that should be "turned off" in the proximity of strong promoters or enhancers.

Enhancer sequences do what their name suggests: They act to enhance the rate at which genes are transcribed, and their effects can be quite powerful. Enhancers can be thousands of nucleotides away from the promoters with which they interact, but they are brought into proximity by the looping of DNA. This looping is the result of interactions between the proteins bound to the enhancer and those bound to the promoter. The proteins that facilitate this looping are called activators, while those that inhibit it are called repressors.

Transcription of eukaryotic genes by polymerases I and III is initiated in a similar manner, but the promoter sequences and transcriptional activator proteins vary.

Strand Elongation

Once transcription is initiated, the DNA double helix unwinds and RNA polymerase reads the template strand, adding nucleotides to the 3′ end of the growing chain (Figure 2b). At a temperature of 37 degrees Celsius, new nucleotides are added at an estimated rate of about 42-54 nucleotides per second in bacteria (Dennis & Bremer, 1974), while eukaryotes proceed at a much slower pace of approximately 22-25 nucleotides per second (Izban & Luse, 1992).