

## Veterinary Physiology II (6 CFU; 66 hours: 58 frontal lessons and 8 practical activities)

**Objectives of the course:** the student should know in details the correct function of the cardiovascular, renal and respiratory systems in physiological conditions

### Lessons

General issues	Arguments	Specific topics	hours
<b>1. VOLUNTARY AND INVOLUNTARY MUSCLE ACTIVITY</b> (total 4 hours)	<b>Striated muscle</b>	Organization of the contractile system. The neuromuscular transmission. Electrical activity and striated muscle contraction. Simple shock and tetanus. Excitability of striated muscle. The energy consumption of the striated muscle.	2
	<b>Smooth muscle</b>	Organization of the contractile system. Electrical and contractile activity of the smooth muscle. Types of smooth muscle. The nervous control. The energy consumption of the smooth muscle.	2
<b>1. CARDIOVASCULAR SYSTEM</b> (TOT. 24 H)	<b>Liquid Compartments</b>	Functions of the cardiovascular system. Liquid compartments. The blood: its distribution in the systemic circulation, lung, in various organs and tissues, at rest and under different conditions. The priority of the circle.	2
	<b>Heart muscle</b>	Anatomical and functional differences between cardiac, smooth and striated muscle. The dominant and gregarious cells: their activation. Membrane potential and cardiac action potential. Impulses conduction.	2
		Dominant cells hierarchy. Normal sinusal, atrio-ventricular, idio-ventricular rhythms. Excitation-contraction coupling. The cardiac excitability, its consequences.	2
	<b>Cardiac cycle</b>	Coordinated organization of contractile cardiac events: the cardiac cycle. Systole and diastole. Ventricular volumes. Duration of the diastolic phase. Frequency and cardiac output in different domestic species. Cardiac output, left and right. Tension-length curve. Laws of the heart. Self-regulation of cardiac output.	3
	<b>Cardiac activity manifestations</b>	Itto and heart sounds. ECG: physiological characteristics.	2
	<b>Cardiac innervation</b>	Sympathic and parasympathic innervation of the heart. Effects of A. N. S. on the heart.	2
	<b>Hemodynamic</b>	Vessels characteristics. The mechanical circulation. The laws of hemodynamics. Speed and flow. Pressure and flow. Resistance to flow. Importance of the vessels geometry. Total energy of a liquid.	2

	<b>Arteries, capillaries, veins</b>	Arterial tract characteristics. The arterial pulse. Measurement of blood pressure. Exchanges in the capillaries: capillaries at the heart level, under the heart, above the heart. Characteristics of the venous tract. Venous return. The venous pulse.	4
	<b>Cardiovascular responses to different situations</b>	Changes in cardiovascular system after exercises, emergency, etc. Priority of circulation. Training.	2
	<b>Regulation of cardiovascular function</b>	Blood pressure control. Peripheral receptors: pressoreceptors, chemioreceptors. Cardioinhibiting, cardioaccelerating and vasomotor centres: their coordinate function for the blood pressure homeostasis.	2
	<b>Special circles</b>	The pulmonary, coronary, skin, brain, rumen circulation.	1
<b>3.RENAL FUNCTION (TOT. 15 HOURS)</b>	<b>Kidney function and renal ultrafiltration</b>	The kidney function. The renal vasculature. The nephron. The thrust pressure, oncotic pressure and endocapsular pressure in the kidney. The filter net pressure. The molecular sieve. Ultrafiltrate characteristics.	2
		Influence of the thrust pressure, oncotic pressure or endocapsular pressure on ultrafiltrate quantity. Renal blood flow autoregulation. Myogenic and juxtaglomerular theory.	1
	<b>Proximal tubule</b>	Active and passive tubular reabsorption. Proximal tubule reabsorption. Ultrafiltrate changes.	2
	<b>Loop of Henle Countercurrent renal</b>	Cortical and juxtamidollary nephrons. Loop of Henle and medullary hypertonic creation. Blood supply to the medulla. Vasa recta as countercurrent exchangers	2
	<b>Medullary hypertonicity and the water balance</b>	Hypertonic medulla and water recovery from the collecting tubule. ADH synthesis and release. Integrated role for the water-salt balance of hypertonic medullary and ADH.	2
	<b>Distal convoluted tubule Aldosterone</b>	D.C.T. mechanisms. Adrenal medulla. Synthesis and actions of aldosterone at the DCT level. Aldosterone secretion. Juxtaglomerular apparatus: juxtaglomerular cells and macula densa. Renin-angiotensin system. Circulation and water-salt balance characteristics.	2
	<b>Distal convoluted tubule pH regulation</b>	pH regulation in the kidney. Buffer systems at DCT cell levels. pH renal regulation in carnivores and omnivores. Kidney's role in the	2

		pH regulation. Respiratory activity involvement. Renal pH adjustment in herbivores.	
	<b>Urination and renal function tests</b>	Bladder innervation. Urination reflex in the zoological scale. Clearances. Renal function test: glomerular ultrafiltration, tubular reabsorption, tubular excretion.	2
<b>4. RESPIRATORY FUNCTION (TOT.15 HOURS)</b>	<b>Respiratory mechanics - Inspiration</b>	Respiratory mechanics. Inspiratory muscles activation. Gamma-alpha circuit. Intrafusal and extrafusal fibers. Lung distension and pleural function. Isotonic contraction and tidal volume.	2
	<b>Expiratory phase</b>	Expiratory phase at rest or expiratory muscles activation. Elasticity of the lungs. The surfactant factor.	1
	<b>Ventilation</b>	Dead space, tidal volume, additional air, complementary air, vital capacity, pulmonary ventilation, alveolar ventilation.	1
	<b>Respiratory exchanges</b>	Gas pressure modifications from atmospheric air, dead space, alveoli to the blood and tissues. Diffusing capacity of the gas. Blood oxygenation and carbon dioxide disposal.	2
	<b>Oxygen and carbon dioxide transport</b>	Hemoglobin. Saturation curve and dissociation of oxygen from hemoglobin. Bohr effect. Carboxyhemoglobin. Myoglobin. The fetal hemoglobin. The transport of carbon dioxide and Haldane effect. Integration between Bohr and Haldane effect.	2
	<b>The Hamburger phenomenon In the lungs and tissues</b>	The oxygen-carbon dioxide exchange in the lungs and tissues. From oxygenated to desoxygenated blood and viceversa.	2
	<b>Chemical regulation</b>	The chemical regulation. The chemoreceptors. Central and peripheral effects of oxygen, carbon dioxide and pH on respiration.	1
	<b>Nervous regulation</b>	Nervous regulation of respiration. Inspiratory and expiratory neurons. The volume receptors of lung and different reflexes of pulmonary origin.	2
	<b>Specific respiratory conditions</b>	Respiration in extreme conditions; altitude. Newborn respiration. Respiration of birds.	2

**Practical activities**

<b>General issues</b>	<b>Arguments</b>	<b>Specific topics</b>	<b>hours</b>
<b>EVALUATION OF PHYSIOLOGICAL FUNCTIONS (TOT 8 HOURS)</b>	<b>Cardiovascular system</b>	Itto and heart sounds - Practical test on animals under physiological conditions	1
		Interactive movie on the ECG in dogs and cats	1
		ECG in dogs - Practical test on animals under physiological conditions	2
		The blood pressure measurement in dogs under physiological conditions	1
	<b>Respiratory function</b>	Spirometry and lung volume assessment	1
	<b>Renal function</b>	Evaluation of the urine physico-chemical properties	1
		The clearances	1