

**SONOMA STATE UNIVERSITY  
DEPARTMENT OF BIOLOGY  
BIOLOGY 344: CELL BIOLOGY  
Fall 2008**

**Instructor** Murali C. Pillai, Ph.D.  
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**Office Hours** Mon. 9:00 AM – 11:00 AM  
 Fri. 10:00 AM – 11:00 AM  
**Lecture** **Mon. & Wed. 1:00 PM – 2:15 PM, DARWIN HALL- ROOM 29**  
**Laboratory** DARWIN HALL- ROOM 204  
SECTION 1: Mon. 2:25 PM - 5:15 PM  
SECTION 2: Wed. 2:25 PM - 5:15 PM

**Course goals and objectives:** An introduction to structural and molecular organization of eukaryotic cells and tissues. Specific topics will represent the central core of modern cell biology and are concerned mainly with those properties that are common to most eukaryotic cells. These include membrane structure and function, intracellular compartments and protein sorting, protein trafficking, cell signaling, structure and dynamics of cytoskeletal elements, molecular mechanisms of cell division and, extracellular matrix molecules and their roles in cell functions. Laboratory experience involving modern cell biological techniques are designed to demonstrate lecture concepts.

**Text Book:** *Molecular Biology of the Cell, Bruce Alberts et al., 5<sup>th</sup> ed., Garland Science, NY.* For lab portion of the course, a **Lab Manual** needs to be purchased from the Copy Center at the Student Union.

**Examinations:** There will be two (2) lecture midterm exams, two (2) laboratory exams and a cumulative final exam.

<b>SOME IMPORTANT ACTIVITIES AND DATES</b>		
<b>DATE</b>	<b>ACTIVITY</b>	<b>POINTS</b>
<b>Sept. 29</b>	<b>First Lecture Midterm Examination</b>	<b>100</b>
<b>Oct. 15/20</b>	<b>First Laboratory Examination</b>	<b>50</b>
<b>Oct. 15/20</b>	<b>Laboratory Notebook Due</b>	<b>25</b>
<b>Oct. 29</b>	<b>Second Lecture Midterm Examination</b>	<b>100</b>
<b>Nov. 24</b>	<b>Library Research Report Due</b>	<b>25</b>
<b>Dec. 08/10</b>	<b>Second Laboratory Examination</b>	<b>50</b>
<b>Dec. 08/10</b>	<b>Laboratory Notebook Due</b>	<b>25</b>
<b>Dec. 17</b>	<b>Cumulative Final Examination</b>	<b>100</b>
<b>TOTAL POINTS</b>		<b><u>475</u></b>

**Library Research Report:** As part of the laboratory portion of the course, you are required to prepare and submit a Library Research Report for a maximum of 25 points. This report is due no later than November 24, 2008 5:00 PM (PST). **Late submissions will not be accepted.** For details of this assignment, please see the lab manual.

In addition, **for 10 bonus points**, you may submit a review paper on a specific topic of your interest in contemporary cell biology. The paper should be 4 pages long (type-written, double spaced), and represent a thorough review of recent literature published during the last 2 years on the topic you choose. The paper is due no later than November 19<sup>th</sup> 1:00 PM (PST). **Late submissions will not be accepted.** AT LEAST BY Nov. 5<sup>th</sup>, YOU MUST see your instructor during his office hours for approval of the review topic and for specific instructions on how to organize the paper.

**Grading:** Your final course grade will be determined based on the total number of points earned. It is expected that letter grades will be assigned on the basis of the following scale:

90 % and above:	<b>A</b> (A <sup>-</sup> , A):	80-89.9%:	<b>B</b> (B <sup>-</sup> , B, B <sup>+</sup> )
70-79.9%:	<b>C</b> (C <sup>-</sup> , C, C <sup>+</sup> )	60-69.9%:	<b>D</b> (D <sup>-</sup> , D, D <sup>+</sup> )
Less than 60%:			

**Regarding Exams:** Questions and concerns regarding your answers on exams must be submitted in writing within one week after receiving the graded exam. Upon your request, the entire exam may be re-graded.

**Attendance** and "serious participation" in lecture and lab are strongly encouraged since history has shown a strong correlation with course grade. Absence from the lab will cost you 5 points per unexcused absence! Poor attendance at lecture can result in deduction of points from your test scores. Late arrivals and early departures for no documented reasons will be counted as absence. Late arriving students disrupt the class, so do those who leave early!! Late students will not be given extra time to complete tests.

**Learning Disabilities:** If you have a learning disability and may have need for some type of accommodation(s) in order to participate fully in this class, please feel free to discuss your concerns in private with me *AND BE SURE TO CONTACT* the SSU Disability Student Services office.

**As a student at Sonoma State University, it is important that you know the policies and procedures that affect you. These policies and procedures, approved by the SSU Academic Senate and the President, may be found at the following web sites.**

*Add/Drop Policy*

<http://www.sonoma.edu/catalog/regulations.html#addrop>

*Cheating and Plagiarism Policy*

<http://www.sonoma.edu/uaffairs/policies/cheatingpolicy.htm>

*Grade Appeal Policy*

<http://www.sonoma.edu/uaffairs/policies/gradepolicy.htm>

*Access to Programs for Students with Disabilities Policy*

<http://www.sonoma.edu/uaffairs/policies/disabilitypolicy.htm>

*Diversity Statement*

<http://www.sonoma.edu/diversity/>

## COURSE OUTLINE

<u>Date:</u>	<u>Lecture Topic</u>	<u>Reading</u>
Aug. 27	Introduction to Course	
	<b><u>Plasma Membrane Structure and Properties</u></b>	<b><u>Chapter 10</u></b>
Sept. 01	Labor Day: No Class	
03	The Lipid Bilayer: Properties and Dynamics	
08	Membrane Proteins: Structure and Properties	
10	Membrane Proteins: Carbohydrate Interaction	
	<b><u>Intracellular Compartments and Protein Sorting</u></b>	<b><u>Chapter 12</u></b>
15	Compartmentalization of Cells	
17	Transport of Molecules Between Cytosol and Nucleus	
22	Transport of Molecules into Mitochondria and Chloroplast	
24	Endoplasmic Reticulum and Protein Integration	
<b>29</b>	<b><u>FIRST MIDTERM EXAMINATION (100 PTS.)</u></b>	
	<b><u>Intracellular Vesicular Traffic</u></b>	<b><u>Chapter 13</u></b>
Oct 01	Molecular Mechanism of Membrane Transport	
06	Transport from the ER Through the Golgi Apparatus	
08	Transport from the <i>Trans</i> Golgi Network to Lysosomes	
13	Endocytosis and Exocytosis	
	<b><u>Cell-Cell Communication</u></b>	<b><u>Chapter 15</u></b>
15	General Principles of Cell Communication	
20	Cell Surface Receptors and Cell Communication	

<u>Date:</u>	<u>Lecture Topic</u>	<u>Reading</u>
22	Signaling via G-protein Linked Cell Surface Receptors.	
27	Intracellular Ca <sup>++</sup> Oscillations: Membrane Lipid Messengers	
<b>29</b>	<b><u>SECOND MIDTERM EXAMINATION (100 PTS.)</u></b>	
	<b><u>The Cytoskeleton</u></b>	<b><u>Chapter 16</u></b>
<b>Nov. 03</b>	Nature and Dynamics of Cytoskeletal Elements	
05	Microtubule and Microtubule Dynamics	
10	Cytoskeleton and Cell Behavior	
	<b><u>The Mechanics of Cell Division</u></b>	<b><u>Chapter 18</u></b>
12	An Overview of Cell Cycle/ M-phase	
17	Mitosis: Molecular Regulators	
19	Cytokinesis in Plants and Animals	
20		
	<b><u>Cell Junctions, Cell Adhesions and Extra-cellular Matrix</u></b>	<b><u>Chapter 19</u></b>
24	Cell Junctions: Structure and General Functions	
<b>26</b>	<b>Thanksgiving Holiday: No Class</b>	
<b>Dec. 01</b>	Cell-Cell Adhesion: Molecular Mechanisms	
03	Extra-Cellular Matrix Molecules and Cell Functions	
08	Tissue Formation: General Principles and Mechanisms	
10	Review and Discussion OR “Catch-up”	
<b>17</b>	<b><u>CUMULATIVE FINAL EXAMINATION (100 PTS.): 2:00 PM-3:50 PM</u></b>	

## TENTATIVE LABORATORY SCHEDULE: [MONDAY GROUP]

<b>WEEK</b>	<b>LABORATORY ACTIVITY</b>
<b>WEEK 1 [SEPT. 01]</b>	<b>Labor Day Holiday: No Lab</b>
<b>WEEK 2 [<u>SEPT. 08</u>]</b>	<b><u>Laboratory Orientation and Preparation for SDS-PAGE</u></b> <ul style="list-style-type: none"><li>• Discussion of various laboratory techniques used for the study of cell biology.</li><li>• Discussion of how to prepare lab notebook and library research report.</li><li>• Tour of the Keck Imaging Facility</li><li>• Tour of the Cell Culture Facility</li></ul>
<b>WEEK 3 [<u>SEPT. 15</u>]</b>	<b><u>SDS-PAGE for Protein Electroelution:</u></b> <ul style="list-style-type: none"><li>• Review of the theory and principles of protein electrophoresis (SDS-PAGE).</li><li>• Preparation of SDS-PAGE samples for Protein Electro-elution.</li><li>• Completion of SDS-PAGE of tissue extracts</li></ul>
<b>WEEK 4 [SEPT. 22]</b>	<b><u>Protein Electro-elution-I</u></b> <ul style="list-style-type: none"><li>• Discussion of the theory, principles and some practical applications of protein electroelution</li><li>• Preparation for electroelution of proteins</li><li>• Electroelution of proteins</li></ul>
<b>WEEK 5 [SEPT. 29]</b>	<b><u>Protein Electroelution-II</u></b> <ul style="list-style-type: none"><li>• Completion of protein electroelution</li><li>• Preparation of electroeluted proteins for SDS-PAGE</li><li>• SDS-PAGE analysis of electroeluted proteins</li><li>• Coomassie brilliant blue staining of electroeluted polypeptides and molecular weight determination of electroeluted proteins(s).</li></ul>
<b>WEEK 6 [OCT. 06]</b>	<b><u>Western Blotting and Immunostaining-I</u></b> <ul style="list-style-type: none"><li>• Discussion of the theory, principles and some practical applications of Western blotting</li><li>• Demonstration of Western blotting</li><li>• Preparation of SDS gels for Western blotting</li></ul>

- Electrophoresis AND Western blotting of tissue polypeptides.
- Detection of polypeptides on Western blots by Ponceau-S staining

**WEEK 7 [OCT. 13]**

**Western Blotting and Immunostaining-II [TENTATIVE]**

- Immunodetection of polypeptides on Western blots
- Review and Discussion of Laboratory Experiences; completion of lab notebooks

**WEEK 8 [OCT. 20]**

**FIRST LABORATORY EXAMINATION (50 PTS.)**

**SUBMIT LAB NOTEBOOK (25 PTS.)**

**WEEK 9 [OCT. 27]**

**Light and Electron Microscopic Techniques**

- Review and discussion of the theory and principles of light (from Biol. 123) and electron microscopic (SEM and TEM) techniques.
- Identification of cellular organelles and structures at the ultrastructural (TEM) level

**WEEK 10 [NOV. 03]**

**Epifluorescence and Laser Scanning Confocal Microscopic Imaging-I:**

- Review and discussion of the theory and principles of fluorescence (from Biol. 123) and confocal microscopy.
- Preparation of samples for epifluorescence and confocal imaging: anti-tubulin and nuclear staining of mouse embryonic fibroblasts
- **Introduction to Animal Cell Culture-I.**
- The “Do’s and Don’ts” of cell culture
- Aseptic techniques and Good Cell Culture Practice: The Sterility Issues

**WEEK 11 [NOV. 10]**

**Epifluorescence and Laser Scanning Confocal Microscopic Imaging-II**

- Preparation of samples for epifluorescence and confocal imaging, **contd....**: anti-tubulin and nuclear staining of mouse embryonic fibroblasts
- Epifluorescence and confocal imaging of immuno-stained samples

- **Introduction to Animal Cell Culture-II.**
- Resuscitation of Frozen NIH 3T3 Cells: Inoculation

**WEEK 12 [NOV. 17]**

**Epifluorescence and Laser Scanning Confocal Microscopic Imaging-III**

- Epifluorescence and confocal imaging of immuno-stained samples, **contd...**
- **Introduction to Animal Cell Culture-III.**
- Subculture of Adherent Cell Lines: Estimation of Confluence

**WEEK 13 [NOV. 24]**

**Completion of Lab Experience on Animal Cell Culture. Completion of Epifluorescence and Confocal Imaging**

**WEEK 14 [DEC. 01]**

**Cytoplasmic Streaming and Amoeboid Motion**

- Studies of cytoplasmic streaming and contraction.
- Phagocytosis and actin-myosin interaction during amoeboid motion.
- Effect of cytoskeletal drugs in cytoplasmic streaming.

**WEEK 15 [DEC. 08]**

**SECOND LABORATORY EXAMINATION (50 PTS.)**

**SUBMIT LABORATORY NOTEBOOK (25 PTS.)**

## TENTATIVE LABORATORY SCHEDULE: [WEDNESDAY GROUP]

### WEEK

### LABORATORY ACTIVITY

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WEEK 1 [AUG. 27]

No Lab

WEEK 2 [SEPT. 03]

#### **Laboratory Orientation and Preparation for SDS-PAGE**

- Discussion of various laboratory techniques used for the study of cell biology.
- Discussion of how to prepare lab notebook and library research report.
- Tour of the Keck Imaging Facility
- Tour of the Cell Culture Facility

WEEK 3 [SEPT. 10]

#### **SDS-PAGE for Protein Electroelution:**

- Review of the theory and principles of protein electrophoresis (SDS-PAGE).
- Preparation of SDS-PAGE samples for Protein Electro-elution.
- Completion of SDS-PAGE of tissue extracts

WEEK 4 [SEPT. 17]

#### **Protein Electro-elution-I**

- Discussion of the theory, principles and some practical applications of protein electroelution
- Preparation for electroelution of proteins
- Electroelution of proteins

WEEK 5 [SEPT. 24]

#### **Protein Electroelution-II**

- Completion of protein electroelution
- Preparation of electroeluted proteins for SDS-PAGE
- SDS-PAGE analysis of electroeluted proteins
- Coomassie brilliant blue staining of electroeluted polypeptides and molecular weight determination of electroeluted proteins(s).

WEEK 6 [OCT. 01]

#### **Western Blotting and Immunostaining-I**

- Discussion of the theory, principles and some practical applications of Western blotting
- Demonstration of Western blotting
- Preparation of SDS gels for Western blotting

- Electrophoresis AND Western blotting of tissue polypeptides.
- Detection of polypeptides on Western blots by Ponceau-S staining

**WEEK 7 [OCT. 08]**

**Western Blotting and Immunostaining-II [TENTATIVE]**

- Immunodetection of polypeptides on Western blots
- Review and Discussion of Laboratory Experiences; completion of lab notebooks

**WEEK 8 [OCT. 15]**

**FIRST LABORATORY EXAMINATION (50 PTS.)**

**SUBMIT LAB NOTEBOOK (25 PTS.)**

**WEEK 9 [OCT. 22]**

**Light and Electron Microscopic Techniques**

- Review and discussion of the theory and principles of light (from Biol. 123) and electron microscopic (SEM and TEM) techniques.
- Identification of cellular organelles and structures at the ultrastructural (TEM) level

**WEEK 10 [OCT. 29]**

**Epifluorescence and Laser Scanning Confocal Microscopic Imaging-I:**

- Review and discussion of the theory and principles of fluorescence (from Biol. 123) and confocal microscopy.
- Preparation of samples for epifluorescence and confocal imaging: anti-tubulin and nuclear staining of mouse embryonic fibroblasts
- **Introduction to Animal Cell Culture-I.**
- The “Do’s and Don’ts” of cell culture
- Aseptic techniques and Good Cell Culture Practice: The Sterility Issues

**WEEK 11 [NOV. 05]**

**Epifluorescence and Laser Scanning Confocal Microscopic Imaging-II**

- Preparation of samples for epifluorescence and confocal imaging, **contd....**: anti-tubulin and nuclear staining of mouse embryonic fibroblasts
- Epifluorescence and confocal imaging of immuno-stained samples

WEEK 12 [NOV. 12]	<ul style="list-style-type: none"> <li>• <b><u>Introduction to Animal Cell Culture-II.</u></b></li> <li>• Resuscitation of Frozen NIH 3T3 Cells: Inoculation</li> </ul>
WEEK 13 [NOV. 19]	<p><b><u>Epifluorescence and Laser Scanning Confocal Microscopic Imaging-III</u></b></p> <ul style="list-style-type: none"> <li>• Epifluorescence and confocal imaging of immuno-stained samples, <b>contd...</b></li> <li>• <b><u>Introduction to Animal Cell Culture-III.</u></b></li> <li>• Subculture of Adherent Cell Lines: Estimation of Confluence</li> </ul> <p><b>Completion of Lab Experience on Animal Cell Culture. Completion of Epifluorescence and Confocal Imaging</b></p>
WEEK 14 [NOV. 26]	<b>Thanksgiving Holiday: No lab</b>
WEEK 15 [DEC. 03]	<p><b><u>Cytoplasmic Streaming and Amoeboid Motion</u></b></p> <ul style="list-style-type: none"> <li>• Studies of cytoplasmic streaming and contraction.</li> <li>• Phagocytosis and actin-myosin interaction during amoeboid motion.</li> <li>• Effect of cytoskeletal drugs in cytoplasmic streaming.</li> </ul>
<b>WEEK 16 [DEC. 10]</b>	<p><b>SECOND LABORATORY EXAMINATION (50 PTS.)</b></p> <p><b>SUBMIT LABORATORY NOTEBOOK (25 PTS.)</b></p>