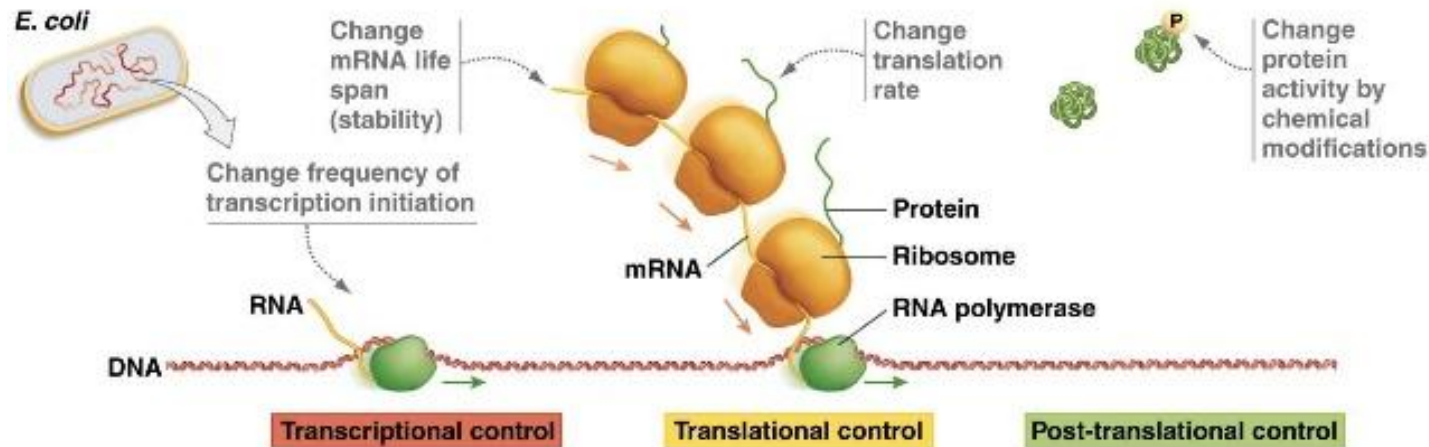


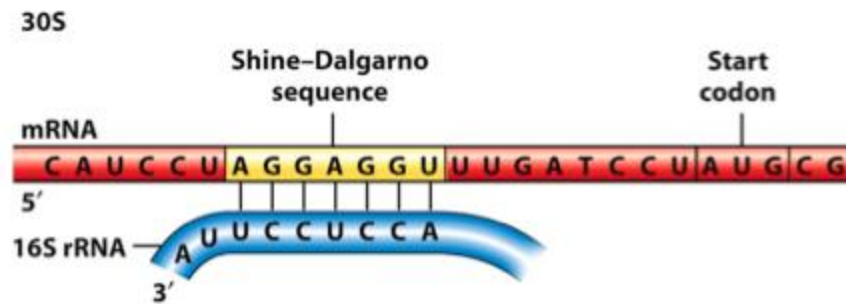
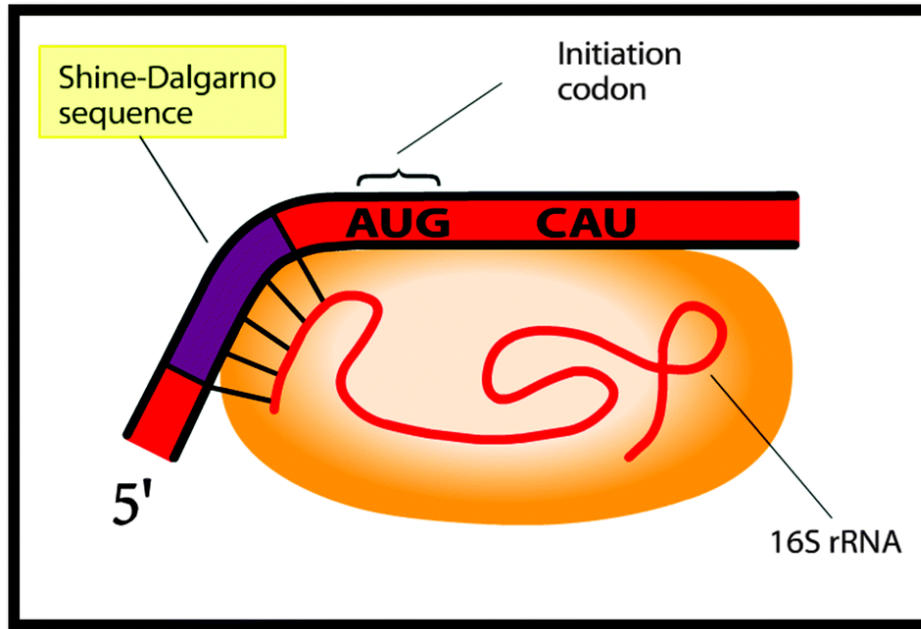
Regulation of Gene Expression



- Gene expression can be regulated:
 - During transcription (transcriptional control).
 - During translation (translational control).
 - After translation (post-translational control).

Translational control in prokaryotes

- In prokaryotes translation begins with binding of ribosome to a specific sequence in the messenger RNA - Shine-Dalgarno (SD) Sequence. SD is a ribosomal binding site generally located around 8 bases upstream of the start codon AUG. The six-base consensus sequence is AGGAGG. It is complementary to a specific region of 16S ribosomal RNA.

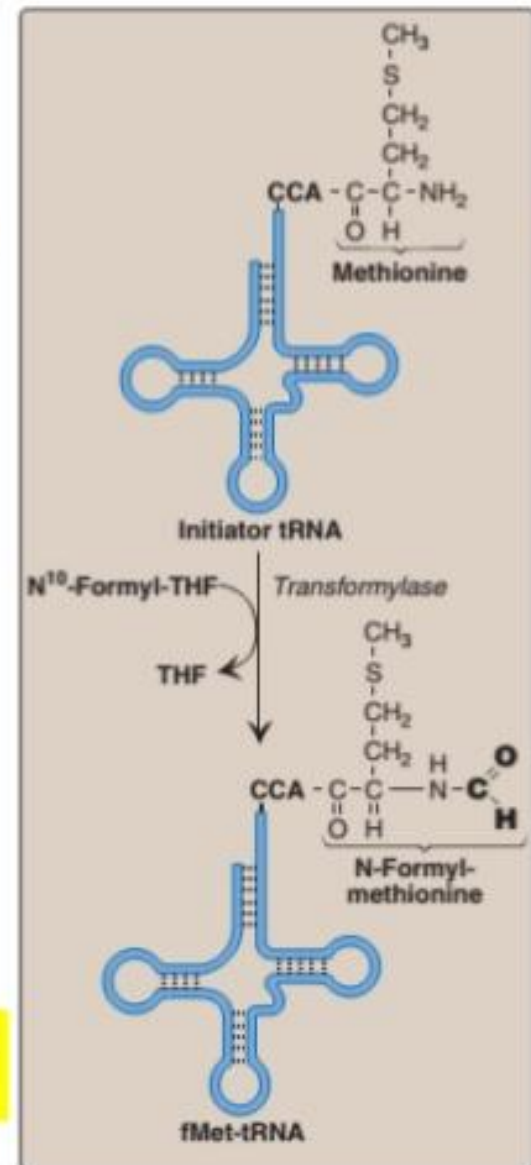


Initiation codon

25

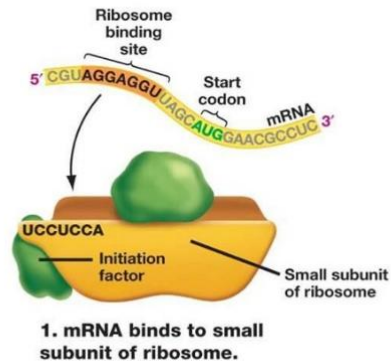
- Initiating “AUG” is recognized by special initiator tRNA.
- Recognition is facilitated by **IF-2 (bound to GTP) in Prokaryotes** and **eIF2-GTP in Eukaryotes**.
- The AA charged initiator tRNA enters the ribosomal P site, and GTP is hydrolysed to GDP.

NOTE: The initiator tRNA is the only tRNA recognized by eIF-2 and the only tRNA to go directly to the P site.



Translation initiation in bacteria

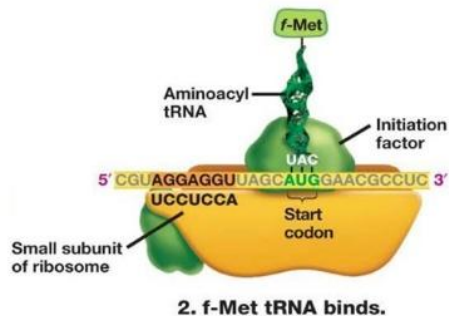
Shine-Dalgarno sequence



Translation initiation in bacteria

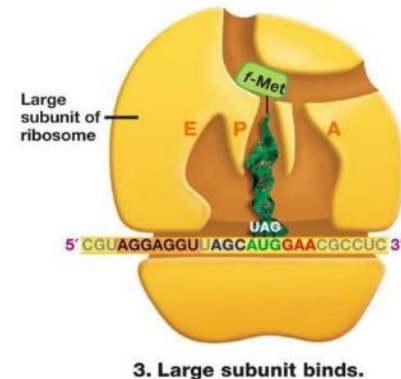
Initiator tRNA in bacteria

1. The initiator tRNA (fMet-tRNA) gets carried to the complex (30S ribosome + IF1 + IF3) by initiation factor IF2 using GTP.



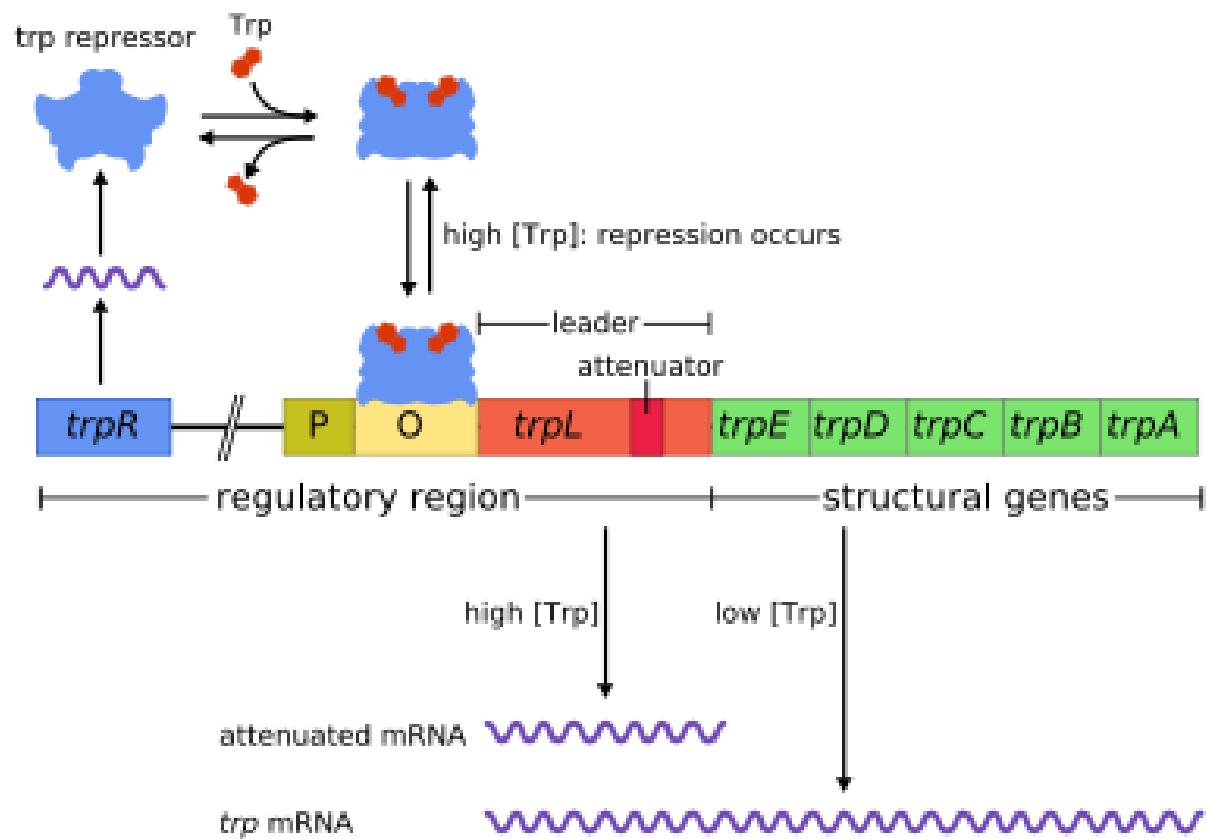
Translation initiation in bacteria

- The initiation factors (IF1 and IF3) gets released and the resulting complex is called **the initiation complex**.



Attenuation of trp operon

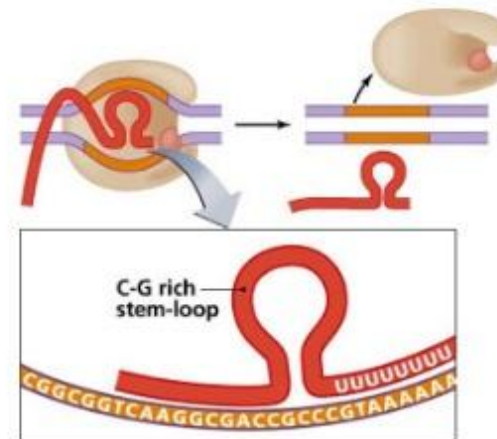
- Attenuation is a second mechanism of negative feedback in the trp operon. The repression system targets the intracellular trp concentration whereas the attenuation responds to the concentration of charged tRNA^{trp}
- Attenuation is made possible by the fact that in prokaryotes (which have no nucleus), the ribosomes begin translating the mRNA while RNA polymerase is still transcribing the DNA sequence. This allows the process of translation to affect transcription of the operon directly.



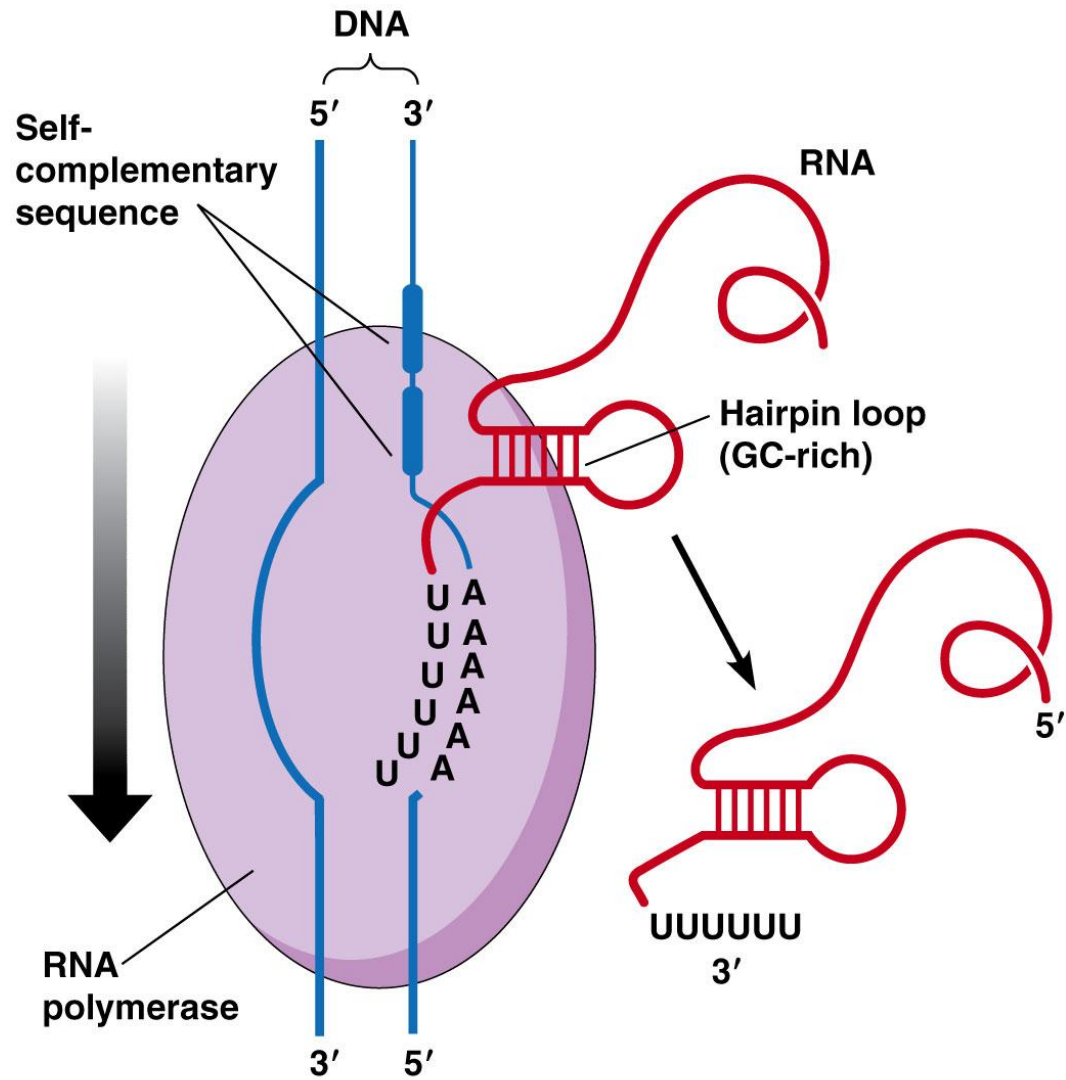
Bacterial transcription termination

Termination (Rho-independent terminator) - type 1 terminator

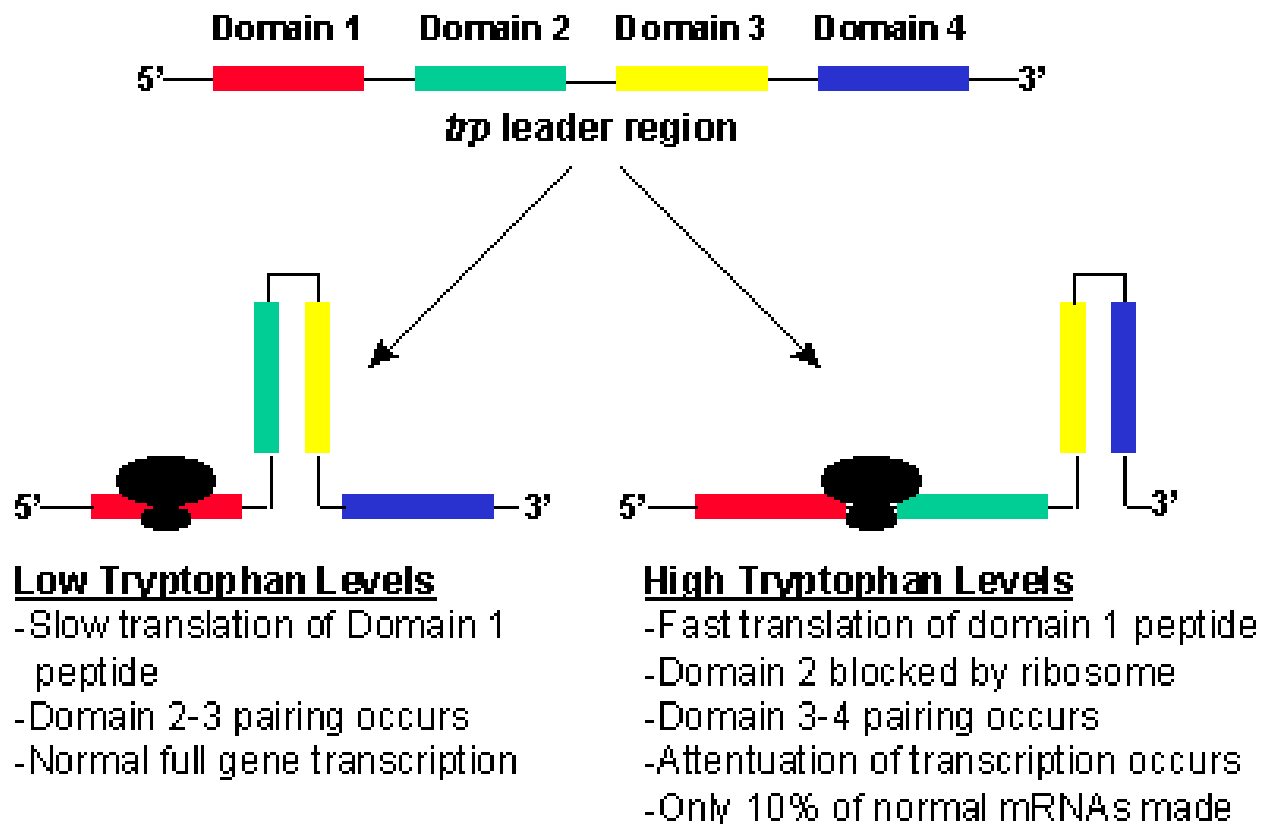
- RNA moves past the inverted repeats and transcribes the termination sequence.
- Because of the inverted repeat arrangement → RNA synthesized forms a hairpin loop structure.
- Hairpin loop makes the RNA polymerase slow down and eventually stops.



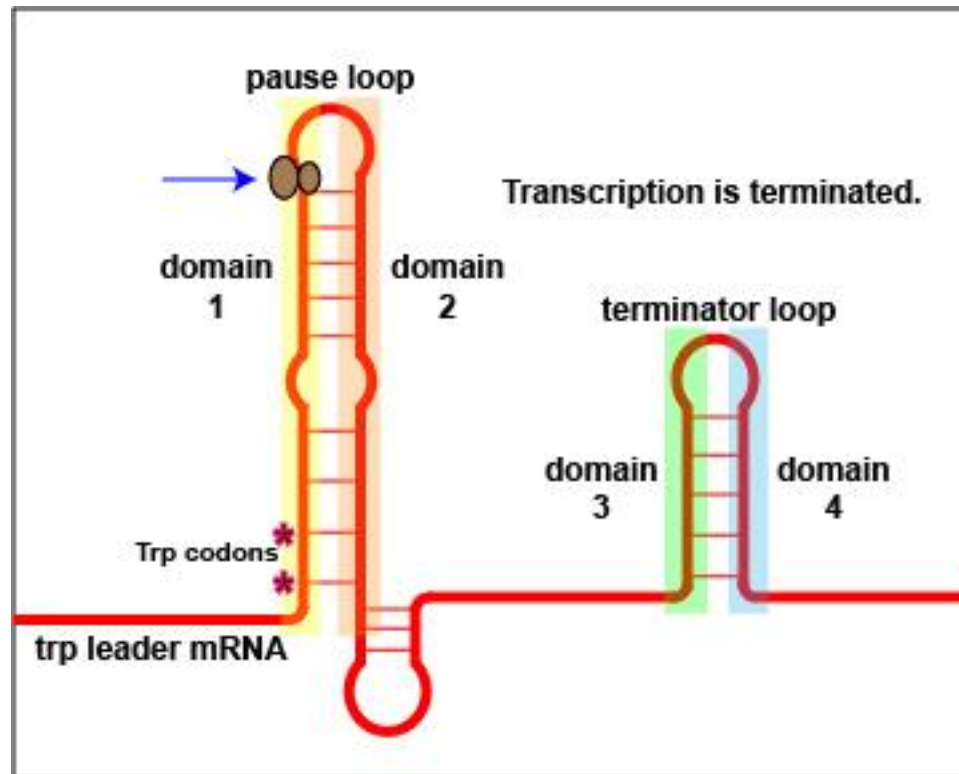
(c) Termination of transcription



Attenuation of the *trp* operon mRNA



Attenuation, tryptophan present



Attenuation, no tryptophan

