

Aim: How is DNA transcribed?





What is transcription?

- Transcription – DNA code is converted to RNA
- Actual transcription and subsequent translation of DNA depends on:
 - Cell environment
 - Cell activity (digestion, replication, growth)
 - Cell specialty (red blood cells constantly produce hemoglobin; skin cells do not)



What are the different types of RNA?

- 1) messenger RNA (mRNA) carries genetic information (protein code) to the ribosome.
- 2) transfer RNA (tRNA) brings amino acids to the ribosome for assembly into polypeptides.
- 3) ribosomal RNA (rRNA) forms part of the ribosome.



What is required for transcription to occur?

- Transcription is mediated by a six protein complex called RNA polymerase.
- RNA polymerase:
 - 1) binds to DNA, opens helix
 - 2) transcription is in a 3' to 5' direction along the DNA template, synthesizing an RNA complement in the 5' to 3' direction.




What is required for transcription to occur? (2)

- Prokaryotes have only one type of RNA polymerase.
- Eukaryotes have 3 types:
 - RNA polymerase I synthesizes rRNA.
 - RNA polymerase II synthesizes mRNA.
 - RNA polymerase III synthesizes rRNA and tRNA.
- Unlike DNA polymerase, RNA polymerase does not need a primer. But RNA polymerase cannot correct errors.



How does transcription take place in prokaryotes?

- Transcription in *E. coli* bacteria:
- The RNA polymerase searches for a ‘promoter site’ and loosely binds to it.
- There are over 100 variations of the ‘promoter site’. Some variations bind RNA polymerase better than others.

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- 3'...AACTGT...ATATAA...GTA.....gene.....5''
 - promoter₁ promoter₂ start
 - There are 17 nitrogen bases between promoter₁ and promoter₂. There are 7 nitrogen base units between promoter₂ and the start signal.



How does transcription take place in prokaryotes?

■ Initiation:

- 1) RNA polymerase binds to the promoters.
- 2) The 'start' signal is 7 base units 'downstream' from the promoter. Usually a GTA triplet.

■ Elongation:

- 3) RNA polymerase moves along the DNA in a 3' to 5' direction adding complimentary RNA nucleotides. The RNA chain formed is mRNA.



How does transcription take place in prokaryotes?

- Termination:
- 4) Transcription continues until a termination signal is reached on DNA.
- 5) Messenger RNA has a ‘self-complimentary sequence’ which binds to each other forming a hairpin loop followed by a poly-uracil chain. The hairpin loop forms a double helix which ‘pulls’ the RNA off the DNA template.
- 3’...TACGGCGT.....ACGCCGTAAAAAAAAAAA 5’ (DNA)
- 5’...AUGCCGCA.....UGC GGCAUUUUUUUUUU 3’ (mRNA)

