Course Title: Biochemistry with Chemistry
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Responsible person/contact: Dr hab. Maria Wróbel /e-mail: mbwrobel@cyf-kr.edu.pl
Address: Chair of Medical Biochemistry, Kopernika 7
Year: 1-6
Total number of hours: **190**
Lectures: **76**
Seminars: **30**
Labs/Practicals: **54**
Others (e.g. recitation): **18**
Exams: **12**

Conduct/Dress Code: **white coat (labs)**

Student's Evaluation:
- grading scheme: Students have to achieve 60% of total points (MCQ tests: partial, final and labs)
- absence allowed: **labs - 1 per each semester**
- type of the final crediting: **MCQ test – June 9, 2016**
- retake information: **MCQ test – September 25, 2017**
ECTS: 13

20th week Feb 20-24	Mo	12.15-13.45	sem 9	2	Gr. A,B Gr.C,D	**Carbohydrates.** Definitions and classification. Monosaccharides. Fischer projection formulas. Chirality – L and D sugars. The cyclic hemiacetal structures of monosaccharides – Haworth projections. Pyranose and furanose structures. Anomers. Mutarotation. Epimers. Reduction and oxidation of monosaccharides. Glycosides. Derivatives of monosaccharides of biological importance. Disaccharides. Polysaccharides. Starch and glycogen. Glycosaminoglycans. Glycoproteins. Q	dr B. Stopa dr S. Olszowski (k) x2	room 5 CH
	Tu	12.00-13.45	Lec 21	2	Whole class	**Metabolic routes in organisms.** Overview of metabolic routes. Bioenergetics. Thermodynamics: free energy, chemical equilibria, group transfer potential. Phosphorylation at the substrate level. Coupling of the thermodynamically favourable and unfavourable reactions. Oxidation of NADH and $FADH_2$.	Dr. M. Wróbel	LH
		14.00-15.30	sem 9	2	Gr.E,F Gr.G,H Gr. I,J	**Carbohydrates.** Definitions and classification. Monosaccharides. Fischer projection formulas. Chirality – L and D sugars. The cyclic hemiacetal structures of monosaccharides – Haworth projections. Pyranose and furanose structures. Anomers. Mutarotation. Epimers. Reduction and oxidation of monosaccharides. Glycosides. Derivatives of monosaccharides of biological importance. Disaccharides. Polysaccharides. Starch and glycogen. Glycosaminoglycans. Glycoproteins. Q	dr B. Stopa dr S. Olszowski dr J. Dulińska-Litewka	room 5 room 8 CH
	Th	14.15-16.00	Lec 22	2	Whole class	**Carbohydrate metabolism I.** Digestion and absorption of carbohydrates from intestinal tract. Central role of G-6-P in intracellular carbohydrate metabolism. Oxidation of glucose and other monosaccharides: glycolysis and pentose phosphate shunt, individual reactions and control sites (regulatory mechanisms). Oxidative decarboxylation of pyruvate.	dr. M. Wróbel	LH
	Fr	10.00-13.00	Lab 11	4	Gr. A Gr. B Gr. C Gr. D	**Laboratories.** "From gene to protein" – part 4.	dr. D. Gil Dr. K. Kocemba dr Halina Jurkowska dr A. Bentke	Lab 1 Lab 2 Lab 3 Lab 4
21st week	Mo	10.00-13.00	Lab 11	4	Gr. I Gr. J	**Laboratories.** "From gene to protein" – part 4.	Dr. K. Kocemba (k) x3 dr D. Ciołczyk-Wierzbicka	lab 3 lab 4

Feb 27-Mar 3		12.15-13.45	sem 10	2	Gr. A,B	**Reactive oxygen species (ROS).** The tetraelectron reduction of the molecular oxygen (O_2). ROS – examples, synthesis in vivo, Fenton reaction. Metabolic and toxic effects of ROS. Oxidative stress. Enzymatic and nonenzymatic defence of organism against ROS:SOD, glutathione and its role (peroxidase, reductase system), catalase, anioxidants (vitamins, albumin, flavonoids, poliphenols). (4 student's presentations). Q	dr. B. Piekarska	room 5
					Gr.C,D		Dr. M. Wróbel	CH
	Tu	12.00-13.45	Lec 23	2	Whole class	**Carbohydrate metabolism II.** Gluconeogenesis. Relationships between oxidative pathways of glucose metabolism and synthesis of glucose from various low molecular weight metabolites. Cori cycle. Alanine cycle.	dr. M. Wróbel	LH
		14.00-15.30	sem 10	2	Gr. E,F	**Reactive oxygen species (ROS).** The tetraelectron reduction of the molecular oxygen (O_2). ROS – examples, synthesis in vivo, Fenton reaction. Metabolic and toxic effects of ROS. Oxidative stress. Enzymatic and nonenzymatic defence of organism against ROS:SOD, glutathione and its role (peroxidase, reductase system), catalase, anioxidants (vitamins, albumin, flavonoids, poliphenols). (4 student's presentations). Q	dr. H. Jurkowska	room 5
					Gr.G,H		dr J. Dulińska-Litewka (k) x2	room 8
					Gr. I,J		Dr. M. Wróbel	CH
	Th	14.15-15.45	Lec 24	2	Whole class	**Carbohydrate metabolism III**. Glycogen, glycogenolysis and glycogenogenesis. Futile cycles. Regulation of glycogen degradation and synthesis. Tissue specificity of carbohydrates metabolism.	dr. M. Wróbel	LH
	Fr	10.00-13.00	Lab 11	4	Gr. E	**Laboratories.** "From gene to protein" – part 4.	dr. D. Gil	Lab 1
					Gr. F		Dr. K. Kocemba	Lab 2
					Gr. G		dr Halina Jurkowska	Lab 3
					Gr. H		dr A. Bentke	Lab 4
22nd week Mar 6-10	Mo	12.15-13.45	sem 11	2	Gr. A,B	**Lipids.** Classification, naming and functions of lipids. Fatty acids. Simple lipids – triacylglicerols, waxes. Phospholipids: glycerol and sphingophospholipids. Glycolipids. Cholesterol and derivatives (bile acids, hormones). Glycolipids. Isoprenoids – dolicholes, lipid soluble vitamines, coenzyme Q. (4 student's presentations) Q	dr D. Ciołczyk-Wierzbicka	Room 5
					Gr.C,D		dr S. Olszowski	CH
	Tu	12.00-13.45	Lec 25	2	Whole class	**Lipid metabolism I**. Digestion and absorption of lipids from intestinal tract. Lipoproteins and transport of lipids in organism. Central role of fatty acyl-CoA in intracellular lipids metabolism. Oxidation of saturated and unsaturated fatty acids. Ketone bodies.	dr. P. Laidler/dr.J. D-L	LH
		14.00-15.30	sem 11	2	Gr. E,F	**Lipids.** Classification, naming and functions of lipids. Fatty acids. Simple lipids – triacylglicerols, waxes. Phospholipids: glycerol and sphingophospholipids. Glycolipids. Cholesterol and derivatives (bile acids, hormones). Glycolipids. Isoprenoids – dolicholes, lipid soluble vitamines, coenzyme Q. (4 student's presentations) Q	dr D. Ciołczyk-Wierzbicka	r. 5
					Gr.G,H		dr S. Olszowski	r. 8
					Gr. I,J		dr B. Stopa(k) x2	CH
	Th	14.15-15.45	Lec 26	2	Whole class	**Lipid metabolism II.** Synthesis of saturated fatty acids. Fatty acids synthase in lower and higher organisms. Regulation of oxidation and synthesis of palmitoyl-CoA. Elongation and desaturation of fatty acids. Microsomal electron transport - cytochrome b5.	dr. P. Laidler/dr.J. D-L	LH
	Fr	10.00-13.00	Lab 12	4	Gr. E	**Laboratories.** "From gene to protein" – part 4.	dr D. Ciołczyk-Wierzbicka	Lab 1
					Gr. F		dr B. Ostrowska	Lab 2
					Gr. G		dr D. Gil	Lab 3
					Gr. H		dr. A. Bentke	Lab 4
23rd week Mar 13-17	Mo	10.00-13.00	Lab 12	4	Gr. I	**Respiratory chain.**	dr J. Dulińska-Litewka	lab 3
					Gr. J		dr. B. Piekarska	lab 4
	Tu	12.00-13.45	Lec 27	2	Whole class	**Lipid metabolism III.** Synthesis of cholesterol and other steroids. Microsomal electron transport - cytochrome P450. Arachidonic acid and synthesis of eicosanoids. Cyclooxygenation and lipooxygenation - prostaglandines and leukotrienes. Diseases related to lipid metabolism.	dr. P. Laidler/dr.J. D-L	LH
		14.00-15.30	Sem 12	2	Gr. E,F	**Lipoproteins.** (4 student's presentations)	dr. B. Piekarska	Room 5
					Gr.G,H		dr J. Dulińska-Litewka	Room 8
					Gr. I,J		dr. M. Wróbel	CH
	Fr	10.00-13.00	Lab	4	Gr. A	**Respiratory chain.**	dr J. Dulińska-Litewka	Lab 1

			12		Gr. B		dr. B. Ostrowska	Lab 2
					Gr. C		dr K. Kocemba	Lab 3
					Gr. D		Dr A. Bentke	Lab 4
24th Mar 20-24	Mo							
		12.15-13.45	Sem 12	2	Gr. A,B	**Lipoproteins.** (4 student's presentations)	dr. B. Piekarska	room 5
					Gr.C,D		Dr. M. Wróbel (k) x 2	CH
	Tu	12.00-13.45	Lec 28	2	Whole class	**Amino acid metabolism I.** Digestion of proteins and absorption of amino acids from intestinal tract. Cystinuria. Metabolic fates of amino acid nitrogen. Transdeamination and urea synthesis. Connections between urea and Krebs cycles. Defects in the urea cycle enzymes. Ammonia toxicity.	Prof. P. Laidler/dr. M. Wróbel	LH
	Th	14.15-15.45	Lec 29	2	Whole class	**Amino acid metabolism II.** Conversion of amino acids C-skeletons to Krebs cycle intermediates. Gluco- and ketogenic amino acids. Endogeneous and exogeneous amino acids. Synthesis of endogeneous amino acids. Folic acid and metabolism of one carbon units. Vitamin B12. Homocystinuria.	Prof. P. Laidler/dr. M. Wróbel	LH
	Fr	10.00-13.00	Lab 13	4	Gr. A	**Glycolysis.**	Dr. A. Bentke	Lab 1
					Gr. B		Dr. H. Jurkowska(k)x3	Lab 2
					Gr. C		Dr. B. Piekarska	Lab 3
					Gr. D		Dr. B. Ostrowska	Lab 4
25th week Mar 27-31	Mo	10.00-13.00	Lab 13	4	Gr. I	**Glycolysis.**	dr D. Ciołczyk-Wierzbicka	lab 3
					Gr. J		Dr B. Ostrowska	lab 4
	Tu	12.00-13.45	Lec 30	2	Whole class	**Amino acid metabolism III.** Metabolism of chosen amino acids: methionine, tryptophan, phenylalanine, tyrosine, branched-chain amino acids. Amino acids as precursors of signal molecules. Inherited diseases of amino acid metabolism: methylmalonyl-CoA mutase deficiency, phenylketonuria, alkaptonuria, albinism, maple syrup urine disease (MSUD).	Prof. P. Laidler/dr. M. Wróbel	LH
		14.00-15.30	sem 13	2	Gr. E,F Gr.G,H Gr. I,J	**Heme.** Biosynthesis, degradation, jaundice, porphyrias. (3 student's presentations) Q	Dr B. Piekarska (k) x 2	Room 5
							dr K. Kocemba	Room 8
							dr. M. Wróbel	CH
	Th	14.15-15.45	Sem 13	2	Gr. A,B	**Heme.** Biosynthesis, degradation, jaundice, porphyrias. (3 student's presentations) Q	Dr. B. Piekarska	LH
					Gr.C,D		dr. M. Wróbel	CH
	Fr	10.00-13.00	Lab 13	4	Gr. E	**Glycolysis.**	Dr. A. Bentke	Lab 1
					Gr. F		Dr. H. Jurkowska(k)x3	Lab 2
					Gr. G		Dr. B. Piekarska	Lab 3
					Gr. H		dr J. Dulińska-Litewka	Lab 4
26th week Apr 3-7	Mo							
		12.15-13.45	Rec 5	2	Gr. A,B	**Review.** Carbohydrates and lipids.	dr. B. Piekarska	Room 5
					Gr.C,D		Dr. M. Wróbel	CH
	Tu	12.00-13.45	Lec 31	2	Whole class	**Purine and pyrimidine nucleotides metabolism I.** Metabolic functions of nucleotides. Synthesis of purine and pyrimidine nucleotides de novo. Salvage pathway of synthesis of nucleotides. Degradation of purines and pirimidines. Regulation of purines and pyrimidines metabolism.	dr. B. Piekarska	LH
		14.00-15.30	rec 5	2	Gr. E,F	**Review.** Carbohydrates and lipids.	Dr. B. Piekarska	Room 5
					Gr.G,H		dr J. Dulińska-Litewka	Room 8
					Gr. I,J		dr. M. Wróbel	CH
	Th	14.15-15.45	**Ex. 3**	2	Whole class	**Test 3.** Oxidative phosphorylation, TCA, carbohydrates and lipids metabolism.	dr. M. Wróbel dr. B. Piekarska	CH LH
	Fr	10.00-13.00	Lab 14	4	Gr.E	**Free radicals.**	dr K. Kocemba	Lab 1
					Gr. F		dr D. Ciołczyk-Wierzbicka	Lab 2

					Gr. G		dr. D. Gil	Lab 3
					Gr. H		dr J. Dulińska-Litewka	Lab 4
27th week Apr 10-11 Mo-Tu	Tu	12.00-13.45	Lec 32	2	Whole class	**Purine and pyrimidine nucleotides metabolism II.** Synthesis of deoxyribonucleotides. Nucleotide coenzyme synthesis. Regulation of purine and pyrimidines metabolism. Discussion on selected topics related to nucleotide metabolism.	dr. B. Piekarska	CH
		14.00-15.30	rec 6	2	Whole class	**Discussion on Exam 3.**	dr. M. Wróbel	CH
Apr 17-21						EASTER		
28th week Apr 24-28	Mo	10.00-13.00	Lab 14	4	Gr. I	**Free radicals.**	Dr D. Gil	Lab 3
					Gr. J		Dr A. Bentke	Lab 4
	Tu	12.00-13.45	Lec 33	2	Whole class	**Nutrition.** Macronutrients and dietary fibers. Vitamins. The minerals - calcium and phosphorus, iron magnesium, zinc, cooper and manganese, iodine, selenium. Nutrient and energy balance; control of energy balance. Disturbances of energy balance.	dr. B. Piekarska	CH
		14.00-15.30	rec 7	2	Gr. E,F	**Recitation.** Review of amino acid and nitrogenous compound metabolism.	Dr B. Piekarska	Room 5
					Gr.G,H		dr J. Dulińska-Litewka	Room 8
					Gr. I,J		Dr M. Wróbel	CH
	Th	14.15-15.45	rec 7	2	Gr. A,B	**Recitation.** Review of amino acid and nitrogenous compound metabolism.	dr. B. Piekarska	Room 8
					Gr. C,D		Dr M. Wróbel	CH
	Fr	10.00-13.00	Lab 14	4	Gr. A	**Free radicals.**	dr K. Kocemba	Lab 1
					Gr. B		Dr H. Jurkowska	Lab 2
					Gr. C		dr D. Gil (k) x 3	Lab 3
					Gr. D		dr. A. Bentke	Lab 4
29th Week May 4-5 Th-Fr	Mo							
	Th	**16.00**-17.45	**Exam 4**	2	Whole class	**Test 4.** Metabolism of amino acid and nitrogenous compounds.	dr. M. Wróbel dr B. Piekarska	CH LH
30th week May 8-12	Mo	12.15-13.45	Sem 14	2	Gr. A,B	**Case II.** Reperfusion injury after hypoxia. Metabolism of heart muscle. (!Note supplementary materials on the website).	Dr B. Piekarska	Room 5
					Gr. C,D		Dr. D. Gil	CH
	Tu	12.00-13.45	Rec 8			**Discussion on Exam IV.**	dr. M. Wróbel	CH
		14.00-15.30	Sem 14	2	Gr. E,F	**Case II.** Reperfusion injury after hypoxia. Metabolism of heart muscle. (!Note supplementary materials on the website).	Dr B. Piekarska	Room 5
					Gr.G, H		dr J. Dulińska-Litewka	Room 8
					Gr. I, J		Dr D. Gil	CH
	Th	14.15-15.45	Lec 34	2	Whole class	**Intercellular communication - hormones.** Chemistry of hormones. Polypeptide and amino acids derivative hormones and their receptors. Signal transduction. G proteins. Secondary messengers. Steroid hormones and their receptors. Intracellular effects of hormone action.	dr. M. Wróbel	LH
31st week May 15-19	Mo	12.15-13.45	sem 15	2	Gr A, B	**Detoxication in organism**. The role of liver in detoxication processes. Biotransformations. Cytochrome P_{450} electron transport systems. **Case III** The effect of ethanol on metabolism. (!Note supplementary materials on the website). Q (3 student's presentations)	Dr B. Ostrowska (k) x 2	Room 5
					Gr C, D		dr. M. Wróbel	CH
	Tu	12.00-13.45	Lec 35	2	Whole class	**Metabolic interrelationships I.** Overview of major metabolic pathways, key junctions and control sites. Metabolic profiles of individual tissues - brain, muscle, liver, adipose tissue, red blood cells.	dr. M. Wróbel	LH
		14.00-15.30	sem 15	2	Gr.E, F	**Detoxication in organism**. The role of liver in detoxication processes. Biotransformations. Cytochrome P_{450} electron transport systems. **Case III.** The effect of ethanol on metabolism. (!Note supplementary materials on the website). Q (3 student's presentations)	Dr B. Ostrowska	Room 5
					Gr.G,H		dr J. Dulińska-Litewka	Room 8
					Gr. I, J		dr. M. Wróbel	CH

	Th	14.15-15.45	Lec 36	2	Whole class	**Metabolic interrelationships II.** Hormonal regulation of fuel metabolism. Intracellular effects of hormone action. Metabolic interrelationships of tissues in various nutritional and hormonal states.	dr. M. Wróbel	LH
32nd week May 22-26	Mo	12.15-13.45	Lec 37	2	Whole class	**Biochemistry of disease I.** Oncogenic transformation of a cell. Oncogenes, suppressor genes and growth factors.	dr. P. Laidler	LH
	Tu	12.00-13.45	Lec 38	2	Whole class	**Biochemistry of disease II.** Cancer invasion and metastasis. Cell membrane proteins and components of signal transduction and inhibition of their activity.	dr. P. Laidler	LH
33rd week May 29 - Jun 2	Mo	12.15-13.45	Rec 9	2	Whole class	**Review**. Metabolism of carbohydrates, lipids and proteins. Metabolic interrelationships.	dr. M. Wróbel	CH
34th week Jun 5-9								
9.06	Fr	11.45-14.45	Ex.5	4	Whole class	**Final Exam**	Dr M. Wróbel Dr. B. Piekarska	CH LH