LIPOIC ACID HAS ITS UNIQUE STRUCTURE


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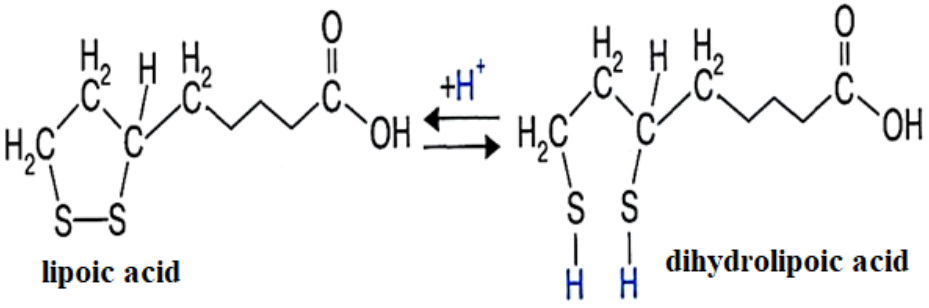
Annotatsiya. *Lipoic acid, entering the tissues, binds covalently to the NH2 group of lysine of the active site of the apoenzymes of "lipoic" enzymes. These include multi-enzyme complexes that carry out keto acid reactions.*

Keywords: ***Metabolism, Biological role,*** *HS-CoA and NAD+, lipoacetyltransferase, lipoacetyltransferase*

Sources of lipoic acid are yeast, meat products, and milk. In the 1950s, lactic acid bacteria growth factor was isolated from yeast and liver tissue, which is not related to any of the known vitamins; some species of streptococci also needed it as a growth factor. In crystalline form, this factor was identified with α-lipoic acid (1,2-dithiolan-3-valeric) (Fig. 3):



Rice. H. Diagram of the redox reaction of lipoic acid

As you can see from these formulas, lipoic acid can exist

S SH

in oxidized (LC <) and reduced (LC <) forms,

S SH

Thanks to which its coenzyme functions are realized

Metabolism. Lipoic acid, entering the tissues, binds covalently to the NH2 group of lysine of the active site of the apoenzymes of "lipoic" enzymes. These include multi-enzyme complexes that carry out keto acid reactions.

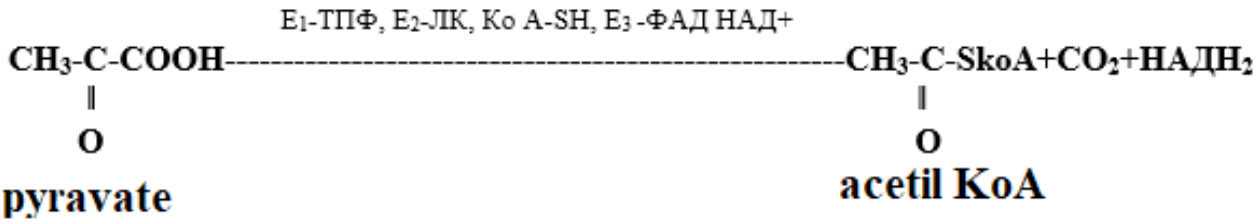
Biological role. Lipoic acid plays the role of a prosthetic group along with thiamine pyrophosphate and HS-CoA in a complex multienzyme pyruvate and α-ketoglutarate-dehydrogenase systems

Pyruvate dehydrogenase multienzyme complex has a complex structure, its molecular weight is $5.3*10^6$ Yes, it includes enzyme and cofactors:

- the first enzyme, pyruvate decarboxylase (K.F.1.2.4.1.) consists of 12 dimeric molecules, each of which has 2 molecules of thiamine pyrophosphate attached, which act as coenzymes;
- the second enzyme is lipoacetyltransferase (K.F.2.3.1.12.), the enzyme is concentrated in the central part of the B complex in the form of 24 molecules packed in the shape of a cube, each B molecule as a prosthetic group contains a lipoic acid residue connected to the apoenzyme via e-aminogrupe lysine; This compound provides lipoic acid with motility as part of a multienzyme complex and contact with pyruvate decarboxylase and dihydrolipoyl dehydrogenase;
- the third enzyme is dihydrolipolyl dehydrogenase (K.F.1.8.1.4.), the enzyme consists of 6 dimeric molecules containing 2 molecules of FAD as a coenzyme
- In addition to the listed enzymes and their cofactors, the complex includes two external coenzymes: HS-CoA and NAD+

The spatial organization of the components of the complex is very important for catalysis. Lipoic acid, due to its specific structure, is very mobile and is capable of forming a bond with the lysine residue of the second enzyme (lipoacetyltransferase). In the process of catalysis, the "handle" of lipoamide moves between the first (pyruvate decarboxylase) and the third (dihydrolipoyl dehydrogenase) enzyme. In this way, lipoamide can react both in the B-bound thiamine pyrophosphate and soluble coenzyme A, as well as with the electron-accepting FAD in the third enzyme. The protein part of acetyltransferase, which binds lipoic acid, is very mobile, and this increases the "range" of action of the lipoamide "pen".

The general equation of oxidative decarboxylation of pyruvate is as follows:



α-ketoglutarate dehydrogenase complex is similar to pyruvate dehydrogenase in mechanism of action and structure, but differs in the structure of apoenzymes.

Lipoic acid plays an indispensable role in the oxidation and transport of acyl groups in multicomponent enzyme systems. Its main function is direct participation in oxidative decarboxylation in tissues of α-keto acids (pyruvic and a-ketoglutaric acids).

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