

## **STRUCTURAL FEATURES OF SIMPLE AND COMPLEX ENZYMES AND THEIR CHEMICAL COMPOSITION**

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Enzymes are highly specialized biological catalysts that accelerate biochemical reactions in living cells. They are essential components of cellular metabolism and ensure the continuous and balanced progression of metabolic processes. The catalytic efficiency of enzymes is closely related to their structural organization and chemical composition.

Structurally, enzymes are protein molecules composed of amino acids linked by peptide bonds. The amino acid sequence forms the primary structure of the protein and determines higher levels of structural organization. The secondary structure is stabilized by hydrogen bonds and appears in helical or sheet forms. The tertiary structure represents the three-dimensional folding of the protein, and the active site is formed at this level.

The active site consists of specific amino acid residues arranged in a precise spatial configuration that allows selective substrate binding. Functional groups such as carboxyl, amino, hydroxyl, and sulfhydryl groups directly participate in catalytic reactions. The balance between hydrophobic and hydrophilic regions contributes to enzyme stability.

According to their composition, enzymes are classified as simple or complex. Simple enzymes consist only of protein molecules, and their catalytic activity depends entirely on the three-dimensional structure of the polypeptide chain. Even slight structural changes may reduce enzymatic activity.

Complex enzymes contain both a protein component and a non-protein component. The protein part is known as the apoenzyme, while the non-protein component is called the cofactor. When combined, they form the active holoenzyme. Cofactors may be metal ions or organic molecules. Metal ions stabilize the active site or participate in electron transfer, while organic coenzymes, often derived from vitamins, function as carriers of chemical groups during enzymatic reactions. The main differences between simple and complex enzymes are presented in Table 1.

**Table 1.**

### **Comparative Structural Features of Simple and Complex Enzymes**

Criterion	Simple Enzymes	Complex Enzymes
Structural basis	Protein only	Protein + cofactor
Active Form	Functional polypeptide	holoenzyme
Catalytic mechanism	Amino acid functional groups	Protein-cofactor interaction
Metal ion presence	Usually absent	Frequently present
Functional diversity	Relatively limited	Broader and more complex

In conclusion, the structural organization and chemical composition of enzymes determine their biological function. Simple enzymes operate solely through protein structure, whereas complex enzymes achieve broader functional capacity through additional molecular components.

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