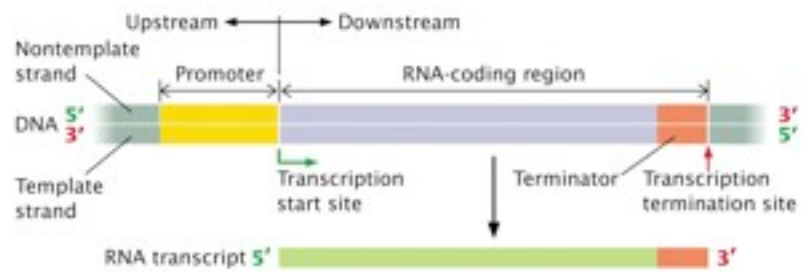
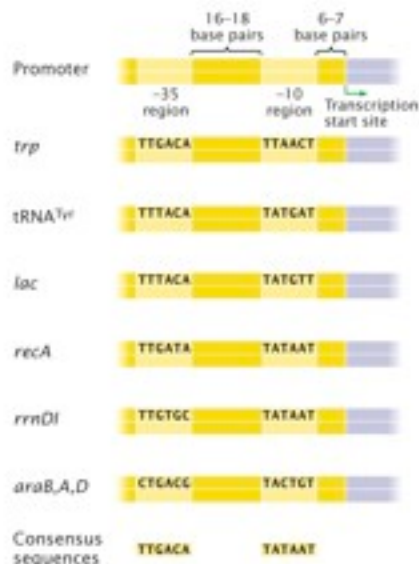
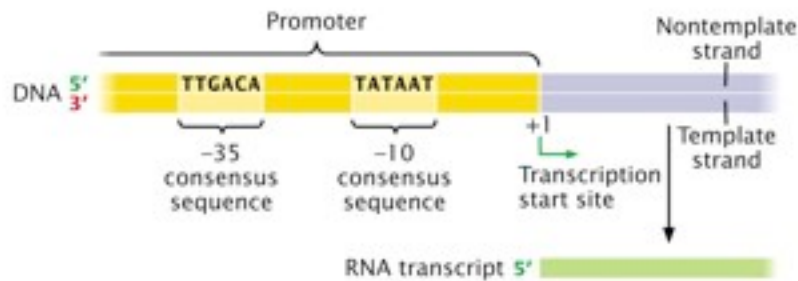


Transcription: II

Starting and stopping in prokaryotes:
Promoters and terminators

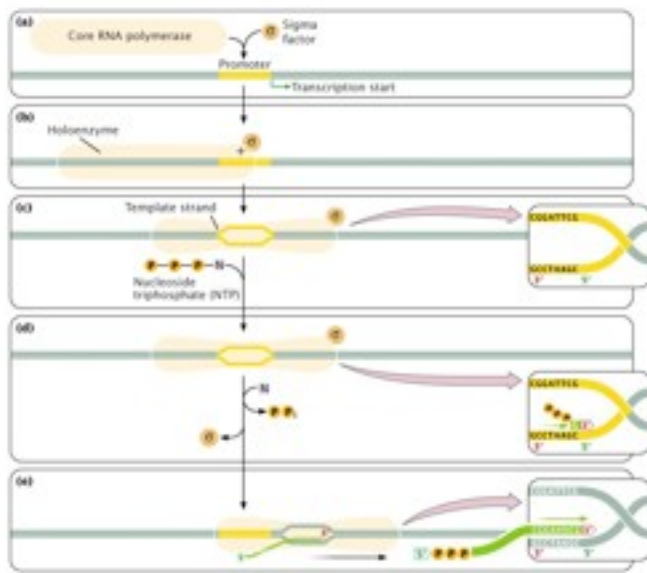


When the strong binding of RNA polymerase holoenzyme was examined, it was found that it tended to be associated with specific DNA sequences, which were termed promoters. Most bacterial genes have two such sites.



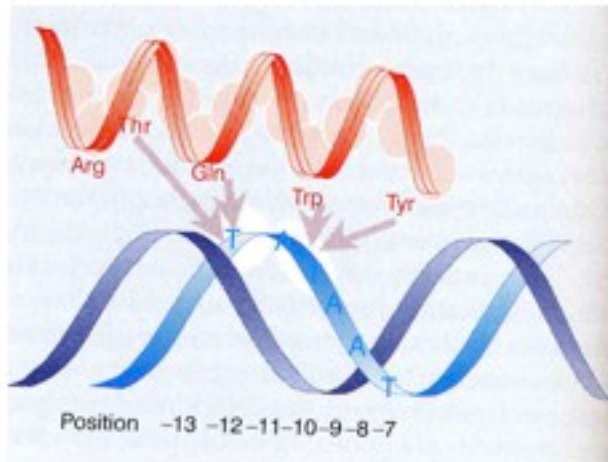
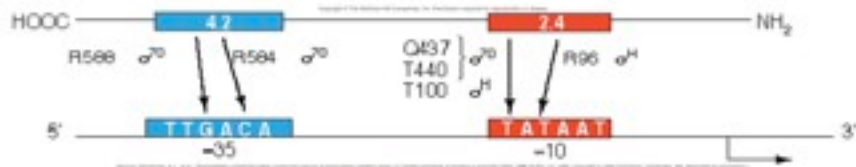
In theory the consensus sequence might never be found: it is purely a statistical concept. In reality it is usually also the most common sequence

Another way of describing it is T₈₀A₉₅T₄₅A₆₀A₅₀T₉₆

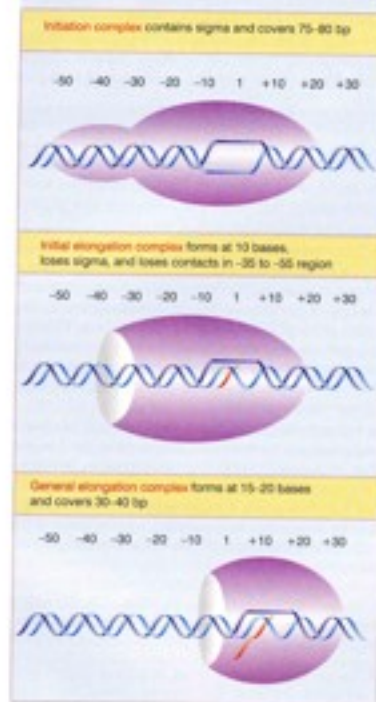


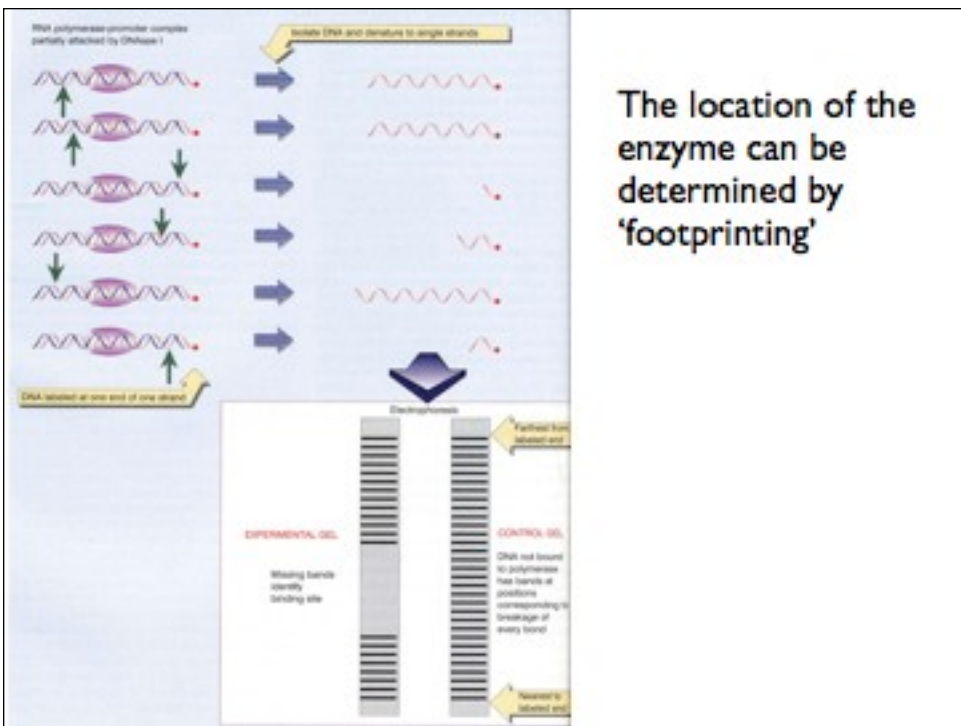
Recognition of the promoter requires sigma. Each sigma tends to recognize a specific promoter sequence

Use	-35 Sequence	Separation
general	TTGACA	16–18 bp
heat shock	CCCTTGAA	13–15 bp
heat shock	not known	not known
nitrogen	CTGGNA	6 bp
flagellar	CTAAA	15 bp

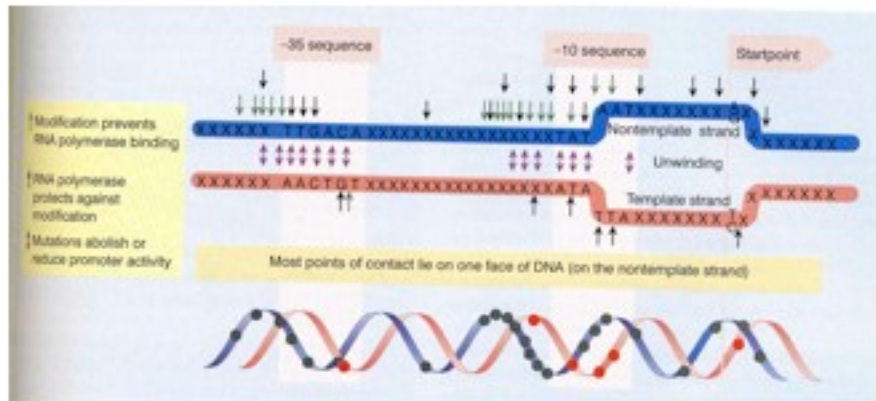


Initiation occurs once the melting at the promoter takes place. At this time the polymerase is in an 'elongated' form. As it starts the initiation process and then elongation, it becomes more compact



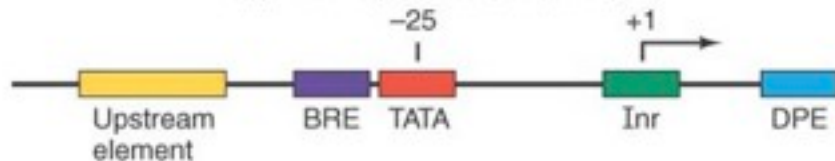


Most of the binding is to the non-template strand.



Eukaryotic promoters

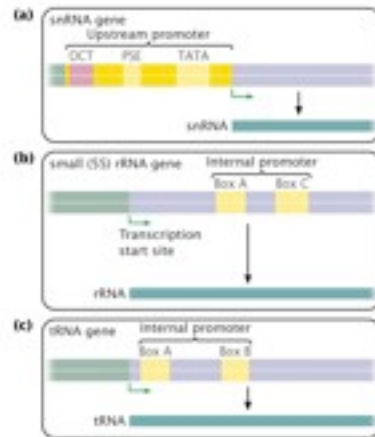
These tend to be more complex and variable since each polymerase typically uses a different type of promoter. Those used by pol II are termed 'class II' promoters



The TATA box is similar to the -10 box in prokaryotes. It is the most common element, but may be absent in many housekeeping genes. The BRE (TFIIB recognition element), Upstream and downstream elements and the initiator region likewise may occasionally be missing. The role of the TATA region varies. In some genes it is essential for transcription, in other sites function is to position the polymerase at the correct start site. The up and downstream promoters are often important in enhancing the polymerase binding, but may not be essential

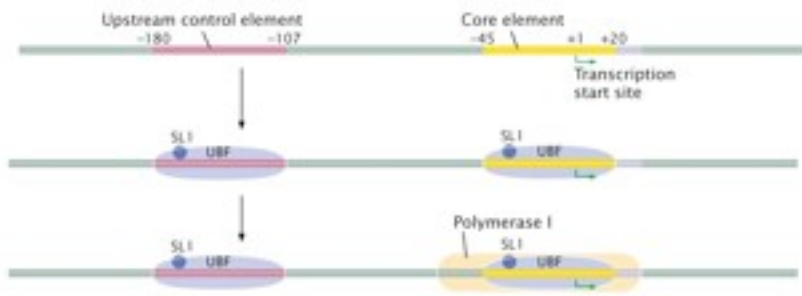
Type I and III promoters

These are associated with genes coding for ribosomal RNA, tRNA and small RNAs. In most cases the promoters are internal, though some have Type II elements as well

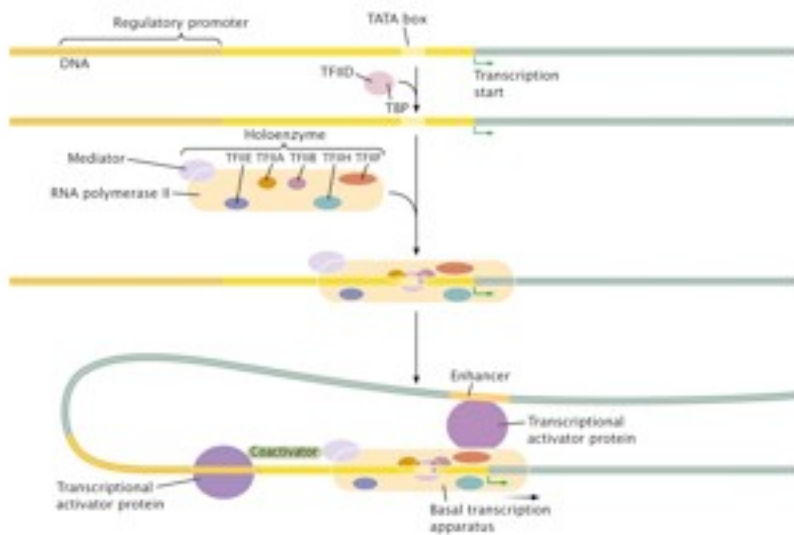


Enhancers and silencers

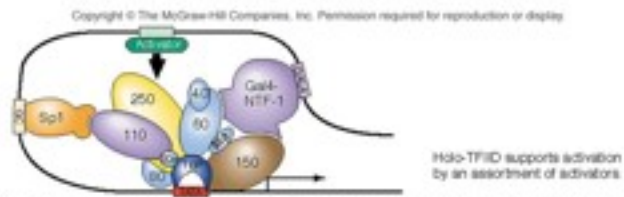
Many promoter sites also contain or interact with 'enhancers' and 'silencers'. These are sequences that increase or decrease the polymerase binding and activity. In some cases these may be hundreds of bases away from the actual gene. Their action may be tissue specific and gene specific: in some cases the same element may act as an enhancer in some cases and a silencer in others



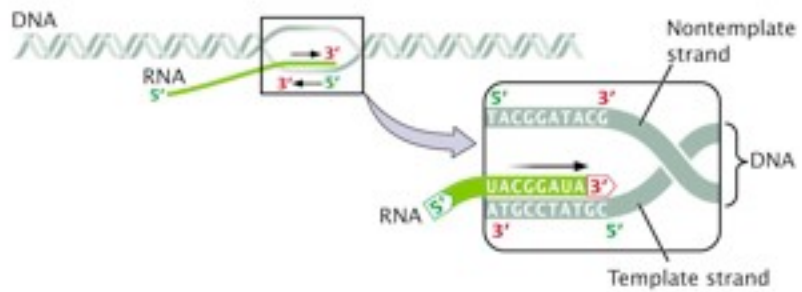
Overall, the binding and initiation of eukaryotic polymerase may involve well over a dozen components



In some cases, the entire complex may involve multiple distant sites

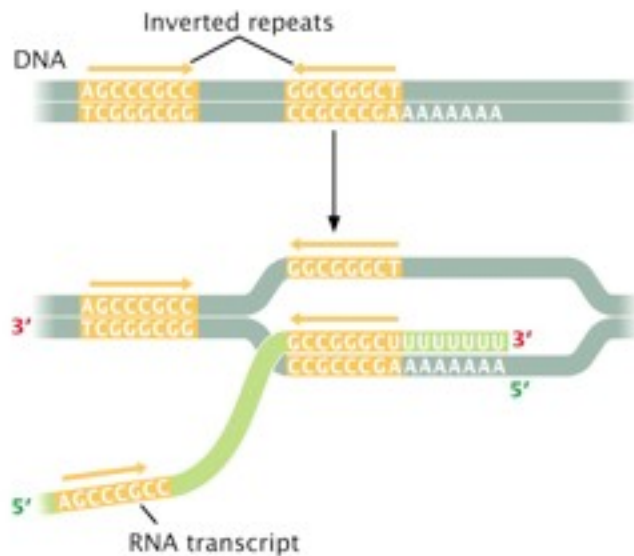


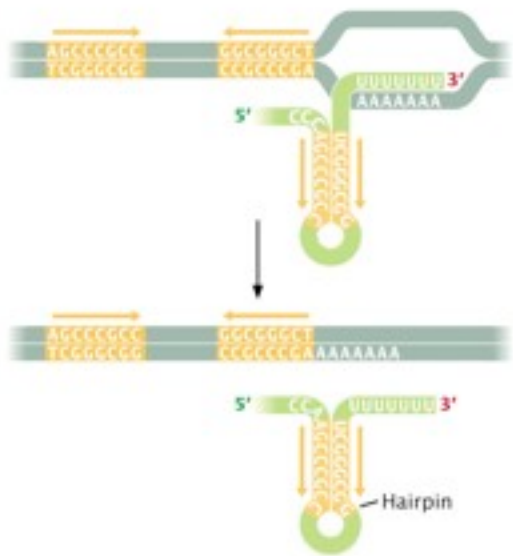
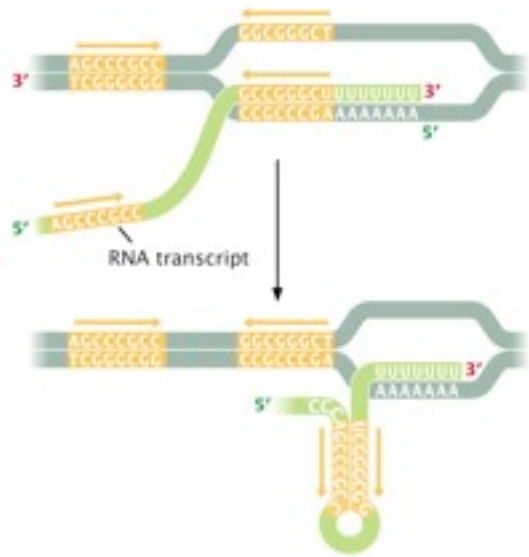
Once initiation is achieved, the polymerase can move along the DNA, synthesizing a complementary RNA strand

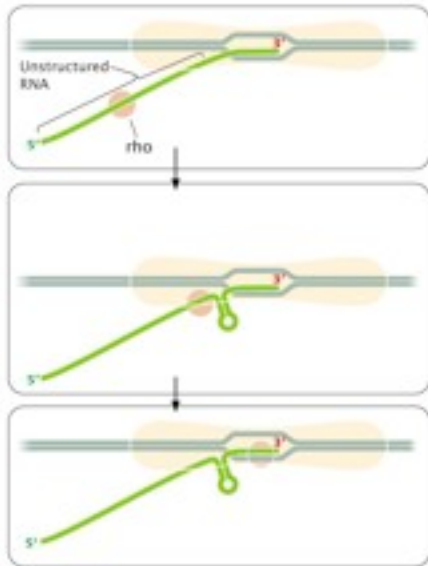


Ending transcription

Transcription ends when the polymerase reaches a terminator. In prokaryotes there are two major classes of terminators. One is directly the result of the specific base sequence, the other depends on the presence of a protein called rho







rho only catches up when the hairpin loop slows the polymerase. rho acts as a helicase, unwinding the RNA from the DNA and causing the entire complex to disassemble.

Termination in eukaryotes is more variable. Many class II genes do have a rho-like protein, but it is attached to the termination sequence of the DNA.

There are several other significant differences between transcription in prokaryotes and eukaryotes

Linked transcription/ translation is possible in prokaryotes, but not eukaryotes.

Eukaryotic RNAs usually require additional modification before they can be used