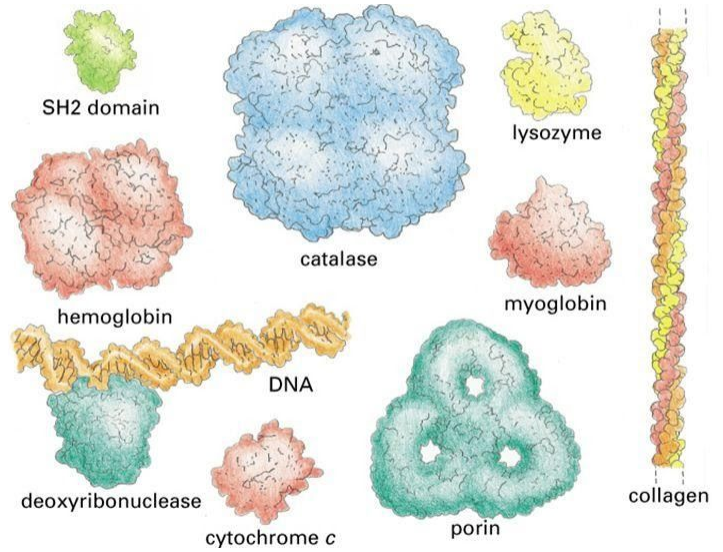


Proteins Reading

Proteins are in First Place!

The word protein comes from the Greek word meaning “first place”. That’s how important proteins are! All living organisms have many different kinds of proteins. Each different protein has a special shape that helps it to do a specific job. Each protein is shaped differently, and can only do one specific thing for your body. Proteins have many different jobs to do inside an organism. The type of job a protein does depends on its shape.

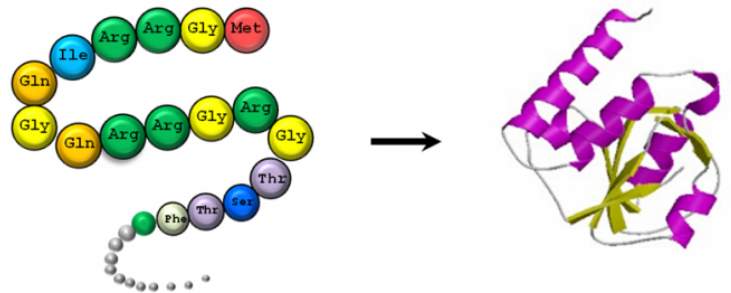


Shape = Function

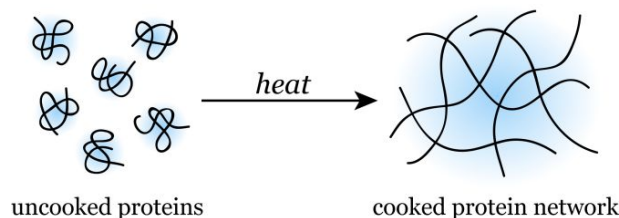
A **protein** is a polymer built from **amino acids**. There are 20 kinds of amino acids in cells that can make thousands of different proteins. Think of how you can make thousands of words by using different combinations of the 26 letters in the alphabet. The amino acids are like letters, and proteins are like words.

1. Explain how thousands of unique proteins can be made from only 20 amino acids.

When a protein is being made, the amino acids do not stay in straight line like beads on a string. The chain of amino acids folds into a special shape, depending on the chemistry of the amino acids. For proteins to work correctly, they have to have the right shape. When the shape of a protein changes, it won't work anymore. For example, when



you cook an egg, the proteins lose their shape. When the egg’s protein gets too hot, the bonds in the protein break so it loses its shape. This change in protein shape is called **denaturation**. Denaturation makes the protein **non-functional**, meaning it cannot do its job anymore. Proteins can be denatured by changing temperature, acidity, amount of salt, or the charge of the protein’s environment.



Enzymes Make Stuff Happen

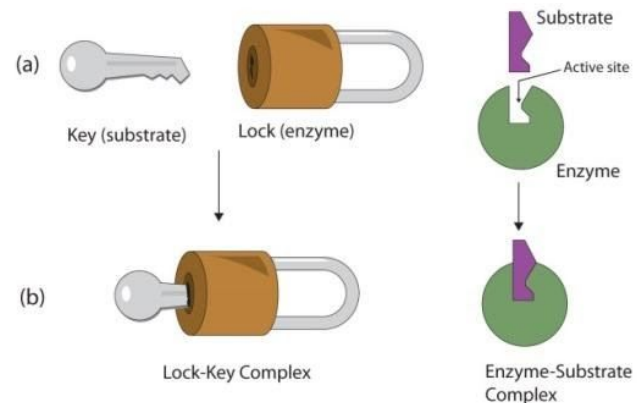
Enzymes are a kind of protein that speeds up chemical reactions. Enzymes have four special properties:

1. Enzymes are specific for each reaction. They can only do one job with their special shape.
2. Enzymes are **catalysts**, which means they **catalyze**, or speed up, reactions.
3. Enzymes are never used up in a reaction! Enzymes can be used again and again.
4. If an enzyme gets too hot or too cold, it can be **denatured**, or lose its shape.

Enzymes Work Like a Lock and Key

Each enzyme has a very special shape that will only work on one type of chemical in a reaction. A **substrate** is the molecule that the enzyme works on. The substrate fits into a part of the enzyme known as the **active site**. Think of the substrate like a key, and an enzyme like a lock. The keyhole is like the active site.

2. Describe the relationship between the substrate, the enzyme, and the active site.



Enzymes can change the speed of reactions

Remember that enzymes can change how quickly chemical reactions happen. But an enzyme can only speed up a reaction if it has the right shape. The enzyme has to have its unique shape in order for the substrate and enzyme to fit together. If the enzyme changes its shape, it can't speed up a reaction because the substrate can't fit in the active site. For example, if you melt a metal lock and change its shape, then a key will no longer work to open it. This phenomenon causes concern among doctors when patients develop high fevers. Higher temperatures can cause enzymes, such as that in the brain, to denature, which can lead to delirium and other life-threatening conditions since the enzymes are no longer functioning.

(<http://www.wilsonssyndrome.com/ebook/body-function-dependent-on-body-temperature/enzyme-function-dependent-on-temperature/>)

3. Why is it so important for enzymes to keep their specific shape?

A reaction might go faster or slower depending on the amount of enzyme, substrate, and product. Think about the Toothpickase lab. If you had even more toothpicks in the bowl (substrate), could you do your job better? What if you had more hands (enzymes)? What if there were more broken toothpicks (products) or paperclips? All these things can change how well the enzyme does its job.