PROGRAMME OF THE SUBJECT
„MEDICAL BIOCHEMISTRY 1“

STUDY BRANCH: „GENERAL MEDICINE“
2ND YEAR – MEDICAL FACULTY UK

LECTURES
Winter semester 2018/2019

1st week: 24.09. – 28.09.2018
**Lecturer:** Doc RNDr. UHLÍKOVÁ

2nd week: 01.10. – 05.10.2018
**Production of energy in the cell - terminal oxidation:** Formation of proton gradient in mitochondria. Utilization of proton gradient in energy metabolism of the cell. Structure and function of ATPase in mitochondrial membrane, synthesis of ATP by oxidative phosphorylation.
**Lecturer:** Doc RNDr. UHLÍKOVÁ

3rd week: 08.10. – 12.10.2018
**Lecturer:** Doc RNDr. UHLÍKOVÁ

4th week: 15.10. – 19.10.2018
**Metabolism of carbohydrates - glycolysis**
**Lecturer:** Doc. MUDr. RENDEKOVÁ

5th week: 22.10. – 26.10.2018
**Metabolism of carbohydrates – gluconeogenesis, pentose phosphate pathway**

**Lecturer:** Doc. MUDr. RENDEKOVÁ

**6th week:** 29.10. – 02.11.2018

**Metabolism of lipids – oxidation and synthesis of fatty acid**
Digestion of triacylglycerols and phospholipids in gastrointestinal tract. Mitochondrial system of β-oxidation of fatty acids - its meaning. Synthesis of malonal-CoA and synthesis of fatty acids by multienzyme complex in cytosol.

**Lecturer:** Doc. MUDr. RENDEKOVÁ

**7th week:** 05.11. – 09.11.2018

**Metabolism of triacylglycerols, phospholipids and steroids:** Synthesis of triacylglycerols, phospholipids and sphingolipids. Utilization of acetyl-CoA for the synthesis of ketone bodies and isoprenoids. HMG-CoA reductase, meaning of the enzyme for the synthesis of cholesterol. Synthesis of bile acids and their meaning for the digestion of lipids.

**Lecturer:** Doc. MUDr. RENDEKOVÁ

**8th week:** 12.11. – 16.11.2018

**Function of lipoproteins, hyperlipoproteineamias:** Metabolism of arachidonic acid and its metabolites. Transport of endogenous lipids. Synthesis of lipoproteins in the intestine and in the liver. Recirculation of cholesterol and function of HDL. Apoproteins and their roles.

**Lecturer:** Doc. MUDr. RENDEKOVÁ

**9th week:** 19.11. – 23.11.2018

Degradation of proteins and **general reactions of amino acid metabolism:** Intake of proteins and nitrogen balance, proteolysis in digestive tract and in the cells of the body. General reactions of amino acids metabolism, connection of essential and non-essential amino acids with intermediary metabolism. Decarboxylation of amino acids. Processes related to ammonia metabolism, transamination, deamination (direct and indirect), fixation and transport of ammonia.

**Lecturer:** Doc RNDr. UHLÍKOVÁ

**10th week:** 26.11. – 30.11.2018

General reactions of amino acid metabolism – **production and detoxification of ammonia**

**Lecturer:** Doc RNDr. UHLÍKOVÁ

**11th week:** 03.12. – 07.12.2018

**Metabolism of individual amino acids and defects in their metabolism:** Metabolism of alanine, glycine, serine, threonine, valine, leucine and isoleucine. Metabolism of aspartate, glutamate, methionine, cysteine, phenylalanine, tyrosine. Conversion of some amino acids into biologically important products.

**Lecturer:** Doc RNDr. UHLÍKOVÁ

**Metabolism of tetapyrrols:** Synthesis of tetapyrrols de novo, synthesis of protoporphyrine and its conversion into heme. Porphyrias - types and diagnosis. Degradation of tetapyrrols, biodegradation of hemoglobin, release of iron from heme, conversion of heme into bile

**Lecturer:** Doc. MUDr. RENDEKOVÁ
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SEMINARS AND PRACTICAL EXERCISES
Winter semester 2018/2019

1st week 24.09. – 28.09.2018
Seminar: Introduction into biochemistry. Safety of work in chemical laboratory
Structure of the cell and function of subcellular compartments in intermediary metabolism. Oxidation-reduction processes in living systems and their compartmentation. Energy-rich compounds
Practical part: Determination of the activity of lactate dehydrogenase
Application in medicine: Meaning of cellular compartmentation for basal processes in metabolism of carbohydrates and lipids

2nd week: 01.10. – 05.10.2018
Seminar: Regulation of metabolic processes at the level of the cell and at the level of whole organism. Regulation of enzyme activities – feed back, feed forward, allosteric enzymes. Covalent modification of enzymes. Mechanism of action of signal molecules.

3rd week: 08.10. – 12.10.2018
Seminar: Transport of compounds across biological membranes
Practical part: Determination of the dependence of Ca²⁺-ATPase activity on the presence of transported ions
Application in medicine: Specific characteristics of transport for various compounds in the cells of individual tissues

4th week: 15.10. – 19.10.2018
Practical part: Determination of glucose and lactate in the tissue of cerebral cortex in vitro in aerobic and anaerobic conditions
Application in medicine: Result of oxygen deficiency for energy yield and its consequences. Main reasons of hypoxia in pathological conditions in medicine.

5th week: 22.10. – 26.10.2018
Seminar: Effect of short starvation on the level of glucose in the blood and amount of glycogen in the liver.
Practical part: Determination of glycogen in tissues, determination of glucose in serum
Application in medicine: Explanation of metabolic changes during short of prolonged
starvation. Understanding of regulation of carbohydrate metabolism in various nutritional conditions

6th week: 29.10. – 02.11.2018
Seminar: Hormonal regulation of glucose metabolism and regulation of blood glucose level
Practical part: Glucose tolerance test
Application in medicine: Evaluation of blood glucose level and main causes of changes of glycaemia, oral glucose tolerance test and its performance

7th week: 05.11. – 09.11.2018
Practical part: Determination of ketone bodies in the blood in physiological conditions and in diabetes mellitus
Application in medicine: Explanation of the causes of increased ketone bodies levels in non-physiological and pathological conditions (starvation, diabetes mellitus).

8th week: 12.11. – 16.11.2018
Seminar: Metabolism of adipose tissue. Synthesis of endogenous triacylglycerols and its mobilization. Transport of lipids by the blood - lipoproteins
Practical part: Determination of unesterified fatty acids in the blood
Application in medicine: Basal procedures in examination of plasma lipids and lipoproteins, preparation of the patient before examination.

9th week: 19.11. – 23.11.2018
Practical part: Determination of TAG, total cholesterol and HDL-cholesterol in blood, Calculation of LDL-cholesterol.
Application in medicine: Evaluation of the results obtained by examination of plasma lipids, basis of differentiation of hyperlipoproteinaemias.

10th week: 26.11. – 30.11.2018
Seminar: Enzymes of amino acids nitrogen metabolism
Practical part: Determination of alanine aminotransferase and aspartate aminotransferase
Application in medicine: Understanding of the factors leading to the changes in enzyme activities in blood plasma. Application of determination of AST and ALT in evaluation of liver and myocardial damage.

11th week: 03.12. – 07.12.2018
Seminar: Detoxification of ammonia, production of urea
Practical part: Determination of urea in blood serum and in urine
Application in medicine: Urea in blood serum and in urine as important parameter in clinical biochemistry, application of urea determination for evaluation of defects of kidney functions.

Seminar: Role of the kidneys in maintenance of homeostasis and excretion of waste products of metabolism. Synthesis of creatine and creatinine. Examination of glomerular filtration rate and tubular functions, creatinine clearance.

Practical part: Determination of creatinine in blood serum and in urine. Creatinine clearance.

Application in medicine: Application of creatinine and urea determination for evaluation of kidney damage.