

LIVER

Characterization of hepatic tissue

- structural units of hepatic tissue (lobulus, acinus)
- microcirculatory system (position of portal triad, central vein)
- metabolic consequences of the microcirculatory system (metabolic characterization of periportal, intermedier and pericentral zones)
- risk regions within hepatic tissue according to absorption of different compounds and hypoxia
- main cell types and their characterization
- structure of hepatocytes, importance of cell organelles

Central role of liver in the intermediate metabolism

Carbohydrate metabolism

- adaptation of carbohydrate metabolism (resorption and postresorption phases, starvation)
- glucose control function (regulation of blood glucose level), storage of glycogen, role of GLUT 2 and glucokinase as glucose sensor
- Cori-cycle, glucose-alanin cycle
- importance of pentose-phosphate cycle in liver
- specific metabolic pathways (metabolism of fructose and galactose); uronic acid cycle

Lipid metabolism

- adaptation of lipid metabolism (resorption and posztresorption phases)
- storage of triacylglycerols and phospholipids
- specific metabolic pathways: synthesis and importance of ketone bodies
- metabolism of VLDL and HDL
- metabolism of cholesterol: complex regulation of cholesterol biosynthesis in the liver; (synthesis of bile acids, see below)

Amino acid metabolism

- special issues of amino acid acid metabolism
- urea cycle, hyperammonemia
- glutamine cycle
- synthesis of plasma proteins

Porphyrine and iron metabolism in the liver

- formation and circulation of bilirubin
 - ❖ types and laboratory background (differential diagnosis) of jaundice
 - ❖ inherited bilirubin disorders

Bile production

- synthesis, circulation and function of bile acids
- composition of bile
- transport mechanism in bile canaliculi
- ❖ molecular basics of bile stone formation

Other pathobiochemical aspects:

- ❖ biochemical signs of liver functional problems; liver function laboratory tests
- ❖ mechanism of fatty liver formation

Biotransformation

- definition of biotransformation, its biological importance and main phases
- reactions of first phase, formation of reactive side chains (hydrolysis, reduction oxidation)
- cytochrome P 450 system and its action
- classification of CYP enzyme family members with examples
- ❖ adduct-formation (DNA, protein) and its consequences (mutation, carcinogenesis)
- formation of reactive oxygen radicals, its role and ways of elimination
- reactions of second phase, conjugation reactions (conjugation with glucuronic acid, sulphate, glycine, glutathione; acetylation, methylation)
- transport/elimination of biotransformation products
- induction and inhibition of enzymes of biotransformation, addiction, interactions, importance of therapeutic drug monitoring

Biochemical effects of alcohol

- fate of ethanol in the human body (first pass mechanism)
- role of ADH and MEOS (+ catalase) system
- ❖ metabolic effects of alcohol: imbalance of reduced coenzymes, fatty liver, lactate acidosis, ketosis
- ❖ toxic effects of acetaldehyde
- ❖ harmful effects of reactive oxygen radicals
- ❖ lack of proteins, amino acids, vitamins and minerals in case of enhanced alcohol intake
- ❖ metabolic and circulatory consequences of liver cirrhosis, their interaction, definition of hepatic coma
- ❖ fate of methanol, toxicity of converted products
- ❖ competitive inhibition of methanol degradation