

**DESCRIPTION OF COURSE UNIT FOR DOCTORAL STUDIES  
AT VILNIUS UNIVERSITY**

<b>Scientific Area/eas, Field/ds of Science</b>	Medical and Health Sciences (M000): Medicine (M001)			
<b>Faculty, Institute, Department/Clinic</b>	Faculty of Medicine Institute of Biomedical Sciences Department of Physiology, Biochemistry, Microbiology and Laboratory Medicine			
<b>Course unit title</b> (ECTS credits, hours)	<b>Cardiovascular Physiology</b> 7 credits (186 hours)			
<b>Study method</b>	<b>Lectures</b>	<b>Seminars</b>	<b>Consultations</b>	<b>Self-study</b>
Number of ECTS credits	-	-	1	6
<b>Method of the assessment</b> (in 10 point system)	<p><u>Presentation and evaluation of the report:</u> the report is presented on a target topic, which is coordinated with the coordinating lecturers (the doctoral student must analyze, review and present the latest scientific publications related to the respective topic).</p> <p><u>Criteria for evaluating the report</u> (minimum readable score - 5):</p> <p>(a) relevance, novelty and relevance of the material submitted (2 points);</p> <p>(b) general structure and scope of the report, clear presentation of the knowledge, reasoning, brevity and specificity (2 points);</p> <p>(c) Summary, presentation and justification of conclusions (1 point);</p> <p>(d) raising problematic issues, presenting the application of the reviewed knowledge in the dissertation (3 points);</p> <p>(e) organization of visual aids, ability to participate in a discussion, management of questions, oratory skills (2 points)</p>			
<b>PURPOSE OF THE COURSE UNIT</b>				
<p>To provide a deeper knowledge base for research and scientific evidence-based on medical practice, prevention, more detailed analysis and systematization of knowledge about the functioning of the human cardiovascular system, the peculiarities of its activity, factors that influencing it, regulating mechanisms, the significance of the cardiovascular system for other body systems. PhD student will be able to systematize information about the human cardiovascular system, forming a database of theoretical knowledge for practical work and research, emphasizing the application of the acquired knowledge for the monitoring and prevention of cardiovascular diseases.</p>				
<b>THE MAIN TOPICS OF COURSE UNIT</b>				
<p><u>Physiology of the heart.</u> Physiology of cardiac muscle. Atrial muscle, ventricular muscle, and specialized excitatory and conductive muscle fibers. Functional characteristics of the heart. The heart as a pump. Cardiac muscle as a syncytium. Mechanism of action potential in cardiac muscle. Causes the long action potential and the plateau. Refractory period of cardiac muscle. Conductive system of the heart. Self-excitation of sinus nodal fibers. The sinus node as the pacemaker of the heart: action potential of sinus node. Transmission of the cardiac impulse through the atria and delay of impulse conduction from the atria to the ventricles. The</p>				

cardiac cycle: diastole and systole. Extrasystole (premature contraction) and a compensatory pause. Intrinsic regulation of heart pumping – the Frank-Starling mechanism and its explanation. Chemical energy required for cardiac contraction at rest and during exercise, role of oxygen. Electrical activity of the heart. The normal electrocardiogram. Heart sounds. Regulation of cardiac function. Control of the heart by the sympathetic and parasympathetic nerves. Mechanisms of excitation of the heart by the sympathetic and parasympathetic nerves. Effect of hormones, biologically active factors, potassium and calcium ions on heart function. Stroke volume and cardiac output, and their changes at rest, during physical activity and different conditions.

Structural and functional properties of blood vessels. Overview of the circulation. Medical physics of pressure, flow, and vascular resistance. Interrelationships among pressure, flow, and resistance. Volumes of blood in the different parts of the circulation, velocities of blood flow. Laminar and turbulent flow of blood in vessels under some conditions. Resistance to blood flow: importance of the vessel diameter, hematocrit, blood viscosity.

Blood pressure: arterial, venous, systolic, diastolic, pulse, mean arterial pressure. Clinical methods for measuring systolic and diastolic pressures. Veins and their functions. Effect of the gravitational factor on arterial and other pressures. Regulation of arterial blood pressure: role of the nervous system in rapid control of arterial pressure (baroreceptor and chemoreceptor reflexes). Sympathetic innervation of the blood vessels. Localization and sensitivity of baroreceptors. Vasomotor center and its control by higher nervous center. Role of the kidney in long-term regulation of arterial pressure: the renin-angiotensin-aldosterone system. osmolarity of blood, antidiuretic hormone, catecholamines. Arterial pressure pulsations. Pulse. Tachycardia, bradycardia in the physiological conditions.

Microcirculation and the lymphatic system. Capillary wall. Pressure in different capillaries. Capillary fluid exchange interstitial fluid, and lymph flow. Role of different pressure: forces of filtration and reabsorption. Exchange different substances between the blood and interstitial fluid. Composition of lymph. The role of the lymphatic system and lymph flow. The safety factors that prevent edema. Characteristics of regional circulation. Regulation flow of blood in the capillaries. Local control of blood flow in response to tissue need: metabolic, myogenic autoregulation mechanism, the endothelium-derived factors. Blood flow in different tissues and organs. Blood flow in skeletal muscles, brain, heart, lung, skin, kidney, liver and gastrointestinal system. Blood flow and cardiac output in different tissues and organs at rest, during exercise and different conditions.

Lifestyle factors that reduce and modifies cardiovascular risk. The importance of physical activity and nutrition. The most important indicators of the cardiovascular system. The blood lipids level and other cardiovascular risk factors.

### **RECOMMENDED LITERATURE SOURCES**

1. John E. Hall. Guyton and Hall Textbook of Medical Physiology, 13th Edition. Elsevier, 2022
2. Silbernagl S, Despopoulos A. Color Atlas of Physiology. Thieme, Stuttgart, 7<sup>th</sup> edition, 2017
3. Koeppen B.M., Stanton B.A. Berne & Levy Physiology, 7<sup>th</sup> edition, 2017
4. Prenumeruojamos duomenų bazės: Prenumeruojama duomenų bazė: <https://www.clinicalkey.com/#/>
5. Prenumeruojama duomenų bazė: <http://accessmedicine.mhmedical.com/>
6. Silverthorn D.U. Human Physiology, an Integrated Approach, 7<sup>th</sup> edition, 2015
7. Theodore Tulchinsky, Elena Varavikova, Joel Matan Cohen. The New Public Health, 4th Edition. 2022
8. Walter F.Boron, Emile L. Boulpaep. Medical Physiology. Saunders; Elsevier, 3<sup>th</sup> edition.

2017

9. Prenumeruojama duomenų bazė: <http://accessmedicine.mhmedical.com/>
10. Kim E. Barrett, Susan M. Barman, Scott Boitano, Heddwen L. Brooks. Ganong's Review of Medical Physiology, 25e.:  
<http://accessmedicine.mhmedical.com/content.aspx?sectionid=97163015&bookid=1>  
[Resultclick=2](#)
11. Jonathan D. Kibble, PhD, Colby R. Halsey, MD. Medical Physiology: The Big Picture.  
<http://accessmedicine.mhmedical.com/content.aspx?bookid=1291&sectionid=75575>  
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### **CONSULTING LECTURERS**

1. Coordinating lecturer: Valerija Jablonskienė (Assoc. Prof. Dr.).
2. Jonas Algis Abaravičius (Prof. Dr. HP).
3. Dalia Paškevičienė (Assist. Prof. Dr.).

### **APPROVED:**

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

Chairperson of the Board: Prof. Janina Tutkuvienė