SYLLABUS

1. Information on the study programme

1.1. Higher education institution	**UNIVERSITATEA DE MEDICINA SI FARMACIE "VICTOR BABEȘ" TIMIȘOARA**
1.2. Faculty	**FACULTATEA DE MEDICINĂ DENTARA**
1.3. Department	MICROSCOPIC MORPHOLOGY
1.4. Study programme field	licence
1.5. Study cycle	licence
1.6. Study programme / Qualification	Dental Medicine

2. Information on the course

2.1. Course title	Cell and Molecular Biology							
2.2. Lecture faculty			ș.l.dr.Ioana Muntean					
2.4. Laboratory instructor			ș.l.dr.Ioana Muntean; asist. univ. dr.Alina Belengeanu; asist.univ.dr.Mituletu Mihai					
2.5. Study year	**I**	2.5 Semester	**II**	2.6 Examination type	**Exam**	2.7 Course type	Content[3)]	**DF**
							Mandatory[4)]	**DI**

3. Estimated study time (number of hours per semester)

3.1 Attendance hours per week	4	3.2 out of which lecture	**2**	3.3 laboratory	**2**
3.4 Attendance hours per semester	**56**	3.5 out of which lecture	**28**	3.6 laboratory	**28**

Distribution of the allocated amount of time	hours
Study of literature, course handbook and personal notes	37
Supplementary documentation at library or using electronic repositories	10
Preparing for laboratories, homework, reports etc.	14
Tutoring	
Examinations (1control paper, 1practical exam, 1final exam)	3
Other activities…	

3.7 Total number of hours of individual study	**64**
3.8 Total number of hours per semester	**120** (4 credits x 30hours/credit)
3.9 Number of credits (ECTS)[5)]	**4**

4. Prerequisites (if it is the case)

4.1. curriculum	Inorganic Chemistry, Organic Chemistry, Biochemistry
4.2. competences	Not necessary

5. Requirements (if it is the case)

5.1 for the lectures	-Students will comply with the UMFT internal rules. • Mobile phones will be closed during classes, telephone conversations are not tolerated during the course, students will not leave the classroom for personal phone calls; • It will not be tolerated the students' delay in the course, as it proves to be disruptive to the educational process; • The date of the course's seminar is announced at the beginning of the semester, in agreement with the students. Applications for rescheduling will not be accepted for other reasons than a legitimate objective; • The attendance at the course is obligatory, the student being accepted in the examination if he / she fulfills at least 70% of the total attendance.
5.2 for the seminar / laboratory	• Mobile phones will be shut down during the lab, with no telephone conversations during the lab nor with students leaving the classroom to take over personal phone

	calls; • The students' delay will not be tolerated as it proves disruptive to the educational process; • Presence at practical works(laboratory) is mandatory; the student is accepted to the practical examination if he / she fulfills at least 85% of attendance (2 absences are tolerated) • Recovery is allowed up to 15% of the total number of paid absences in the second last week of the semester (except for medical cases that will require individual approval of the Dean's). • The practical exam will be held in the last week of the semester or in the regular session, from the subject of the practical works / laboratories / traineeships previously displayed

6. Specific acquired competences

Professional competences	1. Achievement of terminology specific to the cellular and molecular biological study with initiation in medical terminology 2. Achievement of human cell structure and function 3. Understanding communication mechanisms and cellular correlations 4. The ability to explain how molecular alteration determines alteration of cellular function and hence → change of laboratory constants → appearance of clinical signs and symptoms → diagnosis of disease. 5. Understanding the mechanisms of cellular development (proliferation, differentiation) that underlie cell formation, existence, aging and death, but also of the individual.
Transversal	1. 1. Preoccupation for professional development by engaging critical thinking skills demonstrated through active participati in the course and laboratory / seminar / project; 2. Involvement in scientific research activities by participating in the elaboration of papers, studies, specialty articles and initiating in the study of one of the subjects of the subject's license (at the students who express this option) 3. Effective use of information sources and communication resources and assisted training (Internet portals, specialized software applications, databases, on-line courses, etc.) both in Romanian and in an international language.

7. Course objectives

7.1. General objective	1.The course aims to acquire terminology and aspects of cellular morphology (OM), ultrastructural (EM) and molecular structure of cellular components, structure-function relationship and its alteration, direct and distance intercellular relations (adhesion, signaling), reproduction and development (proliferation, differentiation, aging and cell death). All of which is directly related to the human medical study. 2. Practical labs aim to accommodate the student with the techniques used in the cellular study, knowledge of their usefulness for diagnosis / medical research and the formation of minimal manual for possible laboratory activity.

7.2. Specific objectives	1. Knowledge and understanding of the theoretical and practical knowledge of cellular and molecular biology with direct applications in the medical field. 2. Understand diagnostic methods and principles of laboratory techniques used in cell and molecular studies (microscopy, in vitro cell cultures, isolation and amplification of nucleic acids) and knowledge of their usefulness for medical diagnosis / research. 3. Explanation of clinical manifestations as a result of alterations in molecular structure → alteration of cellular function 4. Preoccupation for professional development by engaging critical thinking skills demonstrated through active participation in the course and laboratory / seminar / project; 5. Involvement in scientific research activities by participating in the elaboration of papers, studies, specialized articles; 6. Effective use of information sources and communication resources and assisted training (Internet portals, specialized software applications, databases, on-line courses, etc.) both in Romanian and in an international language.

8. Content

8.1 Lecture	Teaching methods	Hours	Remarks, details
1. **Systemic theory. Cell is an open biological system.** Classification of the living world in terms of cellular organization. Acellular forms of life (prions, viruses) cellular forms of life (prokaryotic and eukaryotic cells): morphology, structure and ultrastructure.	Lecturing, multimedia, interactive Communication Demonstration Debate	2	Frontal activity Power Point presentation Animations Microscopy movies
2. **Molecular constituents of cells and their biological role.** Learning appearance and evolution of molecular constituents of living. Evaluation of elementary composition of living matter. Classification, intracellular localization and biological role of inorganic and organic classes (information and non-informative molecules).		2	
3. **General characters of animal eukaryotic cells. Extracellular matrix.** Morphology of human cells: shape, size, volume, number, life span and molecular turnover. Ultrastructural components of eukaryotic cell. Molecular components, their location and roles of extracellular matrix		2	
4. **Molecular biology of cell membranes**. Definition of membrane topographical classification of cell membranes. General roles of cell membranes. Plasmalema, glycocalyx, membrane cytoskeleton: molecular organisation, specific roles, induced pathology by membrane alterations in each component.		2	

5.	**Cell membrane functions**: adhesion and intercellular signalling. The types of junctions realise cell-cell interactions and cell-extracellular matrix: functional classification, molecular organization, location and role. Evaluation of direct intercellular signalling types and distance. Synaptic and humoral signalling . Definition of cellular receptor, receptor classification depending on the messenger and activation way. Definition of a messenger, messengers classification based on the effect they have on the receptors (agonists, antagonists, and competitive and non-competitive blockers). Cellular responses caused by ligand-receptor interaction. G protein signalling through the membrane.		2	
6.	**The functions of the cell membrane**: transmembrane transport and macrotransport. Establishing the concept of selective transport, bi-directional of cellular membranes in eukaryotes. Classification of types of transport by transported material dimension, metabolic energy and by direction and number of species transported. Ways to achieve passive microtransport: simple diffusion and facilitated diffusion. Ways of achieving active microtransport: ion pumps, ion gradients, coupled transport, ABC transporters fixed on the multiple resistance treatment proteins. Macrotransport: phagocytosis, pinocytosis and transcytosis.		2	
7.	**Cytoplasm-center of cellular metabolic processes**. Definition of cytosol (hialoplasma), structure, ultrastructure, roles , physical and chemical properties. Classification of types of cytoplasmic inclusions: specific localisation in different cell types, role and medical implications. Presentation of cellular cytoskeleton components. Presentation of the molecular organisation of actin and myosin microfilaments;cellular movements based on contractile actin-myosin system (cell locomotion, muscle contraction, microvilli). Molecular organisation, role and importance of diagnostic intermediate filaments. Molecular organisation, classification and intracellular role of microtubules. Ultrastructure, location and roles of cellular organelles which present in the composition microtubules (centriole,cell center,centrosome, division spindle, cilia and flagella, asters). Cell movements based on the contractile system tubulin-dynein . Normal and pathological aspects.		2	
8.	**Mitochondria**. Description of the structure, ultrastructure, molecular organisation and origin of mitochondria. Molecular organisation, mode of transmission of mitochondrial DNA and its role in mitochondrial protein biosynthesis. Pathology caused by altered mitochondrial DNA with an emphasis on cardiac ischemia due to defects in import and metabolites required for ATP synthesis. Major functions of mitochondria: oxidative phosphorylation and production of precursors for other biosynthesis.		2	
9.	**Cellular synthesis and secretion**. Presentation of organelles involved in the synthesis and secretion of cell (ribosomes, endoplasmic reticulum, Golgi complex): origin, structure, ultrastructure, molecular organisation, roles in the secretory cycle. Medical Implications of drug detoxification in SER.		2	

10. **Intracellular digestion (lysosomes), detoxification by H2O2 (peroxisomes).** Lysosomes: structure, ultrastructure, molecular organisation, roles, intracellular origin. Pathology of lysosomal enzymes (storage disease) and therapeutic possibilities in alternate lysosomal enzyme synthesis. Peroxisomes: structure, ultrastructure, molecular organisation, origin and intracellular roles . General mechanism of detoxification of alcohol, acetaldehyde, phenol and formic acid. Possible therapeutic pathology in import or malsynthesis peroxisome enzymes		2	
11. **Cell cycle. Nucleus in interphase**. Cell cycle: stages, events, and control systems. Cyclin-dependent kinase groups and their role in cell cycle progress, the main points of restriction. Classification of cell types depending on cell cycle . Interphase nucleus: morphology, structure, ultrastructural elements. Nuclear membrane: structure, ultrastructure, molecular organisation, origin, specific functions and common functions with the RER. Nuclear matrix. Chromatin: types, roles, Molecular and Supramolecular organisation. Nucleolus: morphology, ultrastructure, role, factors that modulate the activity of nucleoli.		2	
12. **Functions of interphases nucleus:** central dogma of molecular biology. Interphase nuclear mechanisms. DNA autoreplication. The autoreplication components and mechanisms.Transcription: significance, stages of development, posttranscriptional metabolism, transcription factors inhibitors. Translation: stages of development, inhibitors of translation factors with emphasis on the role of antibiotics in the inhibition of protein biosynthesis in prokaryotes.		2	
13. **Cell Reproduction**: amitosis, mitosis, meiosis and gametogenesis. Mitosis: general features, importance, types, stages, morphological factors, activators and inhibitors. Meiosis: the general features, stages, morphological aspects. Gametogenesis: - Ovogenesis:- stages, features, characterisation of chromosomes. Spermatogenesis:-stages and characterisation of cell line chromosome sperm. Factors that influence human gametogenesis.		2	
14. **Cell development: proliferation, differentiation, aging and cell death.** Proliferation: types of cell cultures, mitogenic growth factors. Differentiation: definition of cell differentiation, cell determined inducers, intra and intercellular differentiation, the mechanisms of differentiation, the general characteristics of the cells differentiated and undifferentiated. Hypotheses and theories on cellular aging with emphasis on the role of telomerase. Programmed cell death: from Heyflik experiences in apoptosis. Cell biology of apoptosis.		2	

Mandatory literature:

1. 1. Muntean I., Belengeanu A., Popescu R., *Elements of Cell and Molecular Biology, Eurobit 2010*

Recommended literature:

1. 1. Alberts B., Johnson A., Lewis J., Raff M., Roberts K., Walter P. *Molecular Biology of the Cell.* Fourth edition. Garland Science, 2002
2. Goodman S.R. *Medical and Cell Biology*, J.P.Lippincott Company, 1994
3. .E.D.P. De Robertis, E.M.F. De Robertis, Jr. *Cell and Molecular Biology, eighth edition. B.I. Waverly Pvt Ltd New Delhi 1998.*
4. Lodish H.,Berk A., Matsudaira., Kaiser C.A., Krieger M., ScottM P., Zipursky S. L., Darnell J., Molecular Cell Biology , fifth edition, W.H.Freeman and Company Ney York, 2004

	Teaching methods	Hours	Remarks, details
1. **Simple light microscopy** (optical microscope with transmitted light) - components, operating principle and how to use simple light microscopy.	Oral presentation Demonstrations, Practical exercises Discussions Presentation: advantages and disadvantages, use in diagnosis and research Analyses of slides used and obtained in the laboratory	2	Frontal activity , used materials and didactic supports: microscopes, slides,lamella, biological material, reagents
2. **Special techniques used in diagnosis and research microscopy [demo]** Photon microscopy (dark field microscope, phase contrast microscope, polarized light microscope) UV microscopy (fluorescence microscope), Electron microscopy. Principles of operation, specific components, performance, practicality practice.		2	Frontal activity used materials and didactic supports: microscopes, fixed and temporary microscopic slides
3. **Vital specimen (extemporaneously)** - stages of preparation, utility in clinical practice.		2	Frontal activity , used materials and didactic supports: microscopes, slides,lamella, biological material, reagents
4. **Fixed microscopic preparation (I) in the form of section** - stages of realization, general and specific stains, diagnostic utility.		2	Frontal activity , used materials and didactic supports: microscopes, reagents, animal laboratory and dissection materials
5. **Fixed microscopic preparation (II) in the form of smear.** Manufacturing, coloring, and peripheral blood smear interpretation. The morphological recognition of peripheral blood cells. The normal values of peripheral blood cells.		2	Frontal activity , used materials and didactic supports: slides, lamella, microscopes, reagents, fixed specimens-peripheral blood smear

6. **Cellular morphology. Methods for assessment of cell size.** - Knowledge of typical cellular morphology / type of tissue (epithelial, connective, muscle, nerve, blood) and determination of cell size and volume by stereological and morphometric methods.		2	Frontal activity , used materials and didactic supports: microscopes, reagents, fixed specimens, magnifying glass, computer with a specific morphometric software
7. **Cellular fractionation** Steps of cell fractionation technique and differential centrifugation. Intracytoplasmic organelles separation method using density gradient solutions. Practical, biological and medical aplications(cellular tomography) and differentiated ultracentrifugation. Study methods of intracellular organelles. Knowledges assesments conccerning (OM) and ultrastructure (EM) nonspecific cytoplasmic organelles		2	Frontal activity , used materials and didactic supports: centrifuge, reagents, fixed specimens, electron microscopy photos
8. **Cellular fractionation** Study methods of interphase nucleus		2	Frontal activity , used materials and didactic supports: ultracentrifuge, reagents, fixed specimens, electron microscopy photos
9. **Growing cells in vitro [demonstration and practical application]** - from the laboratory apparatus, necessary materials, stages of implementation. Tripsinisation, reading of the viability and incubation in the culture medium		2	Frontal activity , used materials and didactic supports: Laminar flow hood, centrifuge, water bath, incubator, supplies and cell culture reagents, counting chamber
10. **Flowcitometry** - cell sorting and sorting techniques [demonstration]: data interpretation, advantages, disadvantages, practical applications		2	Frontal activity , used materials and didactic supports: flow cytometer, consumables, reagents, imaging
11. **Basic techniques of molecular biology (I):** Isolation of nucleic acids: importance, necessary materials and devices, phases, spectophotometric quantification		2	Frontal activity , used materials and didactic supports: biological material, centrifuge, reagents, consumables, spectrophotometer
12. **Basic Techniques of Molecular Biology (II):** DNA / cDNA Amplification: Importance, Materials and Equipment Required, Stages, Use in Diagnostics and Research [Demonstration]		2	Frontal activity , used materials and didactic supports: PCR ampificator

13. **Basic techniques of molecular biology (III):** Agarose gel migration, UV visualization, interpretation of the results [demonstration]		2	Frontal activity , used materials and didactic supports: electrophoresis systems, transiluminator
14.**Technics of molecular biology used in diagnosis and research**: sequencing, Northern blot, Western blot, ELISA [demonstration]		2	Frontal activity , used materials and didactic supports: ELISA system, sequencer

Mandatory literature:

1. Texts in support power points and papers at every lab

Recommended literature:

1. 1.Ross M ., Romrell L. J., Kaye I. G., , *Histology a text and atlas* , third edition, Williams &Williams 1995
2. Mescher L. A., *Junqueira"s Basic Histology text and Atlas , McGraw Hill Medical, 2013*

9. Correlations between the content of the course and the requirements of the professional field and relevant employers.

- The curriculum of the discipline is designed to facilitate the formation of professional (professional) skills and transversal skills;
– The content of the practical courses / labs delivers basic notions and skills for postgraduate specializations (residency)
– The contents of the discipline are corroborated with the requirements of the market - highly qualified medical personnel
– The thematic content of the course / labs was selected as a result of the analysis of the analytical programs from the national and foreign universities

10. Evaluation

Activity	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final mark
10.4 Lecture	Requirements for mark 5: 50% of the multiple choice questions contain questions about the structure and function of the normal cell in the main cell types	Written test with 50 multiple choice questions: -10 with one correct answer -40 with multiple answer (2-3 correct answers)	50%
	Requirements for mark 10: 50% of the multiple choice questions contain questions about normal intercellular mechanisms, structural and functional alterations responsible for pathology		
10.5 Laboratory	• Requirements for mark 5 : the student must prove the knowledge of the theoretical protocols of the techniques he has performed in the 14 labs, know how to handle the simple optical microscope, have the notebook of practical work completed with individual activity during the semester. -	Recognition of a biological slides (cell type, staining method, morphological interpretation) – Multiple choice questions exam with 10 questions from the laboratory theory	40%
	• Requirements for mark 10: : In addition to those required in the previous paragraph, the student must recognize in optical microscopy different cell types, used stains, recognize and analyze electronic microscopy images and have participated interactively during practical works		

		Activity during the year: – Presence at courses - Degree of interactive engagement – Seminar mark	10%
10.6 Minimum needed performance Lecture: - knowledge of structure, ultrastructure and cellular functions, - knowledge of cellular metabolic mechanisms - knowledge the detoxification mechanism of the drugs at the cellular level - Understanding phenomena of evolution, differentiation, aging and cell death Labs: - manual training required for laboratory activity: microscopy, cell culture in vitro, genomics, proteomics - knowledge of modern techniques used in the research and study of cellular components and mechanisms			

Date of completion: October 23,2018	Signature (lecture): S. l. Dr. Ioana Muntean	Signature (laboratory instructor): 1. S. l. Dr. Ioana Muntean 2.Asist. univ Dr. Alina Belengeanau 3.Asist univ Dr. Mituletu Mihai
Course Chair Prof. Dr. Doina Verdes		
Date of department approval: October 24, 2018	Signature (head of the department): Prof Dr Doina Verdes	