



ЦЕНТЪР ЗА ОБУЧЕНИЕ – БАИ

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Basic information:

Course name: **MESENCHYMIC STEM CELLS**

Lecturer: **Assoc. Prof. Milena Mourdjeva**

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Schedule: **30 hours**

Abstract (up to 150 words):

The course is a brief overview of the biological characteristics of mesenchymal stem cells (MSCs) and their application in modern regenerative and personalized therapies.

MSCs are stem cells derived from adult organisms, mainly from bone marrow, but have also been identified in other tissues such as adipose tissue, dental pulp, perinatal tissues (umbilical cord, amnion, placenta). When subjected to various stimuli or under the influence of a specific microenvironment, they can differentiate into different cell types in vitro or regenerate tissues in vivo. They are also a source of biologically active molecules that affect angiogenesis, tumor process, tissue homeostasis. MSC are a major component of cell-based therapies.

Course content (brief description by topics or modules):

Topic 1: Classification, characterization, markers of MSC

Topic 2: Isolation and cultivation of MSC. 3D cultivation – spheroids, organoids, microarrays.

Topic 3: Basic biological functions of mesenchymal stem cells. Mechanisms of interaction with other cells. Immunogenicity; Immunoregulation; Interactions with tumor cells;

Topic 4: Therapeutic approaches using mesenchymal stem cells or their products

Topic 5: MSC - role in regeneration of large bone defects. Bioprinting.

Forms of training and assessment:

Topic / Module	Hours	Training form	Comment	Assessment method
Topic 1:	2	Lectures		Presentation on a topic related to the PhD Thesis of each participant (60%); participation in discussions (20%); Questions to the lectures (20%)
Topic 2:	3	Lectures		
Topic 3:	10+5	Lectures/ Seminar		
Topic 4:	5	Lectures		
Topic 5:	5	Lectures		

Competencies acquired as a result of the training:

- **Theoretical competence**



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• Understanding of the biological properties of mesenchymal stem cells and their potential for application in regenerative medicine and personalized therapeutic approaches

• Clinical competence

• Current clinical studies with MSC. Approved therapies.

• Research competence

• Understanding of the methods of isolation, cultivation and characterization of MSC

• Studies of the interactions of MSC with immune and tumor cells

• Practical competence

• Selection and critical analysis of literature on a chosen topic

• Communication and interpersonal competences

• Discussion and argumentation of scientific research and therapeutic approaches in group discussions.

• Preparation of presentations on topics related to MSC in the context of the doctoral student's work.

Literature:

Stem Cells

• Author: Stoyan Chakarov, Rumena Petkova, Rumien Pankov

• Publisher: AI "Prof. Marin Drinov"

Current list of reviews on the topics of the course

Example list:

1. Gomez-Salazar, M., Gonzalez-Galofre, Z. N., Casamitjana, J., Crisan, M., James, A. W., & Péault, B. (2020). Five Decades Later, Are Mesenchymal Stem Cells Still Relevant? *Frontiers in Bioengineering and Biotechnology*, 8, 148. <https://doi.org/10.3389/FBIOE.2020.00148/BIBTEX>
2. Jiang, W., & Xu, J. (2020). Immune modulation by mesenchymal stem cells. *Cell Proliferation*, 53(1), e12712. <https://doi.org/10.1111/CPR.12712>
3. Shammaa, R., El-Kadiry, A. E. H., Abusarah, J., & Rafei, M. (2020). Mesenchymal Stem Cells Beyond Regenerative Medicine. *Frontiers in Cell and Developmental Biology*, 8, 72. <https://doi.org/10.3389/FCELL.2020.00072/BIBTEX>
4. Mishra, V. K., Shih, H. H., Parveen, F., Lenzen, D., Ito, E., Chan, T. F., & Ke, L. Y. (2020). Identifying the Therapeutic Significance of Mesenchymal Stem Cells. *Cells* 2020, Vol. 9, Page 1145, 9(5), 1145. <https://doi.org/10.3390/CELLS9051145>
5. Hmadcha, A., Martin-Montalvo, A., Gauthier, B. R., Soria, B., & Capilla-Gonzalez, V. (2020). Therapeutic Potential of Mesenchymal Stem Cells for Cancer Therapy. *Frontiers in Bioengineering and Biotechnology*, 8, 43. <https://doi.org/10.3389/FBIOE.2020.00043/BIBTEX>
6. Otto, W. R. & Rao, J. Tomorrow's skeleton staff: mesenchymal stem cells and the repair of bone and cartilage. *Cell Prolif.* **37**, 97–110 (2004).
7. Chaparro, O. & Linero, I. Regenerative Medicine: A New Paradigm in Bone Regeneration. *Adv. Tech. Bone Regen.* (2016) doi:10.5772/62523.
8. Dzobo, K. *et al.* Advances in Regenerative Medicine and Tissue Engineering: Innovation and Transformation of Medicine. *Stem Cells Int.* **2018**, 2495848 (2018).
9. Wong, R. S. Y., Tan, E. W. & Goh, B. H. Mesenchymal Stem Cell-Based Therapies: Challenges and Enhancement Strategies. *Cell Biochem. Biophys.* (2025) doi:10.1007/s12013-025-01895-z.
10. Hoseinzadeh, A., Esmaili, S., Sahebi, R., Melak, A. M. & Mahmoudi, M. Fate and long-lasting therapeutic effects of mesenchymal stromal / stem-like cells : mechanistic insights. (2025).