

Odessa National Medical University  
Faculty of Dentistry  
Department of Surgical Dentistry

Syllabus of discipline  
Cellular technologies in dentistry

Amount	60 hours \ 2 credits
Semester, year of study	4th year, 7th semester. 7th semester - classes (2 hours) according to the schedule twice on
Days, time, place	week, 8.30-16.00; Department of Surgical Dentistry (11 Richelievskaya Street)
Teachers	Dmitrieva Natalia Borisovna, associate professor
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Workplace	Department of Surgical Dentistry (11 Richelievskaya Street), 2nd floor, maxillofacial clinic
Consultations	Eye consultations: Thursday from 2.30 pm to 6.00 pm every week

**Communications with students** - face-to-face meetings, E-mail, zoom, Microsoft teams

### **ABSTRACT ABSTRACT**

*The subject of study of the discipline .*

The discipline provides students with rethinking and mastering the relevant general and professional program competencies at the nano- and micro-levels, and is a necessary link in the training of a competitive specialist capable of lifelong learning.

*Prerequisites of the discipline:*

1. Medical biology
2. Medical chemistry
3. Biological and bioorganic chemistry
4. Histology, cytology and embryology
5. Human anatomy
6. Physiology
7. Pathomorphology
8. Pathophysiology
9. Medical and biological physics
10. Medical informatics
11. Microbiology
12. Virology and immunology
13. Pharmacology
14. Medical genetics
15. Clinical pharmacology
16. Clinical immunology and allergology
17. Social medicine and public health

18. Hygiene and ecology
19. Epidemiology and principles of evidence-based medicine
20. The whole set of disciplines of professional training.

*The purpose of the discipline :*

Formation of system knowledge on the etiology and pathogenesis of hereditary and acquired dental diseases at the molecular and cellular levels, as well as modern practical skills of their diagnosis, treatment and prevention.

*Tasks of the discipline:*

- deepening the theoretical foundations of personalized dentistry (terminology, basic principles, approaches and methods);
- determination of etiology and pathogenesis of dental diseases based on the achievements of omix, cellular and nanotechnologies;
- development of practical skills in the diagnosis, treatment and prevention of diseases of the teeth, mouth and maxillofacial region by means of molecular, cellular and nanostomatology;
- expanding the use of laboratory research methods (organoleptic, physical, chemical, molecular biological, cytological, bacteriological methods);
- mastering the algorithms of development and implementation in clinical practice of technologies of molecular, cellular and nanodiagnosics and therapy.

*Expected results:*

As a result of studying the discipline, higher education seekers must

**know :**

- 1) The organization and functioning of human genomes and cells and pathogens of its diseases.
- 2) Molecular and cellular basis of pathology.
- 3) Basic omix technologies, their capabilities and limitations.
- 4) Methods of analysis of biomedical information.
- 5) Features of stem cells, their cultivation and preservation.
- 6) Modern approaches in cell transplantology and tissue engineering.
- 7) Possible complications of transplants and methods of their prevention.
- 8) Technologies for obtaining recombinant DNA.
- 9) Methods of cell reprogramming in culture.
- 10) The main stages of development and testing of drugs and treatment technologies in precision dentistry.
- 11) Methods of molecular, cellular and nanotherapy and prevention of dental diseases.
- 12) Basic bioethical principles in precision dentistry.

**be able:**

1. Provide the required level of individual and biosafety in the individual field of activity.
2. Isolate and analyze nucleic acids and proteins using basic molecular genetic research methods.

3. Analyze the data of sequencing (genome), changes in gene expression (transcript), mass spectrometry in proteomic (proteomic) and metabolomic (metabolol) studies.
4. Use algorithms for processing and analysis of biomedical information to search for candidate genes, gene networks, new drug targets and biomarkers, new effective and safe drugs, etc.
5. To determine the method of culturing different cell types based on their functional features.
6. Evaluate the viability of cultured cells.
7. Transform cells in culture.
8. Analyze biological and medical images, use machine learning methods to process biological, chemical and medical data.
9. Perform three-dimensional modeling of proteins and use 3D structures of proteins to search for new drugs
10. Choose the relevant type of disease therapy based on knowledge of dental diseases at the molecular and cellular levels.

## **9. DESCRIPTION OF THE COURSE:**

### ***Forms and methods of teaching:***

The course will be presented in the form of lectures (10 hours) and practical classes (10 hours), organization of independent work of students (40 hours).

The following teaching methods are used during the teaching of the discipline: verbal (lecture, explanation, instruction, conversation, educational discussion), visual (illustration, demonstration, self-observation), practical (exercises, practical work and solving situational problems to develop skills and skills), innovative (business game, case method, etc.), independent work of students on comprehension and mastering of new material, performance of individual tasks, use of control and educational computer programs on discipline.

*Means of instruction* , presentations, animations, computer programs, lectures, guidance for practical training for students, teaching materials, providing independent work of students practical training protocols.

### ***Course content:***

#### **" Cellular technologies in dentistry"**

The main groups of hereditary diseases of the teeth, mouth and maxillofacial: genetic, chromosomal, multifactorial, etc. Influence of environmental factors on the occurrence, manifestation and course of dental diseases.

Basic tasks and principles of fabric engineering.

Application of tissue engineering products in dentistry.

Methods of introduction of cellular drugs into tissues and organs.

Cell models in preclinical trials of drugs and treatment technologies.

Principles of cell transplantation

Objective research methods with the use of modern diagnostic equipment. Radiological: radiography, tomography, panoramic radiography and pantomography. Application of artificial contrast. Computed tomography and magnetic resonance imaging, radioisotope, ultrasound diagnostics, remote and contact thermography.

## THEMATIC PLAN OF LECTURES AND PRACTICAL CLASSES

### *Lecture topics*

№ : / n	Name topics	Number hours
1	Introduction to precision dentistry	2
2	Cellular technologies in modern medicine and dentistry	2
3	Promising molecular and cellular technologies for the prevention and treatment of dental diseases	2
4	Nanotechnology in modern dentistry	2
5	Molecular, cellular and nanotherapy and prevention in dentistry	2
Total lecture hours		10

### *Topics of practical classes*

№ : / n	Name topics	Number hours
1	Isolation and quantitative analysis of nucleic acids	2
2	Determination of mutations by PCR	2
3	Evaluation of viability of cultured cells	2
4	Fluorescence visualization of target cells	2
5	Modeling of nanocomposite coating	2
Total hours of practical training		10

### *Individual work*

№ / n	Name topics	Number hours
1	Preparation for practical classes - theoretical training and development of practical skills	6
2	The structure of the genomes of major groups of viruses. Regulation of gene expression in prokaryotes and eukaryotes. Types of RNA, their functions	6
3	Genome sequencing technologies. Interpretation of sequencing data, flow cytometry and mass spectrometry	6
4	Comprehensive Association Search (GWAS), its principles and applications	6
5	Biobanking: obtaining, storing and thawing cells	6
6	Quality control in obtaining nanoparticles, nanocrystals, etc. Advances in nanostomatology	6
7	Cell transplantation: principles of cell transplantation. Target organs, methods of delivery and monitoring of regeneration. Molecular basis of humoral and cellular immunity	4
Total hours of independent student work		40

### *List of recommended reading:*

1. Стоматологія : підручник : У 2 кн. — Кн. 1. / М.М. Рожко, З.Б. Попович, В.Д. Куроєдова та ін.; за ред. проф. М.М. Рожка. — К. : ВСВ "Медицина", 2013. — 872 с.
2. Стоматологія : у 2 кн. : підручник. Кн. 2 / М.М. Рожко, І.І. Кириленко, О.Г. Денисенко та ін. ; за ред. М.М. Рожка. — 2-е вид. — К. : ВСВ «Медицина», 2018. — 992 с.
3. Челюстно-лицевая хирургия и хирургическая стоматология : учебник : в 2 кн. Кн. 1 / А. А. Тимофеев. — К. : ВСИ «Медицина», 2020. — 992 с.
4. Моделювання анатомічної форми зубів: підручник / П.С. Фліс, Т.М. Банних, А.М. Бібік, С.Б. Костенко. - К.: ВСВ "Медицина", 2019. -352 с.

5. Хірургічна стоматологія та щелепно-лицева хірургія дитячого віку =Pediatric Oral and Maxillofacial Surgery : підручник / Л.В. Харьков,Л.М. Яковенко, Н.В. Кисельова ; за ред. Л.В. Харькова. — 2-е вид. — К. :БСВ «Медицина», 2020. — 104 с
6. Тимофеев А.А. Руководство по челюстно-лицевой хирургии и хирургической стоматологии. - К.: Червона Рута-Турс, 2004. - 1061 с.
7. Molecular Pathology: The Molecular Basis of Human Disease. 2<sup>nd</sup> ed. / W.B. Coleman, G.J. Tsongalis (Eds.). — London, San Diego, Cambridge, Oxford: Academic Press, 2017. — 802 p.
8. Daskalaki A. Dental Computing and Applications: Advanced Techniques for Clinical Dentistry. — Hershey, New York: Medical Information Science Reference, 2009. — 384 p.
9. Maheshwari S., Verma S.K. Molecular Dentistry: Molecular Biology, Genome, Biomarkers / K.C. Prabhat (Ed.). — Riga: LAP Lambert Academic Publishing, 2013. — 160 p.
10. Regenerative Dentistry / Marei M. (Ed.). — San Rafael: Morgan & Claypool, 2010. — 178 p.
11. Sharma P., Mago G., Hussain W. Nanodentistry. — Riga: LAP Lambert Academic Publishing, 2019. — 84 p.

## EVALUATION

### *Methods of current control*

Current control is based on daily control of theoretical knowledge and practical skills according to specific goals of each topic by verbal control, computer control test using a test database and situational problems that are at the department, on each class for 5 - t and point traditional scale . At the end of the discipline, the current performance is calculated as the average current score.

### *Forms and methods of final control*

At the end of the 10th semester, students take a standardized state test exam (licensed integrated exam Step-2 "Dentistry") and OSKI - an objectively structured clinical exam. The method is used to assess clinical competencies. The method is based on a comprehensive assessment by final multiplication (10-20) of assessment stations that simulate various aspects of clinical competencies. Various simulators and stimulators, standardized patients, as well as additional diagnostic elements are used for the exam. The essence is to create reproductive clinical situations for the student, which allow to demonstrate the acquired technical, deductive (diagnostic, cognitive) and communication skills. OSKI simulates the process of examination and treatment of patients, so the practical tests at the OSKI station are tasks for the interpretation of the study, assessment of communication skills (history taking, etc.). OSKI stations allow to check the clinical competence connected with independent clinical activity.

### *Independent work of students*

Independent work of students (VTS) is one of the organizational forms of learning, which is regulated by the working curriculum and is performed by students independently outside the classroom. The following types of independent work of students are possible: preparation for

practical classes and study of topics that are considered only in terms of independent student work, search and study of additional literature, writing essays, reports for presentations in practical classes.

## **DISCIPLINE POLICY ("GAME RULES")**

The student must acquire knowledge, perform all types of educational tasks, pass all types of educational control, attend all types and forms of classes provided for in the curriculum, avoiding omissions and delays.

### *Deadline and recompilation policy.*

The student completes the missed lecture in the form of writing an abstract on the topic of the lecture. The student completes the missed practical lesson either in the form of writing an essay on the topic of the lesson, or by interviewing the teacher on duty (twice a week on Thursday and Saturday).

### *Academic Integrity Policy*

Adherence to academic integrity by students involves independent performance of educational tasks, tasks of current and final control of learning outcomes.

Unacceptable in the educational activities of participants in the educational process is the use of family or business ties to obtain a positive and higher assessment in the implementation of any form of control of learning outcomes, the use of prohibited aids or technical means (cheat sheets, headphones, telephones, smartphones, etc.); passing of procedures of control of results of training by fictitious persons.

For violation of academic integrity, the applicant may be held subject to the following academic liability:

- reduction of assessment results (exam, test, etc.),
- re-assessment (exam, test, etc.),
- appointment of additional control measures (additional individual tasks, tests, etc.),
- re-passing the relevant educational component of the educational program,
- deprivation of the right to participate in competitions for scholarships,
- deprivation of tuition benefits provided by the University,
- deductions from the university.

### *Attendance and lateness policy.*

Absence of a student at a lecture or practical lesson is noted in the journal of visits in the form of a mark "nb", delay - "op". The student must work off the practical classes for 2 weeks.

### *Mobile devices*

The student can not use technical means (phones, smartphones, tablets) when compiling a test computer control using a database of test and situational tasks that are on the website of the department.

### *Behavior in the audience.*

It is important for students to follow the rules of good behavior at the university. These rules are common to all, they also apply to all faculty and staff, and are not fundamentally different from the generally accepted norms.

During classes

11.allowed:

- 13) leave the audience for a short time if necessary and with the permission of the teacher;
- 14) drink soft drinks;
- 15) take photos of presentation slides;
- 16) take an active part in the lesson).

forbidden:

- eat (except for persons whose special medical condition requires another - in this case, medical confirmation is required);
- smoking, drinking alcohol and even low-alcohol beverages or drugs;
- use obscene language or use words that offend the honor and dignity of colleagues and faculty;
- gambling;
- damage the material and technical base of the university (damage inventory, equipment; furniture, walls, floors, litter the premises and territories);
- shouting, shouting or listening to loud music in classrooms and even in corridors during classes.