

Biology Unit 5
 Amino Acid/Protein Synthesis
 Reading Activity

Name _____
 Date _____
 Hour _____

Proteins are organic compounds that make up many structures and control many functions in living things. Amino acids are the building blocks of proteins. Think of amino acids as "Legos" for your life. They band together in chains to form the stuff from which your life is born. Amino acids make up 75% of the human body. They are important to nearly every bodily function. Every chemical reaction that takes place in your body depends on amino acids and the proteins that they build. Building proteins is a two-step process:

1. Amino acids get together and form peptides or polypeptides.
2. It is from these groupings that proteins are made.

And there's not just one kind of amino acid. A total of 20 different kinds of amino acids form proteins. The kinds of amino acids determine the shape of the proteins formed. Commonly recognized amino acids include glutamine, glycine, phenylalanine, tryptophan, and valine. Three of those - phenylalanine, tryptophan, and valine - are essential amino acids for humans; the others are isoleucine, leucine, lysine, methionine, and threonine. The essential amino acids cannot be synthesized by the body. Instead, they must be ingested through food. When proteins from your food are digested, amino acids are left.

One of the best-known essential amino acids is tryptophan, which performs several critical functions for people. Tryptophan helps induce normal sleep; helps reduce anxiety, depression, and artery spasm risk; and helps produce a stronger immune system. Tryptophan is perhaps most well-known for its role in producing serotonin, which is what gets all the press at Thanksgiving time for putting you to sleep after the big holiday feast.

Twenty standard Amino Acids

The diagram illustrates the general structure of an amino acid: a central alpha carbon bonded to a hydrogen atom, an amino group (NH₂), a carboxylate group (COO⁻), and a variable R group. The R groups are categorized as follows:

- Nonpolar, aliphatic R groups:** Glycine, Alanine, Valine, Leucine, Methionine, Isoleucine.
- Aromatic R groups:** Phenylalanine, Tyrosine, Tryptophan.
- Positively charged R groups:** Lysine, Arginine, Histidine.
- Polar, uncharged R groups:** Serine, Threonine, Cysteine, Proline, Asparagine, Glutamine.
- Negatively charged R groups:** Aspartate, Glutamate.

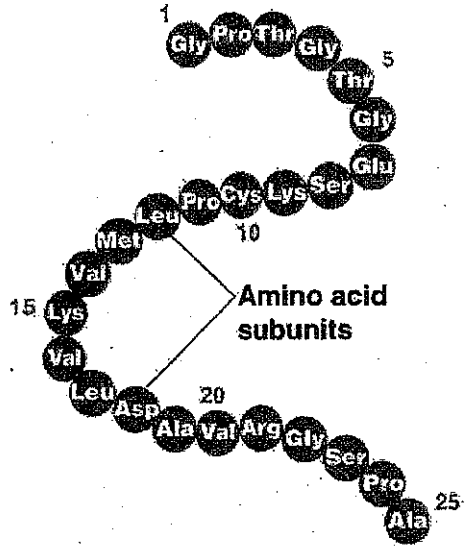
Abbreviations for the 20 amino acids are listed in a table at the bottom of the diagram:

Ala A. Alanine	Leu L. Leucine
Arg R. Arginine	Lys K. Lysine
Asn N. Asparagine	Met M. Methionine
Asp D. Aspartic acid (aspartate)	Phe F. Phenylalanine (phenylalanine)
Cys C. Cysteine	Pro P. Proline
Glu E. Glutamic acid (glutamate)	Ser S. Serine
Gln Q. Glutamine (glutamine)	Thr T. Threonine
Gly G. Glycine	Trp W. Tryptophan (tryptophan)
His H. Histidine	Tyr Y. Tyrosine
Ile I. Isoleucine	Val V. Valine

Essential amino acids	Non-essential amino acids
Histidine	Alanine
Isoleucine	Arginine
Leucine	Asparagine
Lysine	Aspartic acid
Methionine	Cysteine
Phenylalanine	Glutamic acid
Threonine	Glutamine
Tryptophan	Glycine
Valine	Proline
	Serine
	Tyrosine

Essential amino acids are "essential" not because they are more important to life than the others, but because the body does not produce them. The essential amino acids must be ingested every day. Failure to get enough of even one of the 9 essential amino acids can result in protein degradation. The human body simply does not store amino acids for later use, as it does with fats and starches. You can find amino acids many places in nature. In fact, more than 300 have been found in the natural world, from such diverse sources as microorganisms and meteorites.

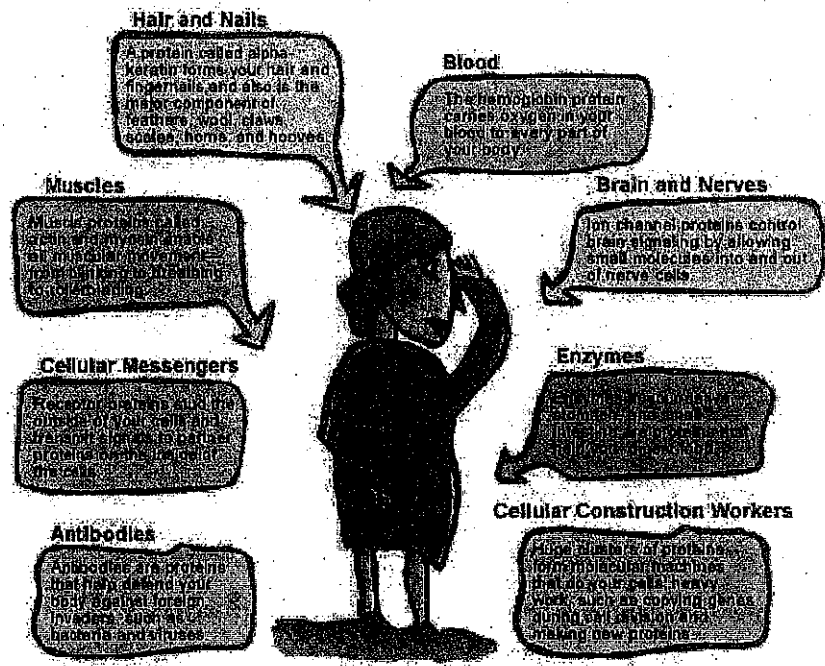
Primary Structure



A peptide is a molecule that contains a short chain of amino acids joined together by peptide bonds. These molecules have the same basic structure as proteins, but there is one specific difference between them. The characteristic that differentiates a protein from a peptide is the number of amino acids that are joined together to make up the molecule. Generally, if there are less than 50 amino acids in the chain, then it is considered to be a peptide.

Within both peptides and proteins, peptide bonds hold the amino acids together. Peptide bonds are an example of covalent bonds, which are formed when electrons are shared between two different atoms. During the reaction that links the two amino acid molecules together, a molecule of water (H₂O) is released when a hydrogen ion (H) from the amino group joins with a hydroxyl (OH) from the carboxyl group.

The shortest peptide that can be formed is called a dipeptide because it contains only two amino acids. From there, they increase in length up to about 50 amino acids. As more amino acids are joined together, tri-, tetra- and pentapeptides are formed. These molecules are also referred to as polypeptides or "many peptides." To form proteins, at least two polypeptides must be joined together.



Peptides and proteins have many different roles with the cells of animals. Both can form hormones and enzymes, which regulate the functioning of certain cells and can stimulate or inhibit particular reactions within cells. They also play a role in the support of different parts of the animal body as they are integral in many different types of cells and tissue, including hair, nails, muscle, bone and skin cells.

The sequence of amino acids in a peptide is determined by the DNA of the organism. The long strands of nucleotides provide the code for which amino acids should be attached to which. A combination of three DNA nucleotides, or a codon, codes for each amino acid. Then, the 20 different amino acids can be joined together to form a peptide chain.



Dear Protein,
 Thanks for building and repairing this awesome bod of mine. I wouldn't have muscle, bone, hair, nails, or lips without you!

XOXO

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Directions:

Use the reading passage to answer the following questions.

Find the sentence in the passage that answers the question and highlight that sentence.

Then, write the number of the question it answers next to the sentence you highlighted.

Finally, find the answer you wrote in the puzzle.

1. What are the building blocks of proteins?
2. What carries oxygen in your body?
3. What determines the sequence of amino acids in a peptide?
4. What helps induce normal sleep?
5. What are proteins that help defend your body against foreign invaders?
6. What puts you to sleep after eating Thanksgiving turkey?
7. How do you get essential amino acids?
8. What are 3 DNA nucleotides that code for each amino acid?
9. What is a molecule that contains a short chain of amino acids joined together?
10. What are amino acids that cannot be synthesized by the body?
11. What are organic compounds make up many structures and control many functions in living things?

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____

B L L V T W D M G E S N G H O
M I J A V R G Q R E I O E E V
Y F C G I S Y P K E H Q D M V
B Q D O Y T A P T A D H I O X
H G Y E D E N O T R N K T G U
L V L R A O R E J O A F P L J
K K V N D P N V S N P Y E O H
Q B P P B Y L O T S U H P B D
A M I N O A C I D S E C A I M
U G S V I X B Z R G K F C N W
N I N O T O R E S B T E W R O
A S E F D B Y N X Q I D Z X J
C M S I A W C G V N E H D O H
G O E S U D V J T Y T R X H L
T S J B Z B A I N G E S T P Z