

# Proteins

by Sophia



## WHAT'S COVERED

In this lesson, you will learn how to identify the makeup of proteins. Specifically, this lesson will cover:

## 1. An Overview of Proteins

**Proteins** are **organic compounds**. If you remember, organic compounds are compounds that contain the element carbon. Common organic compounds include proteins, lipids, nucleic acids, and carbohydrates.



### TERMS TO KNOW

#### **Proteins**

Organic molecules composed of amino acids.

#### **Organic Compounds**

Compounds that contain the element carbon.

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## 2. The Role of Proteins

Proteins are made up of something called amino acids; amino acids are the building blocks of proteins. There are many different types of proteins, so they have many different roles.

➞ **EXAMPLE** Proteins are used in your body like enzymes, which allow you to break down food and build all the molecules of your body. They're also used for structure, transport, movement, regulation of cell activity and defense in your lymphatic system. Additionally, they're used as your hormones; they can even be used as receptors to bind hormones to target cells.

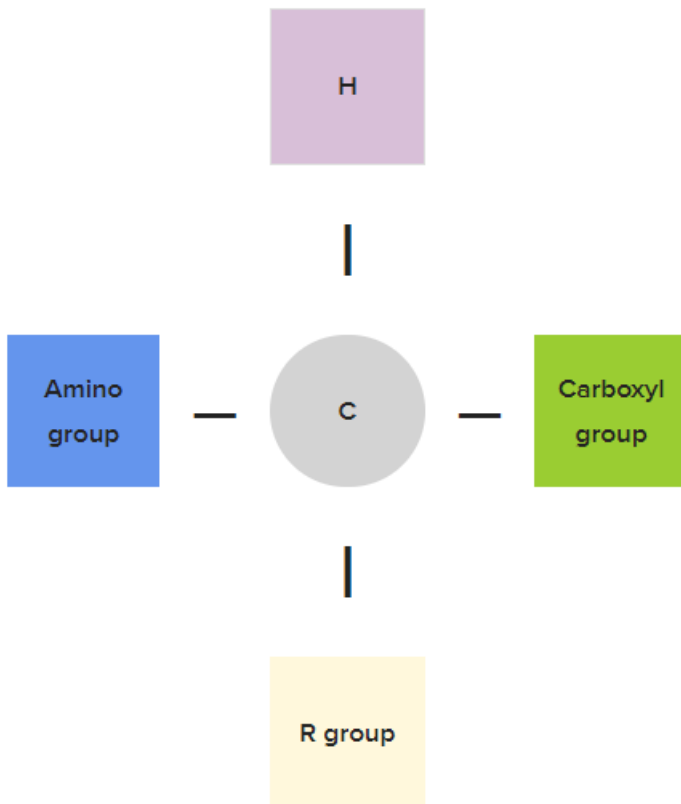
So proteins have many, many different roles and are thus a very important molecule in your body.

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## 3. Amino Acids

**Amino acids** are the building blocks of proteins and combine to form proteins.

The diagram below shows the structure of an amino acid.



In the center, you have a carbon atom that's going to be covalently bonded to a hydrogen atom, an amino group, a carboxyl group, and an R group.

The R group is going to be unique to each of the different 20 amino acids that there are. In each of those 20 amino acids, the rest of the structure will be the same, but the R group will be different. One amino acid is going to have a different R group than another type of amino acid. Each amino acid has its own R group.

Amino acids will make up proteins. The order of amino acids and the number of amino acids will compose different types of proteins. So there are many, many different types of proteins, depending on the structure of amino acids.



#### TERM TO KNOW

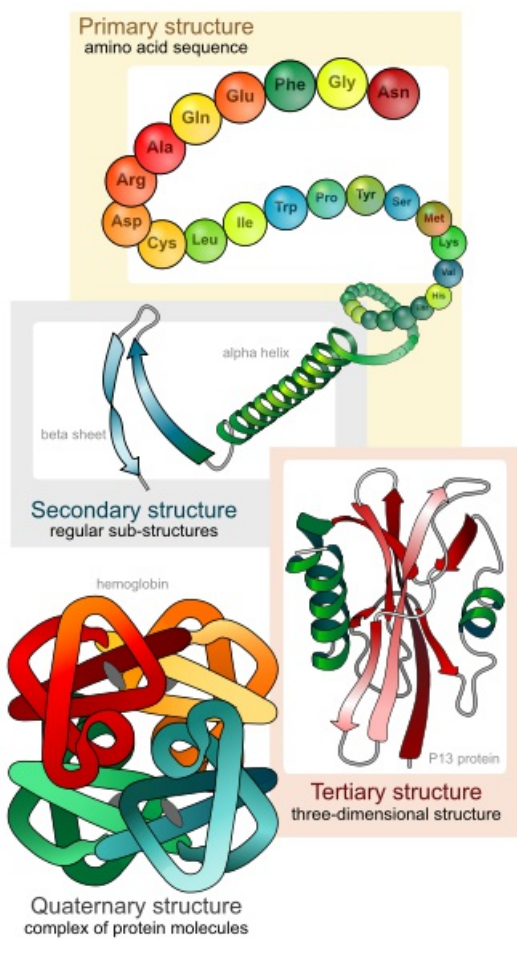
##### **Amino Acids**

The building blocks of proteins; amino acids compose proteins.

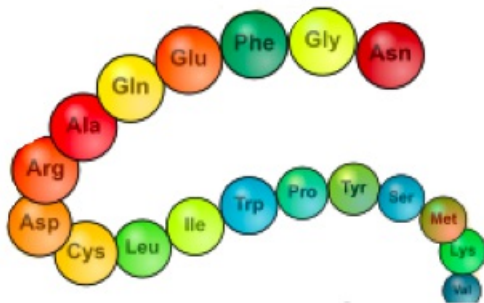
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## 4. The Structure & Function of Proteins

The structure of a protein has four different levels. As you go through the four levels, refer to the diagram below.



## 4a. Primary Structure



The **primary structure of a protein** includes a linear chain of amino acids. Remember, there are 20 different types of amino acids in total.

Suppose you have a chain of four amino acids. When you have amino acids together in a chain, you call that a **polypeptide chain**; the prefix poly means many. These amino acids are linked together in a chain, and each link in the chain is held together by something called a **peptide bond**.

The reason every amino acid has an amino group and a carboxyl group is that the amino group of the first amino acid will bond to the carboxyl group of the second amino acid to form a peptide bond, and so on. When you have many amino acids held together by peptide bonds, this is referred to as a polypeptide chain. Therefore, the primary structure of a protein is a polypeptide chain.



### TERMS TO KNOW

### Primary Structure of Proteins

The simplest structure of proteins composed of a chain of amino acids.

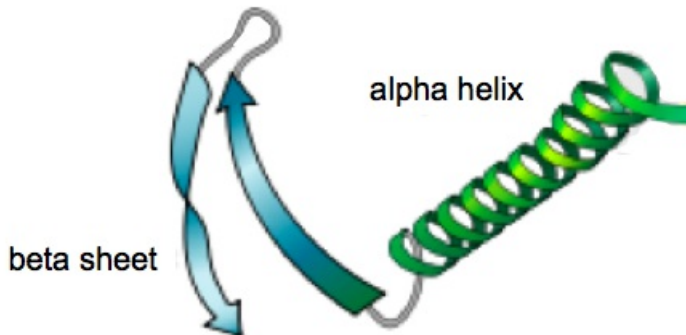
### Polypeptide Chain

A chain formed when three or more amino acids join together.

### Peptide Bond

A type of bond that joins amino acids together.

## 4b. Secondary Structure



The **secondary structure of a protein** is a polypeptide chain that is twisted or folded. When the primary structure twists and folds, it produces the secondary structure of a protein.



HINT

You can think of a protein's primary structure like all the materials needed to build a room laid out: The lumber, glass, sheetrock, nails, etc. A protein's secondary structure is like when those building materials come together to form windows, a floor, walls, etc. A protein's tertiary structure is like a completed room.

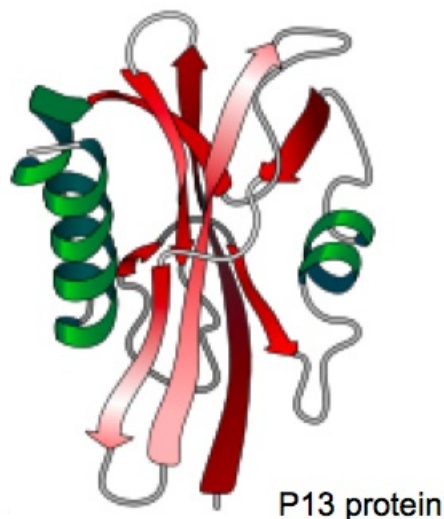


TERM TO KNOW

### Secondary Structure of Proteins

The second level of organization of proteins where some of the amino acids within a single polypeptide chain form into special substructures, such as an alpha helix or a beta-sheet.

## 4c. Tertiary Structure



The **tertiary structure of a protein** is made when that secondary structure starts to twist and fold even more, producing the overall 3D shape of a single polypeptide chain.

Just as some buildings only have one room, some proteins only have one polypeptide chain, and only have primary, secondary and tertiary structure. But just as some buildings have multiple rooms, some proteins are composed of multiple polypeptide chains. These come together to form the protein's quaternary structure.



#### TERM TO KNOW

#### Tertiary Structure of Proteins

The third level of organization of proteins; the overall structure of one entire amino acid chain.

### 4d. Quaternary Structure



The **quaternary structure** is formed when you have two or more polypeptide chains that are held together. After the polypeptide chain has been twisted and folded, then twisted and folded more, it is going to combine with other chains. Those other chains are all going to be bonded together.



#### TERM TO KNOW

#### Quaternary Structure of Proteins

The most complex level of protein structure where the tertiary structure of several amino acid chains are bonded together.



## SUMMARY

In this lesson, you learned that **proteins** are organic compounds found in your body that are built by **amino acids** and that they have **various roles** in your body. You also learned about the **four different levels of protein structure**.

Keep up the learning and have a great day!

Source: THIS WORK IS ADAPTED FROM SOPHIA AUTHOR AMANDA SODERLIND



## ATTRIBUTIONS

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## TERMS TO KNOW

### Amino Acids

The building blocks of proteins; amino acids compose proteins.

### Organic Compounds

Compounds that contain the element carbon.

### Peptide Bond

A type of bond that joins amino acids together.

### Polypeptide Chain

A chain formed when three or more amino acids join together.

### Primary Structure of Proteins

The simplest structure of proteins composed of a chain of amino acids.

### Proteins

Organic molecules composed of amino acids.

### Quaternary Structure of Proteins

The most complex level of protein structure where the tertiary structure of several amino acid chains are bonded together.

### Secondary Structure of Proteins

The second level of organization of proteins where some of the amino acids form into special substructures, such as an alpha helix or a beta-sheet.

### Tertiary Structure of Proteins

The third level of organization of proteins; the overall structure of one entire amino acid chain.

