LIVER BIOCHEMISTRY

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Abstract. *The liver performs important functions in our body. The components of food that have entered the gastrointestinal tract are absorbed into the blood and delivered primarily to the liver. The processes of their transformation take place in it, the substances necessary for vital activity are formed. It takes part in all types of metabolism — in the metabolism of proteins, fats, carbohydrates. Only in the liver the albumin protein necessary for the body is formed, many blood clotting factors. It forms and accumulates glycogen — a source of energy for the body. The liver participates in the metabolism of vitamins and trace elements. Its important function is detoxification.*
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It receives substances and medicines formed in the body during digestion and in the process of vital activity. Some of them can be toxic to the body. In the liver, these substances are converted into low-toxic products. It deactivates hormones and other biologically active substances. The liver also neutralizes all kinds of substances foreign to the body, such as allergens, toxins and poisons, turns them into less toxic or easier to remove compounds. It participates in the metabolism of bilirubin, a pigment formed during the natural decay of red blood cells. Impaired liver function in various diseases leads to impaired metabolism and excretion of bilirubin with bile and the appearance of jaundice staining of the skin and sclera. The bile formed in it is important for the digestive processes. Thus, the liver can be called a large chemical plant, where a huge amount of substances is synthesized and transformed. In addition, the liver is a natural blood depot provided by nature itself. When functioning normally, it contains more than half a liter of blood. This allows you to maintain the necessary volume of circulating blood and the work of the circulatory organs, which is especially important for blood loss. The liver is one of the few organs capable of regeneration, that is, recovery. Due to cell division (hepatocytes), the liver can restore its original volume while maintaining only 25-30% of normal tissue. This is very important for maintaining vital functions in various diseases. The liver consists of about 300 billion cells. 80% of which are hepatocytes. Liver cells occupy a central place in the reactions of intermediate metabolism. Therefore, in biochemical terms, hepatocytes are like a prototype of all other cells. The most important functions of the liver are metabolic, depositing, barrier, excretory and homeostatic. The products of the breakdown of nutrients enter the liver from the digestive tract through the portal vein. Complex processes of metabolism of proteins and amino acids, lipids, carbohydrates, biologically active substances (hormones, biogenic amines and vitamins), trace elements, regulation of water metabolism take place in the liver. The liver synthesizes many substances (for example, bile) necessary for the functioning of other organs. The liver accumulates carbohydrates (for example, glycogen), proteins, fats, hormones, vitamins, minerals. Macroergic compounds and structural blocks necessary for the synthesis of complex macromolecules are constantly entering

the body from the liver. In the liver, neutralization (biochemical transformation) of foreign and toxic compounds received from food or formed in the intestine, as well as toxic substances of exogenous origin, is carried out. From the liver, various substances of endo- and exogenous origin either enter the bile ducts and are excreted with bile, or enter the blood, from where they are excreted by the kidneys. The liver performs important functions to maintain a constant blood composition (homeostasis), providing synthesis, accumulation and release into the blood of various metabolites, as well as absorption, transformation and excretion of many components of blood plasma. The liver participates in the metabolism of almost all classes of substances.

Carbohydrate metabolism. Glucose and other monosaccharides enter the liver from blood plasma. Here they are converted into glucose-6-phosphate and other glycolysis products (see p. 302). Glucose is then deposited as a reserve glycogen polysaccharide or converted into fatty acids. With a decrease in glucose levels, the liver begins to supply glucose due to the mobilization of glycogen. If the glycogen supply is exhausted, glucose can be synthesized during gluconeogenesis from precursors such as lactate, pyruvate, glycerin or the carbon skeleton of amino acids.

Lipid metabolism. Fatty acids are synthesized in the liver from acetate blocks. Then they are included in the composition of fats and phospholipids, which enter the blood in the form of lipoproteins. At the same time, fatty acids enter the liver from the blood. For the energy supply of the body, the property of the liver is of great importance to convert fatty acids into ketone bodies, which then re-enter the blood. In the liver, cholesterol is synthesized from acetate blocks. Then cholesterol in the composition of lipoproteins is transported to other organs. Excess cholesterol is converted into bile acids or excreted from the body with bile. Metabolism of amino acids and proteins. The level of amino acids in blood plasma is regulated by the liver. Excess amino acids are broken down, ammonia binds in the urea cycle, urea is transferred to the kidneys. The carbon skeleton of amino acids is included in intermediate metabolism as a source for glucose synthesis (gluconeogenesis) or as an energy source. In addition, the synthesis and cleavage of many plasma proteins is carried out in the liver. Biochemical transformation. Steroid hormones and bilirubin, as well as medicinal substances, ethanol and other xenobiotics enter the liver, where they are inactivated and converted into highly polar compounds.

The liver serves as a place of deposit of the body's energy reserves (the glycogen content can reach 20% of the liver mass) and precursor substances; many minerals, trace elements, a number of vitamins, including iron (about 15% of all iron contained in the body), retinol, vitamins A, D, K, are also deposited here. B12 and folic acid. The constantly changing concentration of substances entering the body and its relative constancy in the internal environment ensure the multifunctional activity of the liver. The main role of the liver is to maintain homeostasis of the internal environment of the body. Although this organ is characterized by many chemical processes occurring in other organs, but in some of them the liver plays a major role. If there is a lack of glucose in the blood, it is restored again with the participation of the liver. Almost all components are concentrated in the gallbladder. The main component is bile acids - cholic, deoxycholic, henodeoxycholic, litocholic. Bile acids are in the form of paired compounds that are involved in the formation of micelles. The liver plays a leading role in the breakdown of colored complex proteins of chromoproteins. In this case, bile pigments are formed. The determination of these pigments in blood and urine as well as the products of their transformation, are widely used for the diagnosis of liver diseases.

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