

## School of Pharmacy

### Department of Pharmacognosy and Pharmaceutical Biotechnology

**Course Title:** Animal Cell Culture

**Credit:** 1 (Theory), 1 (Practical)

**Prerequisite:** Molecular Biology and Genetics

First semester of 2024 -2025 School Year

**Target students:** Foreign Students (MS-Pharmaceutical Nanotechnology)

**Instructors:** Dr. Mottaghi, Dr. Montazeri

**Responsible Instructor:** Dr. Mottaghi

### Course Description:

#### Course Objectives:

The objective of this course is to familiarize students with the fundamental principles and general techniques of animal cell culture. Students will be introduced to various types of cell lines and the methods used to culture and maintain them. The course will cover essential topics such as the preparation and optimization of culture media, contamination control, and the safe handling of cells in a laboratory setting. By the end of the course, students will have acquired basic skills and knowledge applicable to general laboratory practices involving animal cell cultures, providing a foundation for further studies in pharmaceutical sciences.

#### Course Content:

- 1. Introduction and History of Animal Cell Culture**
  - Overview of the historical development and significance of animal cell culture in scientific research and industry.
- 2. Cell Culture Equipment and Devices**
  - Introduction to essential tools and equipment required for cell culture, including their functions and maintenance.
- 3. Types of Cell Culture Media and Solutions**
  - Study of various cell culture media, their components, and the role of each component in cell growth.

- Comparison of different culture media and their suitability for various cell types.
- 4. Methods of Cell Identification**
  - Techniques for identifying different cell types in culture.
- 5. Applications of Cell Culture**
  - Exploration of the practical uses of cell culture in pharmaceutical and biomedical research.
- 6. Contamination Identification, Prevention, and Treatment**
  - Methods for identifying, preventing, and treating microbial, fungal, and mycoplasma contaminations in cell cultures.
  - Strategies for obtaining various cell lines, including normal and cancerous cells.
- 7. Cell Culture Laboratory Design**
  - Principles of designing a cell culture laboratory, including layout and safety considerations.
- 8. Cell Culture Lab Equipment and Supplies**
  - Detailed overview of equipment and supplies used in cell culture labs.
- 9. Safety and Hazard Control in Cell Culture Labs**
  - Safety protocols and hazard control measures specific to cell culture work.
- 10. Cell Culture Media, Serum, and Supplements**
  - Understanding the role of serum and supplements in cell culture media.
- 11. Morphological Characteristics of Cells in Culture**
  - Observing and understanding the morphological characteristics of cells in culture.
- 12. Routine Cell Culture Protocols and Techniques**
  - Introduction to standard protocols and techniques used in cell culture, including primary culture, subculture, and cell line maintenance.
- 13. Cell Line Sources**
  - Exploration of sources for obtaining cell lines, including primary cultures and established cell lines.
- 14. Quality Control in Cell Culture**
  - Methods for ensuring the quality and consistency of cell cultures.
- 15. Cell Culture Contaminations**
  - Identification and management of common cell culture contaminants.
- 16. Cell Cryopreservation**

- Techniques for the cryopreservation of cells, including freezing and thawing protocols.

#### **17. Cell Counting**

- Methods for counting and assessing cell viability.

#### **18. Cell Passage Protocols**

- Protocols for the passage of different types of cells, including adherent, semi-adherent, and suspension cells.

### **Specific Course Learning Objectives**

By the end of this course, students will be able to:

1. Understand the historical background and significance of animal cell culture.
2. Identify and properly use the equipment and devices necessary for cell culture.
3. Compare and contrast different cell culture media and solutions, understanding their components and functions.
4. Apply various methods for identifying cell types in culture.
5. Recognize the practical applications of cell culture in pharmaceutical sciences.
6. Identify and manage common contaminants in cell cultures, including microbial, fungal, and mycoplasma infections.
7. Design and set up a basic cell culture laboratory, considering safety and hazard control.
8. Select appropriate culture media, serum, and supplements for specific cell types.
9. Observe and describe the morphological characteristics of cells in culture.
10. Follow standard protocols and techniques for routine cell culture, including primary culture and cell line maintenance.
11. Access reliable sources for obtaining cell lines, including primary and established cell lines.
12. Implement quality control measures in cell culture practices.
13. Effectively cryopreserve cells and manage their storage.
14. Accurately count cells and assess their viability.
15. Conduct proper cell passage techniques for various cell types, ensuring their continued growth and health in culture

### **Course Schedule for Animal Cell Culture**

## Course Schedule for Animal Cell Culture

(Saturday 10-13)

Session	Date (1403-2024)	Topic	Teaching Method	Instructor(s)
1	17 Shahrivar 1403 07 Sep 2024 (Extra class will be arranged)	Introduction to Animal Cell Culture - Applications of Cell Culture	PowerPoint/Lecture	Dr. Mottaghi- Dr. Montazeri
2	24 Shahrivar 1403 14 Sep 2024	Design of Cell Culture Laboratory	PowerPoint/Lecture	Dr. Mottaghi- Dr. Montazeri
3	07 Mehr 1403 28 Sep 2024	Equipment and Tools in the Cell Culture Laboratory	PowerPoint/Lecture	Dr. Mottaghi- Dr. Montazeri
4	14 Mehr 1403 05 Oct 2024	Safety and Risk Management in Cell Culture Laboratory	PowerPoint/Lecture	Dr. Mottaghi- Dr. Montazeri
5	21 Mehr 1403 12 Oct 2024	Cell Culture Media, Serum, and Supplements	PowerPoint/Lecture	Dr. Mottaghi- Dr. Montazeri
6	28 Mehr 1403 19 Oct 2024	Morphological Characteristics of Cells in Culture	PowerPoint/Lecture	Dr. Mottaghi- Dr. Montazeri
7	05 Aban 1403 26 Oct 2024	Routine Protocols and Techniques of Cell Culture	PowerPoint/Lecture	Dr. Mottaghi- Dr. Montazeri
According to the resolution of the Faculty's Educational Council, classes will be suspended from November 2 to November 9 due to the midterm examinations.				
8	26 Aban 1403 16 Nov 2024	Sources of Cell Lines - Primary Culture - Subculture and Cell Lines	PowerPoint/Lecture	Dr. Mottaghi- Dr. Montazeri
9	03 Azar 1403 23 Nov 2024	Quality Control in Cell Culture	PowerPoint/Lecture	Dr. Mottaghi- Dr. Montazeri
10	10 Azar 1403 30 Nov 2024	Cell Culture Contaminations	PowerPoint/Lecture	Dr. Mottaghi- Dr. Montazeri
11	17 Azar 1403 07 Dec 2024	Cryopreservation in Cell Culture	PowerPoint/Lecture	Dr. Mottaghi- Dr. Montazeri
12	24 Azar 1403 14 Dec 2024	Cell Counting	PowerPoint/Lecture	Dr. Mottaghi- Dr. Montazeri
13	01 Dey 1403 21 Dec 2024	Thawing and Freezing Protocols in Cell Culture	PowerPoint/Lecture	Dr. Mottaghi- Dr. Montazeri
14	08 Dey 1403 28 Dec 2024	Cell Passage Protocols (Adherent, Semi- adherent, Suspension)	PowerPoint/Lecture	Dr. Mottaghi- Dr. Montazeri
<b>Final Exam</b>	-	Written and Descriptive Test	-	Dr. Mottaghi- Dr. Montazeri

### References:

#### A) Textbooks:

1. *Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications*, R. Ian Freshney, Wiley-Blackwell. The latest edition.
2. *Large Scale Cell Culture Technology*, Bjorn K. Lydersen, Wiley-Interscience. The latest edition.

3. *Epithelial Cell Culture — A Practical Approach*, Edited by A J Shaw, IRL Press at Oxford University Press. The latest edition.

#### **B) Articles:**

- Review articles and relevant websites for each section.

#### **C) Electronic Content:**

- Relevant online resources and e-books.

#### **D) Additional Resources:**

- Websites of regulatory organizations, including:
  - U.S. Food and Drug Administration (FDA)
  - World Health Organization (WHO)
  - European Medicines Agency (EMA)
  - Regulatory organizations in countries approved by the Iranian Food and Drug Administration (including Japan, Australia, etc.).

## Student Responsibilities and Expectations

Students are expected to adhere to the following responsibilities throughout the course:

- **Regular Attendance:** Students must attend all classes regularly and punctually. *Attendance is mandatory in practical classes, with no absences permitted.* For theory classes, a student's total absences should not exceed 4 out of 17 sessions. Otherwise, the score for the course will be considered as zero. Note: Allowed absences are accepted provided students bring in documents for that and the related professor approves it. Acting against absences (excused or not) will be the professor's decision and the college's agreement. For each session missed, 0.25 points will be deducted from the final grade. However, if students provide a summary of the topics covered during the missed session, the 0.25-point deduction will be waived, but the absence will still be recorded
- **Timely Completion of Assignments:** Students are required to complete and submit all assignments by the specified deadlines.
- **Study Assigned Materials:** Students should thoroughly study all the recommended textbooks, articles, and other resources provided during the course.
- **Active Participation:** Students are encouraged to actively participate in class discussions, activities, and any other scheduled programs.

#### **Additional Note on Final Examination**

- **Final Exam Policy:** The final examination will consist of multiple-choice and descriptive questions. There will be no opportunity to retake the final exam for students who do not achieve a passing grade. Students are strongly advised to prepare diligently and manage their study time effectively to perform well. Requests for grade adjustments or exam retakes will not be entertained. It is imperative to approach the course with seriousness and commitment to meet the academic standards set forth.

### Class Location

- **Class Venue:** All classes will be held in Besarati (Eastern 7) Street, North Shahin Boulevard

## Evaluation Criteria and Grade Distribution

Percentage of Total Grade	Evaluation Basis	Method of Evaluation
50% (10 out of 20)	Theory Part (Final Exam)	Written exam at the end of the semester, assessing the student's understanding of theoretical concepts.
50% (10 out of 20)	Practical part	Completion of lab reports and practical exercises based on the experiments conducted during the lab sessions.

### Explanation:

**Theory Part (Final Exam):** This section constitutes 50% of the final grade (10 out of 20). The evaluation is based on a written exam at the end of the semester, where students are tested on their understanding of theoretical concepts covered during the lectures.

**Practical Part:** This section also constitutes 50% of the final grade (10 out of 20). The evaluation is based on the students' understanding and analysis of laboratory procedures, as demonstrated through the completion of lab reports and their engagement with the practical aspects observed during the course.

This table provides a clear breakdown of how the students will be assessed throughout the course and the weightage of each component in the final grade.