DISCIPLINE SHEET

1. Study programme

1.1.	"CAROL DAVILA" UNIVERSITY OF MEDICINE AND PHARMACY BUCHAREST
1.2.	FACULTY OF DENTISTRY
1.3.	DEPARTMENT: 1
1.4.	DISCIPLINE: Biochemistry
1.5.	STUDY DOMAIN: Health, sectoral regulated within the European Union
1.6.	STUDY LEVEL: I (Bachelor's degree) and II (Master's degree)
1.7.	STUDY PROGRAMME: DENTAL MEDICINE IN ENGLISH

2. Discipline

2.1.	Discipline name according to the study curriculum: BIOCHEMISTRY				
2.2.	Discipline code: MD01F02EN				
2.3.	Discipline type (FD/SD/CD): FD				
2.4.	Discipline optionality (COD/ED/FAD): COD				
2.5.	Lectures tenure: Assoc. Prof. Dr. Daniela Miricescu				
2.6.	Practical classes / seminar tenure: Assoc. Prof. Dr. Daniela Miricescu				
2.7. Year of study	I	2.8. Semester	I	2.9. Evaluation (E/C/V)	E

3. Estimated total time (hours/ semester of teaching and training activity /individual study)

I. University training						
3.1. Number of hours per week	3	from which:	3.2. lecture	1	3.3. practical class/ seminar	2
3.4. Total hours in the study curriculum	42	from which:	3.5. lecture	14	3.6. practical class/ seminar	28
II. Preparation/ individual study						
Time distribution						hours
Study of lecture materials, textbooks, books, study of the minimum recommended bibliography						10
Additional documentation activity in the library, on online platforms						20
Specific preparation activities for projects, practical classes, preparation of assignments, and reports						25
Preparation for presentations or evaluations, preparation for the final examination						15
Tutoring activity						-
Other activities						8
3.7. Total hours of individual study						78
3.8. Total hours per semester (3.4.+3.7.)						120
3.9. Number of credits						4

4. Prerequisites (where appropriate)

4.1. curriculum	Organic chemistry knowledge
4.2. proficiencies	-

5. Conditions (where appropriate)

5.1. for lecture activity	The course takes place in the Biochemistry Laboratory of the Faculty of Dentistry equipped with a projection system. Interactive exposure of the material according to the analytical program, using multimedia resources, PowerPoint presentations, and educational films
5.2. for practical class/ seminar activity	Laboratories have facilities specific to practical activities. Each student must complete his/her practical workbook with the obtained results. At each laboratory session, there is a seminar on the subject of the lecture, the practical laboratory session is performed, and students present a report.

6. Learning outcomes*

Knowledge	Skills	Responsibility and autonomy
Acquiring a minimum of practical knowledge of laboratory techniques, understanding the principles and usage of laboratory devices and utensils, gaining additional skills, the ability to interpret results, and establishing the relationship between biological constants and the etiopathogenesis of oral and systemic diseases.	Gaining the ability to handle biological fluids, understanding their properties, and utilizing materials used in dentistry.	Concern for professional development Ability to collaborate effectively within a team Ability to apply and connect acquired concepts in new contexts Development of fundamental biomedical scientific terminology Ability to implement theoretical concepts in medical practice Ability to develop interdisciplinary connections

7. Discipline objectives (correlated with learning outcomes)

7.1. General objective	Introduction to essential biochemistry concepts for understanding biochemical processes in the human body. Gaining essential knowledge about physiological and pathological processes in the oral cavity and their connection to systemic diseases. Familiarity with the most advanced biochemistry laboratory techniques used in medical practice and scientific research.
7.2. Specific objectives	Understanding the metabolic processes in oral and dental tissues with a view to modernizing therapeutic procedures, considering that modern dentistry increasingly benefits from new scientific research in biochemistry.

	Knowledge of the latest techniques and methods for investigating oral and dental tissues. Fostering the ability to apply an interdisciplinary approach and the knowledge gained in dental practice. Acquisition of knowledge to understand the biochemical mechanisms in the oral cavity at the molecular level, as well as their relationship with systemic diseases. Ability to apply and incorporate acquired biochemical knowledge in clinical fields and medical practice. Maintaining interest in progress in dental biomedical research.

8. Contents

8.1. Lecture	Teaching methods	Observations
1.**The subject of Biochemistry. Correlation of biochemistry with other biomedical sciences. Proteins I**: structure, properties, immunoglobulins	Interactive exposure of the material following the analytical program, using multimedia resources, PowerPoint presentations, and educational films. *Lecture, systematic presentation, conversation, biochemistry-clinical aspects correlations *Exemplification, problematization, debate *The content of the course is dynamic, permanently correlated with similar courses from the Faculties of Dentistry in the country and abroad, with which we collaborate, and according to the latest discoveries in the field	Ability to understand questions related to: -**p**eptide bonds -protein organization levels -immune response -oral immunithy
2. **Proteins II**: myoglobin, hemoglobin, cytochrome c, collagen, elastin, keratins		Ability to understand questions related to: -protein classification and roles -transport of O_2 and CO_2 -bone proteins
3. **Liposoluble vitamins**: A, D, K, E, F (structure, role)		Ability to understand questions related to: - Vitamin roles and deficiencies related to the oral cavity
4. **Hydrosoluble vitamins**: B1, B2, PP, B6, B12 (without structure), C, pantothenic acid, folic acids (without structure), biotin. Structure, biological active form, role		Ability to understand questions related to: -Riboflavin and FAD -Niacin, NAD^+, and $NADP^+$ -Pantothenic acid and Co-enzyme A - Vitamin role and deficiencies related to the oral cavity
6. Enzymes: structure, nomenclature, classification, specificity, kinetics, inhibition, and activity regulation, isoenzymes		Ability to understand questions related to: -enzyme activity -Michaelis-Menten theory K_M significance -enzyme inhibition -isoenzymes
6. **Energetic metabolism**: free energy, endergonic and exergonic reactions coupling, ATP use, the respiratory chain, and oxidative phosphorylation		Ability to understand questions related to: -biological oxidation -redox balance -high-energy compounds -organization of the electron transport chain -chemiosmotic theory

7. **Nucleic acids**: DNA, RNA (structure, biosynthesis), genetic code, protein biosynthesis, mutations		Ability to understand questions related to: -DNA and RNA structure -replication and transcription -protein biosynthesis

Recent bibliography:

1. Baynes, J., Dominiczak, M.H., *Medical Biochemistry*, 5th Edition, USA, 2018
2. Bishop, M.L., Fody, E.P., Shoeff, L.E., *Clinical Chemistry. Techniques, Principles, Corellations,* 7th ed., Lippincott Company, USA, 2018
3. Devlin, T.M., *Textbook of Biochemistry with Clinical Correlations*, John Wiley & Sons, 8th Edition, 2024
4. Ferrier, D., *Lippincott Illustrated Reviews: Biochemistry*, Seventh Edition, Lippincott Williams and Wilkins, 2017
5. Murray, R.K., Bender, D.A., Botham, K.L., Kennelly, P.J., Rodwell, V.W., Weil, P.A, *Harper's Illustrated Biochemistry,* 30th Edition, McGraw-Hill Companies, Inc., 2015

Journals

Annual Review of Biochemistry
Biomarkers in Medicine
Clinical Biochemistry
International Journal of Molecular Science
Molecules
Oral Diseases
Dental Materials
Clinical oral investigations
Journal of Biomedical Material Research

8.2. Practical classes/ seminar	**Teaching methods**	**Observations**
1. Notions of labor protection and conduct in the biochemistry laboratory. Presentation of the laboratory and the student activity sheet. Solution concentrations	* At each laboratory session, there is a seminar on the subject of the lecture, the practical laboratory session is performed, and students present a paper. * Presentation of papers by students, competitions * Practical and theoretical applications (biological tests, chemical and biochemical techniques) * Interactive programmed education * Use of multimedia resources, didactic films, presentations of analysis bulletins, and their discussion with students, and practical demonstrations	The ability to prepare a solution and dilute solutions
2. pH and buffer systems: definition, properties, biological importance		The ability to determine the pH of solutions and buffer system capacity. Discussions involving acid-base balance in the oral cavity.
3. Protein analysis: colour reactions, precipitation, denaturation, and determination of the isoelectric point of proteins		Color and precipitation reactions of proteins. Protein denaturation importance
4. Modern methods for the determination of biochemical compounds in biological fluids: electrophoresis, chromatography, HPLC, ELISA, chemiluminescence: principle, importance		Oral compounds that can be detected using modern methods

5. Metabolism of mineral compounds I: sodium, potassium, chlorine, magnesium: the principle of determination, normal values, clinical significance. The relationship with the biochemical processes in the oral cavity		Results interpretations and correlation with the oral cavity pathology
6. Metabolism of mineral compounds II: calcium, fluorine, phosphorus, hydroxyapatite: the principle of determination, normal values, clinical significance. The relationship with the biochemical processes in the oral structures		Results interpretations and correlation with the teeth structure and oral cavity pathology
7. Metabolism of mineral compounds III: iron, copper, and other mineral elements: principle of determination, normal values, clinical significance. The involvement in the antioxidant defense of the oral cavity		Results interpretations and correlation with the oral cavity pathology
8. Vitamin analysis. Sources, roles. Hypovitaminosis and oral diseases. Students' presentations and competitions. The role of hydro and liposoluble vitamins in maintaining the integrity of periodontal tissue		Vitamin deficiencies and oral pathologies
9. Enzymatic kinetics: variation of the speed of an enzymatic reaction depending on the substrate concentration, determination of KM		Clinical significance of K_M determinations
10. Clinical important enzymes: transaminases, phosphatases, CPK, LDH: Brief presentation, principle of determinations, normal values, and clinical significance		Clinical significance of serum and salivary enzyme determinations correlated with oral pathology
11. Clinical significance of plasma protein electrophoresis**.** Examples of electropherograms		Clinical significance of plasma protein electrophoresis- correlation with oral pathologies
12. Molecular biology techniques and their clinical importance: PCR-principle, importance. Didactic film		PCR and the oral cavity

13. Oxidative phosphorylation		ATP formation in aerobic *versus* anaerobic conditions
14. **Tissue biochemical functions** and their clinical significance: stomach, gallbladder, pancreas, intestine, liver, brain, red blood cells, adipose tissue, skeletal muscle, myocardium, kidneys		Tissue biomarkers in health and disease

Recent bibliography:

1. Bishop, M.L., Fody, E.P., Shoeff, L.E., *Clinical Chemistry. Techniques, Principles, Corellations,* 7th ed., Lippincott Company, USA, 2018.
2. Karam, D.W., *Medical Biochemistry Principles for Medical Students*, Trafford Publishing, 2011.
3. Lieberman, M.A., Peet, A., *Marks' Basic Medical Biochemistry, A clinical approach,* 5th edition, Wolters Kluwer*,* 2018.

Journals

Annual Review of Biochemistry
Biomarkers in Medicine
Clinical Biochemistry
Molecules
Oral Diseases
Dental Materials
Clinical oral investigations

9. Assessment

Activity type	9.1. Evaluation criteria	9.2. Evaluation methods	9.3. Percentage of final grade
9.4. Lecture	**A. Knowledge for mark 5:** - Participation in the written exam is conditioned by passing the practical exam (minimum mark 5) - Proteins: structure, properties, immunoglobulins, collagen; vitamins - role **B. Additional knowledge for mark 10** knowledge is taken into consideration - **Proteins:** myoglobin, hemoglobin, cytochrome c, collagen, elastin, keratins - Vitamins – structure, roles - Enzymes - structure, nomenclature, classification, specificity, kinetics, inhibition, and activity regulation, isoenzymes	**Exam**: -4**0 multiple-choice test** -20 **correct answers represent mark 5** -40 **correct answers represent mark 10**	70%

	- Nucleic acids - Energetic metabolism		
9.5. Practical classes/ seminar	**A. Knowledge for mark 5:** Periodic evaluation of the student through seminars and tests during the semester **(2 tests)** - The presentation of papers at seminars and participation in student scientific sessions are appreciated. - normal values for all the studied parameters **B. Additional knowledge for mark 10:** - Knowledge of the principles of all the methods of determination presented in the laboratory sessions work -The correct interpretation of laboratory test results	**Practical assessment** The semestrial test papers consist of 9 written questions (2-3 are essay questions) with different degrees of difficulty. The practical exam is an oral exam	30% (20% semestrial test papers + 10% practical exam)
9.5.1. Individual project (if any)	-	-	-
Minimum performance standard			
Knowledge and understanding of the basic notions of biochemistry (theoretical and practical) from the analytical program, knowledge of normal values, and the importance of determining the biochemical parameters in blood and saliva.			