

Section 7.2: Transcription: DNA-Directed RNA Synthesis

7.2 Section Questions, page 324

1. The three stages of transcription are: (1) Initiation: the process that allows RNA polymerase to bind to the DNA. The DNA promoter region contains a TATA box that allows the DNA to unwind and separate, allowing RNA polymerase to bind. (2) Elongation: the process in which RNA polymerase makes an RNA copy of the DNA template. (3) Termination: the process in which transcription stops and the mRNA is released. This is accomplished by various devices such as hair pin loops in the RNA and factors binding to the stop codon that prevent further RNA production.

2. The sequence of an RNA molecule transcribed from the DNA template strand

3'-CAAATTGGCTTATTACCGGATG-5' is:

5'-GUUUAACCGAAUAAUGGCCUAC-3'.

3. (a) The role of the promoter in transcription is to prepare a site where RNA polymerase can access and bind to the DNA strand.

(b) The role of RNA polymerase is to read the DNA code and create a complementary RNA molecule.

(c) The role of spliceosomes is to take part in eukaryotic post-transcriptional modifications that remove introns from the mRNA molecule.

4. Introns are sequences of genetic code found in eukaryotic organisms that are transcribed into RNA but are not coded and are removed before translation. Exons are sequences of the genetic code that are transcribed and remain to be translated into an amino acid sequence.

5. There are several key differences between transcription in eukaryotes and transcription in prokaryotes. Eukaryotic transcription takes place in the nucleus and prokaryotic transcription takes place throughout the cell. Eukaryotic transcription makes use of several RNA polymerases and prokaryotic transcription makes use of just one. Eukaryotic transcription adds bases slowly and prokaryotic transcription adds bases more quickly. Eukaryotic transcription results in pre-mRNA and prokaryotic transcription results in mRNA. In addition, in eukaryotic transcription, the transcript undergoes posttranscriptional modification, e.g., removal of introns, and in prokaryotic transcription it does not.

6. DNA Replication and Transcription

DNA replication	Both	DNA transcription
- produces 2 semi-conserved double stranded DNA molecules -uses DNA polymerase	-create new complementary nucleic acid strands -read DNA code -use RNA polymerase	-produces a single strand of mRNA

7. Answers may vary. Sample answer: The organism could produce more proteins than it has genes for because post-transcriptional modifications allow a single mRNA to be used to code for many polypeptide chains.

8. Answers may vary. Sample answer: I would look for non-coding regions in the mRNA, a 5' cap containing seven guanine residues, and a 3' adenine tail, all of which would indicate the mRNA is from a eukaryotic organism.

9. (a) DNA strand II served as the template for the mRNA strand A. DNA strand I served as the template for the mRNA strand B. This is true because the ratios of T:A and G:C are approximately 1:1 in both cases.

(b) The percentage of adenine is higher in the mRNA strand than in the DNA because during eukaryotic transcription a poly-adenine tail was added to the mRNA strand.

10. The absence of a nucleus prevents prokaryotes from modifying RNA after transcription because ribosomes can bind to the mRNA as it is being transcribed before it has a chance to be modified.