Liver function

The liver has a large number of functions aimed at maintaining homeostasis.

Metabolic functions

They include the biosynthesis of the body's own compounds, their storage, conversion and breakdown into molecules capable of excretion.

Carbohydrate metabolism

One of the most important functions of the liver is to maintain a constant concentration of glucose in the blood. In hepatocytes, glycogen is synthesized from glucose through the process of Glycogenesis during **elevated glycemia**. If the concentration of glucose in the blood **is lower**, glucose is released from glycogen stores using glycogenolysis. If there are no more glycogen stores in the cell, hepatocytes use other substrates to synthesize glucose:

- **non-sugar substrates** (glycerol, lactate and glucogenic amino acids – gluconeogenesis),
- **monosaccharides** (fructose and galactose),
- **non-sugar substrates** (amino acids).

Regulation of gluconeogenesis in the liver is controlled by hormones. Cortisol, glucagon and adrenaline activate it, while insulin inhibits it. Hepatocytes have insulin-independent transporters built into the membrane , at the same time they contain the enzyme **glucose-6-phosphatase** (muscles do not have this enzyme), which enables the release of glucose from glucose-6-phosphate. Metabolism ofu fructose and galactose also occurs here.

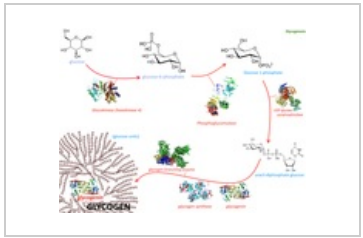
Amino acid and protein metabolism

Deamination and transamination of amino acids take place in the liver . During **deamination** the body gets rid of energy-unusable nitrogen. Therefore, urea, is synthesized in the liver , which is then excreted from the body in urine. **The carbon skeletons** of amino acids are used to synthesize glucose and fatty acids. In addition to urea, the liver synthesizes most blood plasma proteins, coagulation factors and is the main site of purin nucleotide synthesis.

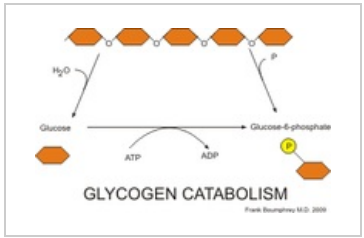
Lipid metabolism

Fatty acids are transported to the liver by means of chylomics or by the formation of an albumin-fatty acid complex. Their β-oxidationtakes place here, with**increased** formation of acetyl-CoA followed by ketogenesis. The liver is unable to metabolize the resulting ketone bodies, their utilization takes place in extrahepatic tissues. Other important processes include the synthesis of fatty acids, the synthesis of triacylglycerols and phospholipids. These are transported using lipoprotein particles to other tissues of the body. Cholesterol, is synthesized in the liver , and at the same time it is converted into **bile acids**.

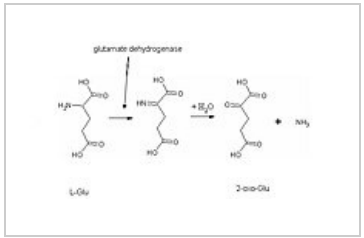
🔎 *For more information see Lipid and Lipoprotein Metabolism.*



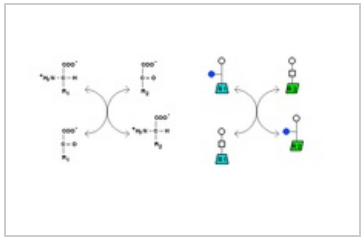
Glycogenesis

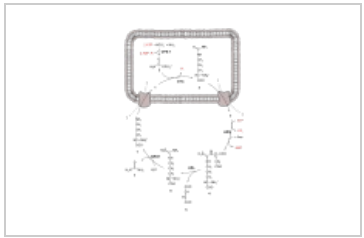


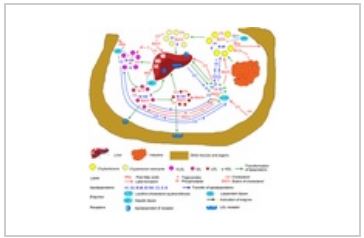
Glycogenolysis

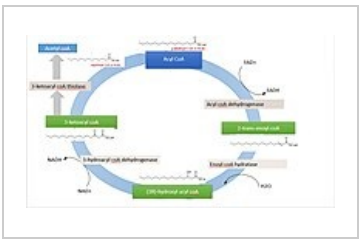


Deamination

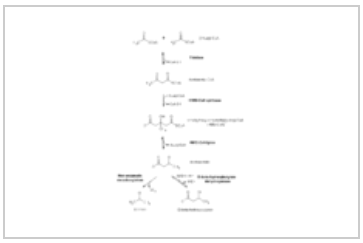

Transamination


Urea cycle


Lipoprotein metabolism



Beta oxidation



Ketogeneze

Thermoregulation function

The liver produces a large amount of heat, which is related to its high metabolic activity.

Storage function

The liver can serve as a blood reservoir. Blood can be expelled from them under certain circumstances (e.g. in case of circulatory hypovolemia). The following are also stored in the liver:

- glucose (in the form of glycogen),
- metals: iron (bound in the form of ferritin), copper, cobalt (in the form of B12)
- Vitamins: vitamin A – supply for 10 months, vitamin D – 2–3 months, vitamin B_{12} – several years.[1]

Exclusion function

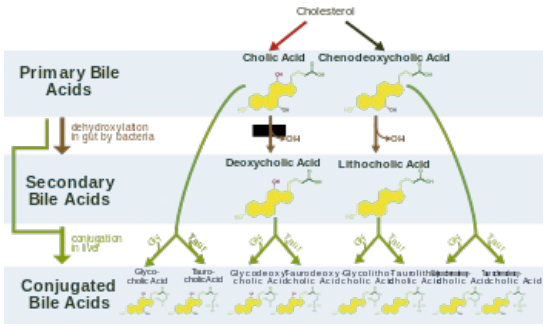
For example steroid hormones and bilirubin are inactivated in the liver by transformation reactions and converted to more polar metabolites that can be excreted.

Secretion functions

The liver makes approximately 500–1000 ml[2] of bile per day.

Bile consists of::

- bile acids and their salts (used in lipid emulsification),,
- cholesterol,
- phospholipids (increase the solubilizing ability of bile acids),
- bilirubin (degradation product of heme),,
- protein a minerals.



Bile acid metabolism

Synthetic functions

Synthesis takes place in the liver:

1. of glucose (gluconeogenesis) and glycogen (glycogenesis),
2. ketolates,
3. fatty acids, cholesterol, triacylglycerols and phospholipids,
4. urea,
5. plasmatic proteins,
6. fibrinogen and coagulation factors,
7. angiotenzinogen,
8. somatomedin,
9. VLDL and HDL type lipoproteins,
10. erythropoietin – about 10% of the total production of erythropoietin occurs in the liver[1] (the rest in the kidneys).

Detoxification and defense functions

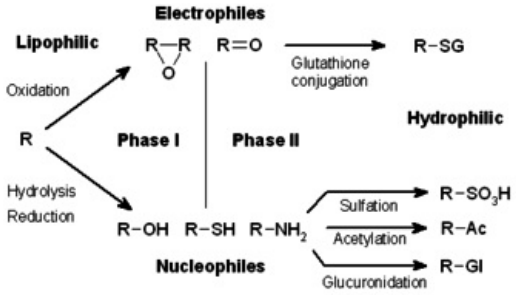
Microorganisms that have passed through the intestinal barrier or various toxic substances can reach the liver via the portal blood. Liver enzymes and phagocytic Kupffer cells prevent their penetration into the systemic circulation.

Enzymatic systems of the liver break down **exogenous** látky (xenobiotika) substances (xenobiotics), which include medicines, food additives, etc. The biotransformation of these substances takes place in two phases. In **the first phase** the substance is transformed by oxidation, hydroxylation, reduction or hydrolysis, in **the second phase** it is conjugated with other substances (synthesis), and then it is excreted in the urine.

🔎 *For more information see biotransformation.*

Other functions

- Hematopoiesis in the fetal period.
- Participation in maintaining the acid-base balance of the organism.
- Influencing the function and effect of some hormones – inactivation if inzslin for example.



Metabolism of xenobiotics

Links

External Links

- Liver - Anatomy and function (YouTube) (https://www.youtube.com/watch?v=O71niTozP-o)

Related articles

- Liver
- Biochemical examinations of the liver • Diagnostic imaging methods in the examination of the gallbladder and bile ducts
- Hepatomegaly • Hepatosplenomegaly • Sarcoidosis of liver • Liver Cysts and abscess • Liver Failure • Cirrhosis • Hepatitis • Liver tumors • Liver injuries • Portal hypertension
- Development of the liver and gallbladder
- Bile ducts • Gallbladder • Spleen • Kidney

References

1. KITTNAR, Otomar, et al. *Lékařská fyziologie.* 1. edition. Praha : Grada, 2011. 790 pp. ISBN 978-80-247-3068-4.
2. MATOUŠ, Bohuslav. *Základy lékařské chemie a biochemie.* 1. edition. Galén, 2010. 540 pp. ISBN 9788072627028.

Used literature

- ČIHÁK, Radomír. *Anatomie.* 3. edition. Grada Publishing, a.s., 2011. 287 pp. ISBN 9788024738178.
- KITTNAR, Otomar, et al. *Lékařská fyziologie.* 1. edition. Praha : Grada, 2011. 790 pp. ISBN 978-80-247-3068-4.
- KOOLMAN, Jan – RÖHM, Klaus-Heinrich. *Barevný atlas biochemie.* 1. edition. Praha : Grada, 2012. 512 pp. ISBN 978-80-247-2977-0.
- MYSLIVEČEK, Jaromír – TROJAN, Stanislav. *Fyziologie do kapsy.* Levou zadní edition. Praha : Triton, 2004. 466 pp. vol. 103. ISBN 80-7254-497-7.
- TROJAN, Stanislav – TROJAN, Stanislav, et al. *Lékařská fyziologie.* 4. edition. Praha : Grada, 2003. 772 pp. ISBN 80-247-0512-5.