DESCRIPTION OF COURSE UNIT FOR DOCTORAL STUDIES AT VILNIUS UNIVERSITY

Scientific Area/eas, Field/ds of Science	Medical and health sciences (M 000): Medicine (M 001) Natural sciences (N 000): Biochemistry (N 004); Biology (N 010)			
Faculty, Institute, Department/Clinic	Faculty of Medicine Institute of Biomedical Sciences Department of Physiology, Biochemistry, Microbiology and Laboratory Medicine			
Course unit title (ECTS credits, hours)	**Laboratory Haematology,** 9 credits (243 hours)			
Study method	**Lectures**	**Seminars**	**Consultations**	**Self-study**
Number of ECTS credits	-	-	1	8
Method of the assessment (in 10 point system)	Report presentation and evaluation: the report is presented on a focused topic, which is approved by the coordinating lecturers (the PhD student has to analyse, review and present the most recent scientific publications related to the relevant topic). Criteria for the evaluation of the report (minimum score of 5): (a) Relevance, novelty and adequacy of the material in relation to the chosen topic (2 points); (b) the overall structure and scope of the presentation, clarity of knowledge, reasoning, conciseness and precision (2 points); (c) summary, presentation and justification of conclusions (1 point); (d) raising problematic issues and demonstrating the application of the knowledge reviewed in the thesis (3 points); (e) organisation of visual aids, ability to participate in discussion, question management, oratorical skills (2 points).			

PURPOSE OF THE COURSE UNIT

To provide an in-depth theoretical and practical knowledge in laboratory haematology, including modern mechanisms of physiology and pathogenesis of haemopoiesis and haemostasis systems, their analytical techniques (spectrophotometry, turbidimetry, impedance, optical light scattering, flow cytometry, morphology and molecular biology) and the clinical significance of the most relevant analytes. Promote an interdisciplinary, holistic approach to patient health, relying on evidence-based laboratory medicine science to address the individual problems of relevant PhD topics from different disciplines and fields.

THE MAIN TOPICS OF COURSE UNIT

Morphology and haemopoiesis. Structure and function of haematopoietic organs. Microenvironment and humoral factors influencing blood cell growth and maturation. Peripheral blood examination. Haemoglobin concentration, haematocrit, RBC count, their clinical significance. RBC indices. Reticulocyte examination and interpretation. ESR test, its clinical significance. Total WBC count, differentiation, clinical significance. Platelet analysis and interpretation. Smear staining techniques and morphological examination. Pathological morphology of WBC in various diseases. Patho-morphology of RBCs and platelets. Cytological examination of bone marrow including differential staining procedures. Examination and interpretation of megakaryocytes. Evaluation of erythropoiesis. Evaluation of granulopoiesis and monopoiesis. Assessment of thrombopoiesis. Lymphopoiesis, plasma cells. Bone marrow stromal cells and their morphology. Haemoglobinopathies. Structural

defects of haemoglobin, thalassaemia. Fractionation of haemoglobin: agarose gel electrophoresis, high-performance liquid chromatography. Modern morphological classification of anaemias. Iron metabolism. Microcytic-hypochromic anaemias and their laboratory diagnosis. Vit.B12 and folic acid metabolism. Pathogenesis of macrocytosis. Megaloblastic anaemias and their laboratory diagnosis. Morphological evaluation of megaloblastic haematopoiesis. Normal and pathological RBC destruction. Laboratory diagnosis of haemolysis. Aplastic anaemia and its laboratory diagnosis. Modern morphological-cytochemical-immunological-molecular diagnosis of acute leukaemias. FAB, WHO classifications. Aetiology, pathogenesis, classification, diagnosis of myelodysplastic syndromes. Chronic myelogenous leukaemia and its laboratory diagnostics. Differentiation from leukemoid reaction. Chronic lymphocytic leukaemia and its laboratory diagnosis. True polycythaemia and its laboratory diagnosis. Myeloma and laboratory diagnosis of paraproteinaemias. Classification, aetiology, diagnosis of Hodgkin's disease and non-Hodgkin's lymphomas. Methods and basic principles of bone marrow transplantation. The role of stem cell (CD34+) counting in BMT.

Analytical haematology. Principles of haematological analysers: impedance, optics, etc. Quality control in laboratory haematology. Cell analysis by flow cytometer: viability analysis, marker expression assays on the cell surface and internal structures, cell cycle analysis, stem cell phenotyping, classification of leukaemias, diagnosis of paroxysmal nocturnal haemoglobinuria etc. Molecular biology methods: cytogenetics, fluorescence in situ hybridization, polymerase chain reaction, molecular microarrays, DNA, RNA sequencing and comparative genomic hybridization studies.

Haemostasiology. Factors involved in primary haemostasis (platelet count, adhesion, activation and aggregation). Platelet function studies. Bleeding time. Von Willebrand factor assays, effects of ADP-adrenaline, collagen, ristocetin, ADP and ATP on platelet aggregation. Determination of serotonin. Spontaneous aggregation. Clot retraction. Determination of coagulation factor III. Thrombasthenia (congenital disorders of adhesion, activation, aggregation). Acquired platelet dysfunction. Idiopathic thrombocytopenic purpura and its laboratory diagnosis. Thrombocytopenia and thrombocytosis. Secondary haemostatic factors (clotting proteins, intrinsic and extrinsic clotting pathways, fibrin clot formation) and their regulatory systems (fibrinolysis, protein C, serine proteases, intrinsic clotting pathway inhibitor). Characterisation of normal and impaired coagulation functions (prothrombin time: thrombin time, activated partial thromboplastin time) and the identification of individual clotting factors. Use of chromogenic substrates for the determination of coagulation factors. Determination of circulating inhibitors. Immunological identification of coagulation factors and understanding of coagulation abnormalities (factor deficiency, increased fibrinolytic activity), control and monitoring of thrombosis and disseminated intravascular coagulation. Anticoagulant action, fibrinolytics and aggregation inhibitors. Prekallikrein, high molecular weight kininogen detection, plasminogen, antiplasmin, plasminogen activators. Use and control of anticoagulants. Fibrinolysis test. Congenital (haemophilia, factor VII, X, V deficiencies) and acquired coagulation disorders, bleeding and thrombosis. Thrombophilias. Protein S, protein C, antithrombin, heparin II cofactor deficiencies. Dysfibrinogenemia. Acquired (lupus anticoagulant, antiphospholipid syndrome, Trousseau syndrome) and congenital (Leiden factor V, prothrombin gene mutations, protein C resistance) thrombophilic disorders.

RECOMMENDED LITERATURE SOURCES

1. John E. Hall, PhD and Michael E. Hall, MD, MSc. Guyton and Hall Textbook of Medical Physiology, 14th Edition, Elsevier, 2021.

2. Kenneth Kaushansky, Marshall A. Lichtman, Josef T. Prchal, Marcel M. Levi, Linda J. Burns, David C. Linch. Williams Hematology, 10th Edition, Published McGrawHill: February 24, 2021.
3. Richard A. McPherson, MD, MSc and Matthew R. Pincus, MD, PhD. Henry's Clinical Diagnosis and Management by Laboratory Methods, 24rd Edition, Elsevier, 2021.
4. A. Victor Hoffbrand, Paresh Vyas, Elias Campo, Torsten Haferlach, Keith Gomez. Color Atlas of Clinical Hematology: Molecular and Cellular Basis of Disease, 5th Edition, Willey Blackwell, 2019.
5. A. Victor Hoffbrand, David P. Steensma. Hoffbrand's Essential Haematology. 8th edition. Willey-Blackwell. 2019.
6. Editors: John P. Greer, MD (Professor, Department of Medicine and Pediatrics, Divisions of Hematology and Oncology, Vanderbilt University of Medicial Center, Nashville, Tennessee), George M. Rodgers, MD, PhD, Bertil Glader, MD, PhD, Daniel A. Arber, MD, Robert T. Means, Jr., MD, Alan F. List, MD, Frederick R. Appelbaum, MD, Angela Dispenzieri, MD, Todd A. Fehniger, MD, PhD.. Wintrobe's Clinical Hematology. 14th edition, Walters Kluwer/Williams&Willkins, 2019.
7. Anna Porwit Marie Christine Bene. Multiparameter Flow Cytometry in the Diagnosis of Hematologic Malignancies. Cambridge University Press, 2018.
8. Matuzevičienė R. Tėkmės citometrija ir jos taikymas laboratorinėje medicinoje. Vilnius, Petro ofsetas. 2013.
9. Interneto šaltiniai:
https://labtestsonline.org/
https://www.ncbi.nlm.nih.gov/pubmed/
https://www.islh.org/ISLH-Education/index.php
https://wiki.clinicalflow.com/cases
https://www.cytometry.org/web/education-public.php

CONSULTING LECTURERS

1. Coordinating lecturer: Rėda Matuzevičienė (Assoc. Prof. Dr.).
2. Dovilė Karčiauskaitė (Assoc. Prof. Dr.).
3. Algis Abaravičius (Prof. Dr. HP).

APPROVED:

By Council of Doctoral School of Medicine and Health Sciences at Vilnius University: 29th of September 2022

Chairperson of the Board: Prof. Janina Tutkuvienė