

VETERINARY CYTOLOGY, HISTOLOGY AND EMBRYOLOGY

The course is aimed to give knowledge of: 1) the structural organization and functional morphology of the cell; 2) the structural organization of Mammal tissues; 3) the early development of Mammal embryo and the development of foetal membranes in Domestic animals

Lessons

Objectives	Subject	Specific subjects	Hours
<p><i>CYTOLOGY (8 HOURS)</i> OBJECTIVES: Know the structural organization of the plasma membrane, nucleus (nuclear envelope, chromatin, nucleolus), cell organelles (RER, SER, Golgi apparatus, mitochondria, lysosomes, centrioles), microfilaments, microtubules, glycogen, lipid, endogenous pigment inclusions.</p>	<i>Methods</i>	Introduction to the Lab.	0,5
	<i>Cell biology</i>	Biology of the cell: prokariotic and eukaryotic cells.	0,5
	<i>Plasma membrane</i>	The molecules of the cell membrane, membrane asymmetry, topography and structure of membrane proteins. Membrane transports. Endocytosis and exocytosis.	1
	<i>Nucleus</i>	Structure and functions of the nucleus: nuclear matrix, nuclear envelope, nuclear pore, lamins, nuclear export of proteins, nuclear protein import.	1
	<i>Nucleolus</i>	DNA in eukaryotic cells: structure and replication. Transcriptional regulatory mechanisms.	1,5
	<i>Nucleolus</i>	Structure and function of the nucleolus.	0,5
	<i>Cell organelles</i>	Endoplasmic reticulum (rough and smooth): ultrastructure and functions. Golgi apparatus: compartmental organization, function, biogenesis of lysosomes, constitutive secretion, and regulate secretion.	1
	<i>Cell organelles</i>	Mitochondria: structure and functions. Microbodies: structure and biology of oxigen radicals. Centrioles: structure and functions.	1
<p><i>EPITHELIAL TISSUE (4 HOURS)</i> OBJECTIVES: Know the structural organization of the epithelial tissues.</p>	<i>Classification and microscopic structure</i>	Simple epithelium: simple columnar epithelium, simple cuboidal epithelium, simple squamous epithelium. Stratified epithelium: Stratified squamous nonkeratinizing epithelium, Stratified squamous keratinizing epithelium, Stratified columnar epithelium, Stratified cuboidal epithelium. Pseudostratified epithelium. Surface modifications (microvilli, glycocalix, cilia, stereocilia); cellular attachments..	1
	<i>Glands: general classification; morphological characteristics</i>	General classification of the glands: Exocrine and Endocrine glands. Exocrine glands: unicellular (goblet cells) and Multicellular glands.	1
	<i>Glands: general classification; morphological characteristics</i>	Exocrine glands: tubular glands, acinar glands and alveolar glands. Merocrine secretion, Apocrine secretion, and Holocrine secretion.	1
	<i>Glands: general classification; morphological characteristics</i>	Exocrine glands: tubular glands, acinar glands and alveolar glands. Merocrine secretion, Apocrine secretion, and Holocrine secretion.	1

		Histological Structure of Large Exocrine Glands: parenchyma, capsule and septa.	0,5
		Endocrine glands: morphological characteristics and classification	0,5
		General features of the connective tissue: cells and intercellular matrix	1
<p style="text-align: center;">CONNECTIVE TISSUE (6 HOURS)</p> <p>OBJECTIVES: Know the structural organization of the connective tissues.</p>	<p style="text-align: center;">Connective tissue: cells, ground substance, fibers (collagen, reticular, elastic) and classifications</p>	Connective tissue: cells and matrix (collagen, reticular, and elastic fibers). Gelatinous connective tissue. Loose connective tissue: fibroblast, plasma cells, neutrophils, macrophages, fat cells, mast cells, chromatophores, and matrix. Reticular tissue: cells and matrix. Dense connective tissue (dense irregular connective tissue, dense regular connective tissue): cells and matrix. Elastic tissue: cells and matrix.	1
	<p style="text-align: center;">Adipose tissue (white and brown)</p>	White adipose tissue, brown adipose tissue: histological features, histogenesis and functions.	1
	<p style="text-align: center;">Cartilage</p>	Hyaline cartilage: chondroblast, chondrocyte, lacuna, isogenous group, matrix, and perichondrium. Elastic cartilage: chondroblast, chondrocyte, matrix. Fibrocartilage: chondroblast, chondrocyte, matrix. Process of chondrogenesis. Cartilage nutrition.	1
	<p style="text-align: center;">Bone</p>	Compact and cancellous bone, periosteum, endosteum, osteon, canaliculus, lacunae, osteocyte, Haversian systems/canals and Volkmann's canals, osteoblasts, osteocytes, osteoclasts.	1
	<p style="text-align: center;">Osteogenesis and bone remodelling.</p>	Intramembranous bone formation: role of the osteoblasts, osteocytes and osteoclasts in the process of intramembranous bone formation and conversion of cancellous bone to compact bone. Peri-Endochondral bone formation: formation of a bony collar, chondrocyte death, invasion of an osteogenic bud from the periosteum. Increasing of the diameter of a long bone. Elongation of a long bone: epiphyseal growth mechanism, zones of a cartilage growth plate and processes of osteogenesis that take place in each zone (zone of resting cartilage, proliferation, hypertrophy, calcification and ossification).	1
<p style="text-align: center;">MUSCLE TISSUE (3 HOURS)</p> <p>OBJECTIVES: Know</p>	<p style="text-align: center;">Skeletal muscle</p>	Cytology of skeletal muscle fiber: shape, sarcolemma, structure of the sarcomere.	1
		Myofibrils and triads. Contraction. Perimuscular Connective Tissue: Endomysium, Perimysium, and Epimysium.	1

the structural organization of the muscle tissue.	<i>Cardiac muscle and smooth muscle</i>	Cardiac muscle cells: shape, sarcolemma, structure of the sarcomere, myofibrils, and intercalated discs. Smooth muscle cells: shape, sarcolemma, myofibrils, functional activity and gap junctions.	1
NERVOUS TISSUE (3 HOURS) OBJECTIVES: Know the structural organization of the nervous tissue.	<i>Neurons and glial cells</i>	Structural organization and functional morphology of the neuron. Types of neurons. Direction of the information flow. Mechanisms of fast and slow axonal transport. Glial cells: cytology, morphology, classifications, functional properties. Gray matter and white matter. Ganglia.	2
	<i>Myelin and synapses</i>	Chemical and electrical synapses: ultrastructural features and functions. Basic organization of neuromuscular junctions. Neurotransmitters. Myelin: structure and functions. Process of myelination. Peripheral nerves: structure and functions. Receptors.	2
BLOOD (1 HOUR) OBJECTIVES: Know the structural organization of the blood.	<i>Blood</i>	Introduction. Erythrocytes: morphology and functions.	1
		Morphology and functions of: Neutrophil, Eosinophil, Basophil Lymphocyte, Monocyte. Thrombocyte and Megakaryocytes. Hematopoiesis.	1
EMBRYOLOGY (8 HOURS) OBJECTIVES: Know the early development of Mammal embryo and the development of foetal membranes in Domestic animals	<i>Early development of Mammal embryo and the development of foetal membranes</i>	The early development of the Mammal: fertilization, cleavage. Types of placenta.	1
		Blastocyst, gastrulation, implantation.	1
		The notochord. The neuronal tube Flexion and torsion. The axial, intermediate and lateral mesoderm.	1
		Development of foetal membranes.	2
		Chorion, amnion, yolk sac, and allantois	1
		Types of placenta.	2

Practical work			
Objectives	Subject	Specific subjects	Hours
PRACTICAL WORK (11 HOURS) OBJECTIVES: Be able to identify: epithelial, connective, muscle, nervous tissues and blood.	<i>EPITHELIAL TISSUE</i>	Simple epithelium. Stratified epithelium. Pseudostratified epithelium.	1
		Simple epithelium. Stratified epithelium. Pseudostratified epithelium.	1
	<i>EPITHELIAL TISSUE</i>	Exocrine glands. Endocrine glands.	1
		Exocrine glands. Endocrine glands.	1
	<i>CONNECTIVE AND MUSCLE TISSUES</i>	Gelatinous connective tissue. Loose connective tissue. Reticular tissue. Dense connective tissue Elastic tissue. White adipose tissue. Brown adipose tissue.	1
		Hyaline cartilage. Elastic cartilage. Fibrocartilage.	1
		Bone and bone formation. Skeletal muscle.	1
	<i>NERVOUS AND</i>	Neurons and glial cells. Skeletal muscle,	1

	<i>MUSCLE TISSUES</i>	Cardiac muscle, and smooth muscle	
	<i>NERVOUS AND BLOOD</i>	Neurons and glial cells. Erythrocytes. Neutrophil, Eosinophil, Basophil Lymphocyte, Monocyte. Thrombocyte and Megakaryocytes.	1
	<i>MISCELLANEOUS</i>	Review	1
	<i>MISCELLANEOUS</i>	Review	1