

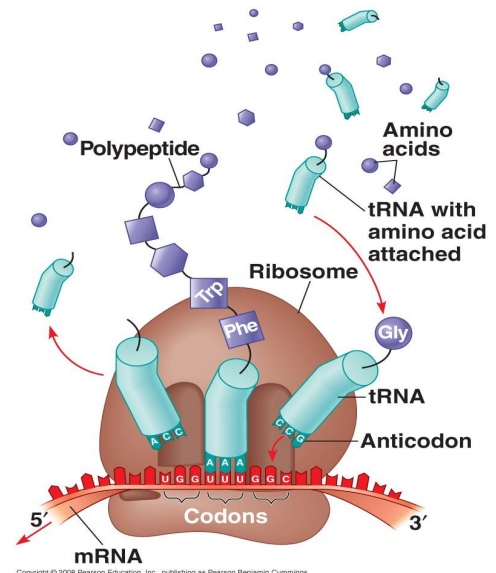
KEY CONCEPTS:

- Genes specify proteins via transcription and translation
- Transcription is the DNA-directed synthesis of RNA
- Eukaryotic cells modify RNA after transcription
- Translation is the RNA-directed synthesis of a polypeptide
- Point mutations can affect protein structure and function
- While gene expression differs among the domains of life, the concept of a gene is universal

READ:

- Chapter 17

KEY TERMS: Here is a list of key terms and concepts you will hear about and see during the chapter readings. Get to know them!



<i>Gene expression</i>	<i>Reading frame</i>	<i>5' cap</i>	<i>Point mutation</i>
<i>Transcription</i>	<i>RNA polymerase</i>	<i>Poly-A tail</i>	<i>Base substitution</i>
<i>RNA processing</i>	<i>Promoter</i>	<i>Introns</i>	<i>Insertion</i>
<i>Translation</i>	<i>Terminator</i>	<i>Exons</i>	<i>Deletion</i>
<i>Messenger RNA (mRNA)</i>	<i>Initiation</i>	<i>Spliceosome</i>	<i>Frame shift</i>
<i>Transfer RNA (tRNA)</i>	<i>Elongation</i>	<i>snRNPs</i>	<i>Missense mutation</i>
<i>Ribosomal RNA (rRNA)</i>	<i>Termination</i>	<i>Alternative RNA splicing</i>	<i>Nonsense mutation</i>
<i>Ribosome</i>	<i>Transcription factors</i>	<i>P site (peptidyl-tRNA site)</i>	<i>Silent mutation</i>
<i>Codon</i>	<i>Transcription initiation complex</i>	<i>A site (aminoacyl-tRNA site)</i>	<i>Mutagen</i>
<i>Anticodon</i>	<i>TATA box</i>	<i>E site (exit site)</i>	

QUESTIONS FOR YOUR BILL:

The Connection between Genes and Proteins

1. Define *gene expression*.
2. Explain how the “one-gene-one protein” hypothesis was derived by Beadle and Tatum. Why has this hypothesis been refined to “one gene-one polypeptide,” and now “one gene-one (protein) domain?”
3. Explain THREE structural ways in which *RNA* differs from *DNA*.
4. Distinguish between the three types of *RNA* produced during transcription:
 - a. *Messenger RNA (mRNA)*
 - b. *Transfer RNA (tRNA)*
 - c. *Ribosomal RNA (rRNA)*
5. Distinguish between *transcription* and *translation*.
6. Compare where transcription and translation occur in bacteria and in eukaryotes.
7. Francis Crick coined the term “central dogma” with regard to the relationship between *DNA* and *RNA*. Explain what Crick meant by this.
8. Explain the relationship between protein synthesis and an organism’s phenotype.
9. Define “*codon*” and explain the relationship between the linear sequence of codons on *mRNA* and the linear sequence of *amino acids* in a polypeptide.
10. Explain the significance of the *reading frame* during translation.
11. Explain the evolutionary significance of a nearly universal genetic code.

The Synthesis and Processing of RNA

12. Create a cartoon strip that illustrates how RNA is modified after transcription in eukaryotic cells. Add captions to help highlight key points and terms. Include the following in your diagram:
13. How does RNA polymerase identify where to begin transcription of a gene?
14. Explain the relationship between the promoter, enhancers, and transcription factors.
15. Diagram each of the following phases of transcription.
 - a. initiation
 - b. elongation
 - c. termination
16. Create a cartoon strip that illustrates how RNA is modified after transcription in eukaryotic cells. Add captions to help highlight key points and terms. Include the following in your diagram:
 - a. *RNA splicing*
 - b. *5' cap*
 - c. *poly-A tail*
17. Define and explain the role of *ribozymes*.
18. Explain why, due to *alternative RNA splicing*, the number of different protein products an organism can produce is much greater than its number of genes.

The Synthesis of Protein

19. Draw a tRNA molecule and discuss how its structure enables its function. Explain the significance of the *anticodon* and *wobble* in your tRNA molecule.
20. Make a detailed diagram of a ribosome that illustrates the structures listed below. Describe the function of each component of the *ribosome*. Include the following
 - a. *small ribosomal subunit*
 - b. *large ribosomal subunit*
 - c. *P site, A site, and E site*.
21. Diagram the process of translation including the phases listed below and include the location (A, P, or E site) of incoming tRNA molecules, incoming amino acids, energy sources, the growing polypeptide chain, uncharged tRNA molecules and release factors as appropriate:
 - a. Initiation
 - b. Elongation
 - c. Termination
22. Describe the significance of *polyribosomes*.
23. Explain the purpose of a *signal peptide* at the beginning of a newly synthesized protein.
24. Use the following DNA nucleotide sequence to create the appropriate codon sequence for a strand of mRNA, the appropriate series of tRNA anticodons, and ultimately the amino acid sequence that would be generated.

(DNA template strand) **T-A-C-T-C-A-G-T-G-G-G-G-C-A-C-T-T-A**

Point Mutations

25. Define "*point mutations*".
26. Distinguish between the following types of mutations:
 - a. Silent mutation
 - b. Missense mutation
 - c. Nonsense mutation
 - d. Frameshift mutation
27. Why is an insertion or deletion more likely to be deleterious than a substitution?
28. Define the term '*mutation*'. Give an example of a physical and a chemical agent of mutation.

SUPPLEMENTARY RESOURCES: Click the links below for more information to help you learn more about this lesson.

Interactives

- **McGraw-Hill 3D Animation:** [Molecular Biology of the Gene \(Protein Synthesis\)](#)
- **Pearson's BioCoach Activity:** [Transcription](#) and [Translation](#)
- University of Utah Genetic Science Learning Center: [DNA to Protein](#)
- McGraw Hill: [Transcription Animation](#)
- McGraw Hill: [RNA Processing](#)
- McGraw Hill: [Translation Animation](#)
- University of Nebraska: [Transcription Animation](#)
- University of Nebraska: [Translation Animation](#)

Lectures

- Bozeman Biology's "[Transcription & Translation](#)" video.
- Bozeman Biology's "[The Central Dogma](#)" video.
- Bozeman Biology's "[Genotypes and Phenotypes](#)" video.
- Crash Course Biology's video: [DNA, Hot Pockets, & The Longest Word Ever](#)
- Crash Course Biology: [DNA Transcription and Translation](#)

HYPERLINK "<http://quietube5.com/v.php/http://www.youtube.com/watch?v=itsb2SqR-R0>"