ACTIVITY 5.4.1 *continued*

3. Transcribe the DNA into mRNA.
4. Identify the middle, end, and beginning sequence. Use your knowledge of start and stop codons to help you figure it out.
5. Remove codons 24 to 66, including codon 66.
6. Translate the mRNA into protein using the genetic code.

Analysis

(a) Which fragment was the beginning fragment? How do you know?

(b) Which fragment was the end fragment? How do you know?

(c) Codons 24 to 66 represent an intron. At what point in the process of protein synthesis are introns removed? What is the name of the enzyme responsible for this excision?

(d) How many amino acids does this protein contain?

(e) Is this genetic sequence eukaryotic or prokaryotic? How do you know?

(f) If you worked backward, starting with the amino acid sequence of the protein, would you obtain the same DNA nucleotide sequence? Why or why not?

(g) Provide the anticodon sequence that would build this protein.

ACTIVITY 5.7.1

Protein Synthesis: A Very Close Look

By studying electron micrographs, scientists have been able to obtain even more valuable information about numerous biochemical cellular processes. In this activity, you will examine electron micrographs that illustrate different aspects of protein synthesis. Using your knowledge of the process of protein synthesis, you will identify organelles and enzymes involved in protein synthesis.

Procedure

1. Examine each electron micrograph (**Figures 1** to **5**).

Analysis

(a) The electron micrograph in **Figure 1** depicts an mRNA strand as it undergoes posttranscriptional modification in a eukaryotic cell. Given your knowledge of this process, identify the enzyme depicted by the large white spot.

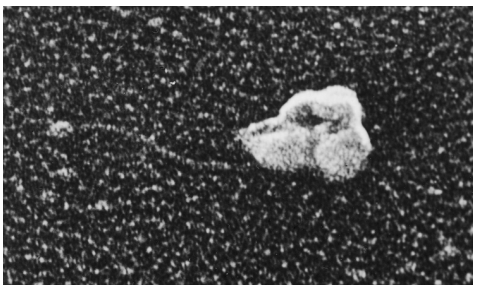

Figure 1

(b) Explain the function of the enzyme in **Figure 1**.

(c) The electron micrograph in **Figure 2** depicts ribosomes translating an mRNA sequence. Identify the ribosomes. Can you distinguish the two subunits of the ribosome?

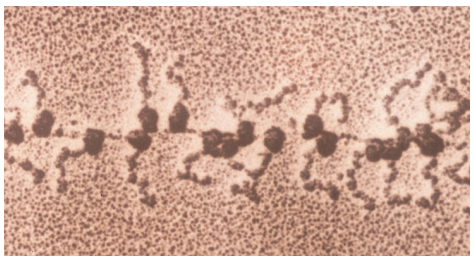

Figure 2

(d) **Figure 3** depicts the process of transcription. What enzyme is represented by the dark spots? Why does more than one enzyme exist on the strand of DNA?

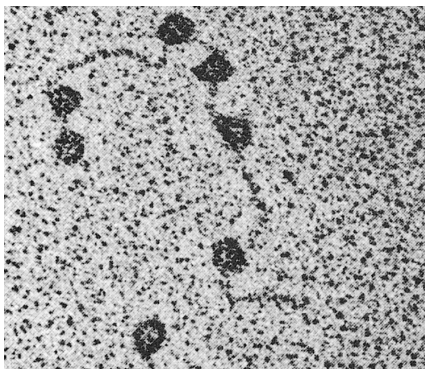

Figure 3

ACTIVITY 5.7.1 *continued*

(e) In the electron micrograph in **Figure 4**, more than one ribosome is translating the mRNA at one time. Identify the ribosomes.

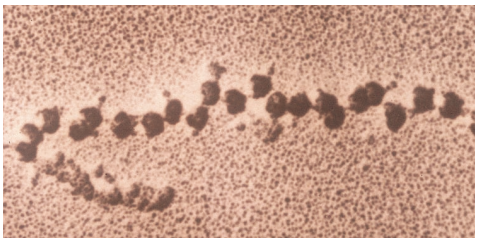

Figure 4

(f) The polysome shown in **Figure 4** exists in prokaryotes and eukaryotes. Why is it more efficient to translate an mRNA strand more than once and simultaneously by many ribosomes?

(g) Identify the ribosomes in **Figure 5**.

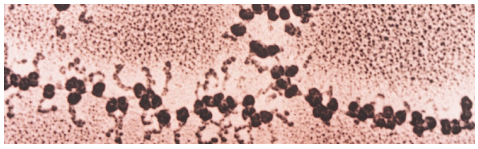

Figure 5

(h) In **Figure 5**, why is the polypeptide chain increasingly longer as you move across the mRNA?

ACTIVITY 5.8.1

Comparison of Eukaryotic and Prokaryotic Genomes

The organization of eukaryotic and prokaryotic genomes differs greatly. In addition, prokaryotic RNA does not undergo posttranscriptional modification. In this activity, you will be provided with an example of a eukaryotic genome and a prokaryotic genome. You will identify different areas of the genomes, including promoter regions, microsatellite regions, telomeric regions, and possible gene regions. Assume that all these regions are found on the one strand provided.

Procedure

1. Copy each of the following sequences onto a separate piece of paper. Assume that the sequences represent an organism's entire genome.

Genome A

5′- GCAGGCCATATAAAATAGCGCCATACTAGATACGGG
CCATATTATTGCATATCCGCCGATTACAGGATTTAATTT
GGGAATTCCCCGATTAACGCGATCGATCGGGCCATATC
GATATGCATCGTAATCCGGTAGATTCACAGGTAG -3′

Genome B

5′- GCATACCCAAATTAATAACGGCGGTAGGCGACTCATT
CTGATATACGCATCGGCATTTACCTACGGCCGGCCGGC
CGGCCGGCCTAGATTTACCGCATTTACCGGCCGCATCG
GATCGGGATTAGCATAATTAAAATGCATCGGCGTAGTAG
GCAATCGGCGCAGCCGAGCCACCTCCCGGAGAATCATC
ATCATCATCATCATCATCATCATCATCATCATCATACGGAT
AGATCCATTACCATGCGATTTAAAGGCCATTCATGGGC
CCCCGATTTATCCATTTAGGCCGGATTCCATGGATTCAT
TTCCATTTTTCGGCATCATCATCATCATCATCATCATCAT
CATCATCATCATCATCATCAT -3′

Analysis

(a) Based on the size of the genome, which of the sequences would you consider eukaryotic and which prokaryotic? Justify your answer.

(b) The prokaryotic genome contains one ten base pair promoter region, whereas the eukaryotic genome contains two. Find these regions and circle them. How do you know these are the promoter regions?

(c) Which of the two genomes has telomeric DNA? How do you know? Circle the telomeric region.

(d) Does the eukaryotic genome contain any microsatellites? Circle the areas if they exist. What sort of sequence is found in a microsatellite region?

(e) Identify the areas that may be sequences that code for a gene in both genomes. Identify the difference between the eukaryotic and prokaryotic sequences. How many genes are found in the eukaryotic genome? (Hint: Look for start codons.)

(f) Using the Internet or library resources, find other examples of prokaryotic and eukaryotic sequences. Compare the sequences for size, gene clustering, and the presence of microsatellites.

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(g) Why is it important that genomic databases are shared among researchers?