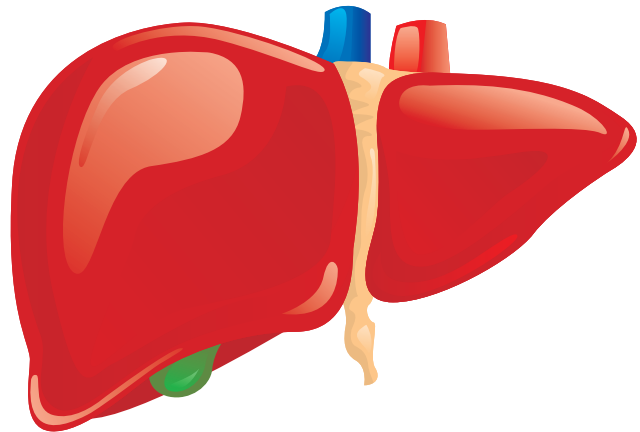


Functions of the Liver

DO YOU KNOW what your liver does? The organ performs about 500 functions necessary for life. It acts as a chemical wizard in your body. Before reading this unit, take a minute to name as many liver functions as you can. Don't worry if you can't name many yet. In this unit, you will learn more about the numerous functions of your liver and how they are important to your health.



Objective:



Explain the functions of the liver.

Key Terms:



| | | |
|---------------|-----------------|------------------|
| albumins | ferritin | Kupffer's cells |
| amino acids | fibrinogen | lipid |
| bile | gall bladder | lipoproteins |
| bile pigments | globulins | metabolism |
| bile salts | gluconeogenesis | phagocytize |
| bilirubin | glycogen | prothrombin |
| carbohydrates | glycogenesis | steroid hormones |
| cholesterol | glycogenolysis | triglycerides |
| duodenum | hemoglobin | urea |
| emulsifying | heparin | |
| fatty acids | ketone bodies | |

Understanding Functions of the Liver

The liver is a reddish-brown organ in the upper right portion of your abdomen. It acts as a filter and regulates most chemical levels in the blood. In addition, it excretes bile, which carries waste products away from the liver and helps digest fats.

COMPONENTS AND FUNCTIONS OF BILE

Bile is a substance secreted by the liver that helps digest fats and serves as a medium for ridding the blood of wastes. The main components of bile are water, bile salts, bile pigments, and cholesterol. **Bile salts** are the most essential part of bile. They aid in the absorption of fats by **emulsifying** or breaking globules into smaller droplets that can be broken down more easily by digestive enzymes, the fats.

Bile pigments are colored compounds formed from the end products of the breakdown of hemoglobin. **Hemoglobin** is the pigment in red blood cells. In addition, **bilirubin** is a red-dish-yellow pigment and is the principal bile pigment. It is further broken down in the intestine where it gives feces its normal brown color.

Cholesterol is a type of lipid. A **lipid** is a category of water-insoluble organic compounds (e.g., fats and oils). Cholesterol is located in cell membranes and is used in the synthesis of bile salts and **steroid hormones**, which are lipid soluble hormones (e.g., sex hormones and cortisone).

Bile is formed by the liver cells and passes through small bile ducts toward larger ducts that carry bile to the gall bladder or the duodenum. The **gall bladder** is a small sac located under the liver that stores bile. The **duodenum** is the first section of the small intestine.

METABOLISM

The liver helps the body metabolize nutrients. **Metabolism** includes all the processes related to how the liver helps convert food for energy, storage, or the synthesis of new molecules.



DIGGING DEEPER...

UNCOVERING ADDITIONAL FACTS: Cholesterol

While cholesterol does serve a purpose in the body, too much can be harmful. Your body produces cholesterol, but additional amounts come from the food you eat, specifically animal products. There are “good” and “bad” types of cholesterol. HDL is the “good” kind, and LDL is the “bad” kind that can clog arteries and lead to a heart attack.

Do your own research on cholesterol. Use the Internet or speak to a health care professional to determine healthy cholesterol levels. If possible, ask your parents to take you to the doctor to get your own cholesterol checked with a simple blood test. You could speak to family members who may already know they have high cholesterol. Find out what they are doing to treat the problem. For example, they may follow a strict, healthy diet and/or take prescription medications.



A blood test can be used to determine cholesterol levels.

The liver stores, releases, and synthesizes **carbohydrates**, which are compounds that are the primary sources of energy for body cells. **Glycogenesis** is the process in which simple sugars, (e.g., glucose, fructose, and galactose) are converted to glycogen. **Glycogen** is a carbohydrate stored in the liver and muscles.

The glycogen is stored in the liver and is broken down by the liver in a process called **glycogenolysis**. Then it is released by the body to raise blood glucose levels as needed. The liver can synthesize glucose from proteins or fats in a process known as **gluconeogenesis**, which helps maintain blood glucose levels.

The liver can store, convert, and synthesize lipids. It stores neutral fats called **triglycerides**. The liver also breaks down **fatty acids**, which are constituents of fat molecules. It then converts the product into **ketone bodies**, which are chemicals produced when fats are excessively used as energy sources. In addition, the liver synthesizes cholesterol and **lipoproteins**, which are compounds that are combinations of lipids and proteins. Lipoproteins can combine with cholesterol and fats. The water-soluble lipoproteins can transport fats and cholesterol to and from body cells via the bloodstream.

The liver synthesizes proteins and chemically converts **amino acids**, which are the building blocks of proteins. About 50 grams of protein are synthesized from amino acids each day. Some examples are albumins, globulins, fibrinogen, prothrombin, and heparin. **Albumins** are proteins that help maintain water balance between blood and tissue. **Globulins** are proteins with antibodies that help fight infections. **Fibrinogen** and **prothrombin** are proteins needed for blood clotting. **Heparin** is a protein that is an anticoagulant.

The liver can convert amino acids into simpler molecules and toxic ammonia. The ammonia is converted to less toxic **urea**, a nitrogenous waste, which is eliminated by the kidneys in urine.

The liver stores vitamins, including vitamins A, B₁₂, D, E, and K. It also stores minerals, such as iron, which is combined with a protein to make ferritin. **Ferritin** is a storage molecule from which iron can be released when needed.

DETOXIFICATION

The liver can detoxify, alter, or excrete into bile substances (e.g., drugs and antibiotics) and steroid hormones (e.g., sex hormones and cortisone). The liver also makes toxic substances more water soluble so they can be excreted from the body in the urine.

Kupffer's cells are star-shaped cells in the blood-filled spaces of the liver that can **phagocytize** or ingest and destroy microbes and debris from worn-out blood cells.

Byproducts of detoxification are excreted into the blood or the bile. Water-soluble byproducts enter the blood. They are filtered out by the kidneys and leave the body in urine. Byproducts in bile enter the intestines and leave in the form of feces.

Summary:



The liver acts as a filter and regulates most chemical levels in the blood. It also excretes bile, which carries waste products away from the liver and helps digest fats. Bile is formed by the liver cells and passes through small bile ducts toward larger ducts that carry bile to the gall bladder or the duodenum. The liver helps the body metabolize nutrients. The liver stores, releases, and synthesizes carbohydrates and lipids. It synthesizes proteins, chemically converts amino acids, and stores many vitamins and minerals.

Checking Your Knowledge:



1. What are the liver's main functions?
2. What are the main components of bile?
3. What is cholesterol, and what does it do?
4. What vitamins and minerals are stored in the liver?
5. What are Kupffer's cells, and what can they do?

Expanding Your Knowledge:



Create a study guide for yourself by listing and defining all the key terms in this unit. Then list as many liver functions as you can. Compare lists with your classmates to add any you forgot. Use these lists to quiz one another in preparation for the unit test.

Web Links:



Alcohol's Effects on the Liver

<http://pubs.niaaa.nih.gov/publications/arh21-1/05.pdf>

Cholesterol

http://www.heart.org/HEARTORG/Conditions/Cholesterol/CholestrolATH_UCM_001089_SubHomePage.jsp

How the Liver Works

<http://www.lpch.org/DiseaseHealthInfo/HealthLibrary/digest/liverant.html>