دانشگاه علوم پزشکی تبریز
دانشکده علوم نوین پزشکی

Syllabus for 2D and 3D Cell Culture

Course Guide for 2D and 3D Cell Culture (Theoretical and Practical)

Instructor / Instructors: Dr. Ahmad Mahdipour, Dr. Azizeh Rahmani Del, Dr. Behrouz Niknafs

Prerequisite or Corequisite: None

Number of Units: 2 **Type of Units:** 2 Theoretical Units and 1 Practical Unit **Level:** PhD in Tissue Engineering

Number of Sessions: 32 sessions

Start and End Date of Sessions:

Weekly Session Schedule: Sundays, 10 AM - 12 PM

Venue for In-person Sessions: Class 1, Faculty of Modern Medical Sciences

Overall Goal and Course Introduction: This course teaches techniques for isolating and culturing cells on scaffolds using common 3D culture techniques.

Overall Session Objectives: Providing an introduction and history of cell culture; comparison, advantages, and limitations of tissue and cell culture; designing a cell culture laboratory and introducing related equipment; presenting types of cell culture media and sera; primary and secondary culture; examining cell behavior in culture medium, cell cycle, cell growth curve; performing cell counting, passaging, freezing and thawing; preparation of cryovials; presenting cell isolation techniques; presenting cell characterization techniques; familiarizing students with immortalization and cell differentiation techniques; student knowledge about sources of contamination in cell culture; presenting methods for controlling and eliminating contamination; presenting various methods of 3D cell culture on scaffolds, such as cells within hydrogels or on the scaffold surface or in micro-well and microfluidic systems; familiarity with cell culture equipment; familiarity with cell culture consumables; preparation of culture media;

familiarity with solution preparation and isolation of mesenchymal stem cells; evaluation of cell growth; practical performance of the MTT test; familiarity with freezing and thawing of cells.

Domains of Objectives: Cognitive, Affective, and Psychomotor

Course Learning Objectives

It is expected that learners, after completing this course, will be able to:

1. Know and explain the history of cell culture, advantages and limitations of tissue and cell culture.
2. Be able to design a standard cell culture laboratory.
3. Introduce equipment related to cell culture laboratories.
4. List various types of cell culture media and sera.
5. Explain concepts related to primary and secondary culture.
6. Be able to examine cell behavior in culture medium, cell cycle, cell growth curve.
7. Be able to perform cell counting, passaging, freezing and thawing, preparation of cryovials.
8. Know and explain cell isolation techniques.
9. Know and explain cell characterization techniques.
10. Be familiar with immortalization and cell differentiation techniques and explain them.
11. Discuss sources of contamination in cell culture and methods for controlling and eliminating contamination.
12. Explain various methods of 3D cell culture on scaffolds, such as cells within hydrogels or on the scaffold surface or in micro-well and microfluidic systems.
13. Be able to perform 2D and 3D cell culture.
14. List cell culture equipment, cell culture consumables, preparation of culture media, and explain their applications.
15. Be familiar with and be able to perform solution preparation, isolation of mesenchymal stem cells, and evaluation of cell growth.
16. Perform the MTT test practically.

17. Perform freezing and thawing of cells practically.
18. Be able to teach the learned materials.
19. Observe laboratory safety principles.
20. Fully observe ethical principles related to the laboratory and effective communication with laboratory experts and other students.
21. Observe ethical principles of working with laboratory animals when extracting cells.

Teaching Methodology

Lecturing, conference, question and answer, discussion, case presentation, self-study, practical and laboratory work.

Student Assessment Method

Continuous Assessment: Group work and quizzes, participation in class discussions, performing class activities including seminar presentation, assignment (score).

Final Assessment: Written and practical exam (score: 16).

Attendance and Absence: (Score: 2).

Total Score: 20.

Minimum Passing Score for this Course: 14.

Permissible Absence Hours for this Course: 12 hours.

Educational Resources

- Resources from which exam questions will be designed:

✓ Haycock J. 3D cell culture, methods and protocols (Latest edition)
✓ Marx U, Sandig V. Drug testing In Vitro: Breakthroughs and trends in cell culture technology (Latest edition)

Learning Opportunities

- Attending classes and laboratories.
- Holding various specialized workshops in the department by faculty members and senior students.
- Participating in the department's journal clubs.

Contact Information

Course Instructors:

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Session Topics for 3 Units of 2D and 3D Cell Culture

Session	Date	Instructor	Topic and Curriculum
1		Dr. Mahdipour	Introduction and History of Cell Culture
2		Dr. Mahdipour	Comparison, Advantages and Limitations of Tissue and Cell Culture
3		Dr. Mahdipour	Designing a Cell Culture Laboratory and Introducing Related Equipment
4		Dr. Mahdipour	Types of Cell Culture Media and Sera
5		Dr. Mahdipour	Primary and Secondary Culture
6		Dr. Mahdipour	Examining Cell Behavior in Culture Medium, Cell Cycle, Cell Growth Curve
7		Dr. Mahdipour	Cell Counting, Passaging, Freezing and Thawing
8		Dr. Mahdipour	Preparation of Cryovials
9		Dr. Rahmani Del	Cell Isolation Techniques
10		Dr. Rahmani Del	Cell Characterization Techniques

Session	Date	Instructor	Topic and Curriculum
11		Dr. Rahmani Del	MTT Test
12		Dr. Rahmani Del	Immortalization and Cell Differentiation Techniques
13		Dr. Rahmani Del	Sources of Contamination in Cell Culture, Control and Elimination of Contamination
14		Dr. Niknafs	Types of 3D Cell Culture Methods on Scaffolds: Cells within Hydrogels
15		Dr. Niknafs	Types of 3D Cell Culture Methods on Scaffolds: Cells on the Scaffold Surface
16		Dr. Niknafs	Types of 3D Cell Culture Methods on Scaffolds: Cells in Micro-well and Microfluidic Systems

In addition to the theoretical classes mentioned above, practical classes will be held for 34 hours in the laboratory.

Time: Sundays, 10 AM - 12 PM

Session Format: In-person in the classroom, at Class 1, and also practically in the laboratory.

Educational Media: Computer, whiteboard, and practical laboratory.