LECTURES 20 & 21 – Transcription & Translation

QUESTIONS TO TRY FOR PRACTICE

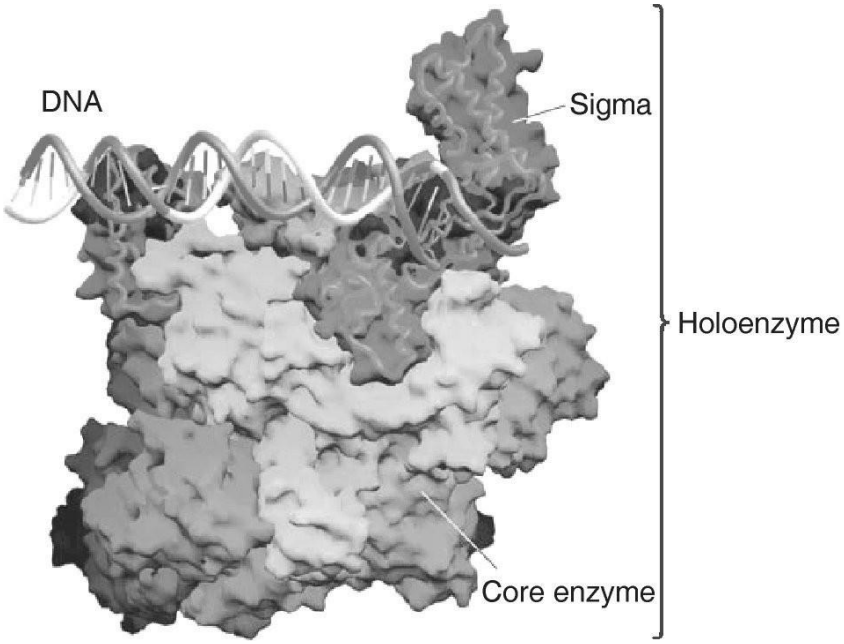

Figure 17.1

1) The enzyme complex associated with DNA in the figure is
A) helicase.
B) DNA polymerase.
C) RNA polymerase.
D) topoisomerase.

2) RNA polymerase needs a subunit to initiate transcription that is not needed for transcript elongation. What is the subunit?
A) Mg^{2+}
B) rho
C) sigma
D) the holoenzyme

3) The segments of DNA where transcription begins have a binding site for RNA polymerase. These segments are known as
A) sigma.
B) the holoenzyme.
C) initiation factors.
D) promoters.

4) Which of the following processes is central to the initiation of transcription?
A) binding of sigma to the promoter region
B) formation of a phosphodiester bond in the elongating RNA strand
C) binding of DNA polymerase to the promoter region
D) formation of a DNA primer

5) Put the following events of transcription in chronological order.
1. Sigma binds to the promoter region.
2. The double helix of DNA is unwound, breaking hydrogen bonds between complementary strands.
3. Sigma binds to RNA polymerase.
4. Sigma is released.
5. Transcription begins.

A) 2, 3, 4, 5, 1
B) 2, 3, 1, 4, 5
C) 3, 1, 2, 5, 4
D) 3, 2, 1, 4, 5

6) Which molecule or reaction supplies the energy for polymerization of nucleotides in the process of transcription?
A) the interaction between RNA polymerase and the promoter
B) the phosphate bonds in the nucleotide triphosphates that serve as substrates
C) the energy released when hydrogen bonds are broken as the DNA molecule is unwound
D) ATP only

7) A primary transcript in the nucleus of a eukaryotic cell is _____ the functional mRNA, while a primary transcript in a prokaryotic cell is _____ the functional mRNA.
A) the same size as; the same size as
B) larger than; the same size as
C) larger than; smaller than
D) the same size as; larger than

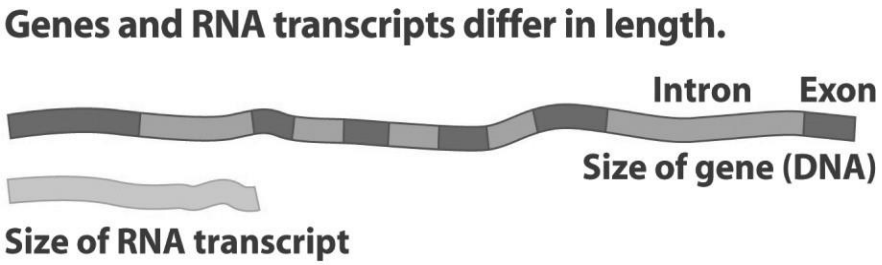

Figure 17.2

8) Refer to Figure 17.2. The mRNA is smaller than the length of the DNA that codes for it because
A) the regulatory regions (introns) of the gene are not transcribed.
B) post-transcriptional modification removes the introns.
C) post-transcriptional modification removes the exons.
D) bases are added to the tail of the primary transcript.

9) Which of the following is/are post-transcriptional modifications occurring in eukaryotic mRNAs?
A) addition of a poly (A) tail
B) addition of a methyl-guanosine cap
C) removal of introns
D) all of the above

10) In an experimental situation, a student researcher inserts an mRNA molecule into a eukaryotic cell after she has removed the mRNA's 5' cap and poly-A tail. Which of the following would you expect her to find?
A) The mRNA is quickly converted into a ribosomal subunit.
B) The cell adds a new poly-A tail to the mRNA.
C) The mRNA attaches to a ribosome and is translated, but more slowly.
D) The molecule is digested by enzymes because it is not protected at the 5' end.
E) The mRNA would not be translated.

11) There should be a strong positive correlation between the rate of protein synthesis and
A) the quantity of DNA polymerase.
B) the size of the genome.
C) the size of mRNA.
D) the number of ribosomes.

12) What molecule/feature ensures that the correct amino acid is added with reading of a specific codon during translation?
A) the anticodon of a properly formed aminoacyl tRNA
B) the methyl-guanosine cap of a properly modified mRNA
C) the poly (A) tail of a properly modified mRNA
D) the twisting number of a properly supercoiled DNA

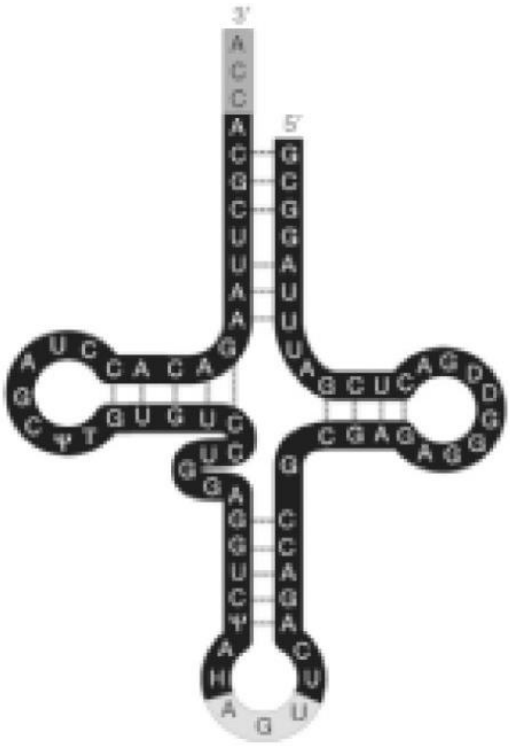

Figure 17.3

13) Refer to Figure 17.3. What is the function of the AGU on the loop of the tRNA?
A) It attaches to the amino acid.
B) It base pairs with the codon of mRNA.
C) It stabilizes the tRNA-amino acid complex.
D) It is the active site of this ribozyme.

14) What is the function of the 3′ end of the tRNA?
A) It attaches to the amino acid.
B) It base pairs with the codon of mRNA.
C) It stabilizes the tRNA-amino acid complex.
D) It is the active site of this ribozyme.

15) There are 61 codons that each specify the addition of a specific amino acid, and three stop codons for which there is no corresponding amino acid. However, there are only about 40 tRNA molecules, representing 40 anticodons. How is that possible?
A) Only about 40 of the recognized 61 codons are present in mRNA.
B) An anticodon forms hydrogen bonds with the codon; it must match the first two bases of the codon, but is less specific with respect to the third base.
C) There are tRNAs that can bind one of two related amino acids.
D) Only 20 of the codons are active–one for each amino acid.

16) A mutant bacterial cell has a defective aminoacyl-tRNA synthetase that attaches a lysine to tRNAs with the anticodon AAA instead of the normal phenylalanine. What would the consequence of this be for the cell?
A) None of the proteins in the cell will contain phenylalanine.
B) Proteins in the cell will include lysine instead of phenylalanine at amino acid positions specified by the codon UUU.
C) The cell will compensate for the defect by attaching phenylalanine to tRNAs with lysine-specifying anticodons.
D) The ribosome will skip a codon every time a UUU is encountered.
E) The ribosome will stall whenever an abnormal lysine tRNA binds to the A site.

Figure 17.4

17) Refer to Figure 17.4. During elongation, which site in the ribosome represents the location where a codon is being read?
A) E site
B) P site
C) A site
D) small subunit

18) Once a peptide has been formed between the amino acid attached to the tRNA in the P site and the amino acid associated with the tRNA in the A site, which process on the list occurs next?
A) translocation
B) reading of the next codon of mRNA
C) initiation
D) the codon-anticodon hydrogen bonds holding the tRNA in the A site are broken

19) The start codon is the same for prokaryotes and eukaryotes. What is the start codon?
A) an anticodon
B) a ribozyme
C) AUG
D) GGC

20) Put the following events of elongation in prokaryotic translation in chronological order.

1. Binding of mRNA with small ribosomal subunit.
2. Recognition of initiation codon
3. Complementary base pairing between initiator codon and anticodon of initiator tRNA
4. Base pairing of the mRNA codon following the initiator codon with its complementary tRNA
5. Attachment of the large subunit

A) 1, 2, 3, 4, 5
B) 2, 1, 4, 3, 5
C) 5, 4, 3, 2, 1
D) 1, 2, 3, 5, 4

21) Which of the following is NOT one of the steps in initiation of translation?
A) binding of the large ribosomal subunit to the small ribosomal subunit
B) binding of tRNA carrying formyl methionine to the start codon and small ribosomal subunit
C) recognition and binding of mRNA by the small ribosomal subunit
D) formation of a polypeptide bond

22) How does termination of translation take place?
A) The ribosome reaches the end of the mRNA molecule.
B) Stop codons with no corresponding tRNAs are read.
C) Hairpin turns of mRNA force the ribosome off the molecule.
D) Energy depletion causes termination.

23) Post-translational modifications include all of the following EXCEPT
A) removal of introns.
B) formation of hydrogen bonds among carbonyl and amino groups of the polypeptide backbone.
C) formation of covalent bonds between cysteine residues of the amino acid site chains.
D) addition of carbohydrates to form a glycoprotein.

24) A part of an mRNA molecule with the following sequence is being read by a ribosome: 5' CCG-ACG 3'(mRNA). The following charged transfer RNA molecules (with their anticodons shown in the 3' to 5' direction) are available. Two of them can correctly match the mRNA so that a dipeptide can form.

Table 17.1

tRNA Anticodon	Amino Acid
GGC	Proline
CGU	Alanine
UGC	Threonine
CCG	Glycine
ACG	Cysteine
CGG	Alanine

What is the anticodon loop of the first tRNA that will complement this mRNA?
A) 3' GGC 5'
B) 5' GGC 3'
C) 5' ACG 3'
D) 5' UGC 3'
E) 3' UGC 5'

25) A transfer RNA (#1) attached to the amino acid lysine enters the ribosome. The lysine binds to the growing polypeptide on the other tRNA (#2) in the ribosome already.

Where does tRNA #2 move to after this bonding of lysine to the polypeptide?
A) A site
B) P site
C) E site
D) exit tunnel
E) directly to the cytosol