

CALIFORNIA STATE POLYTECHNIC UNIVERSITY, POMONA

BIO 577: Transmission Electron Microscopy Techniques

Fall Quarter, 2001

Course Information Sheet (Syllabus)

<u>CRN#</u>	<u>Subj</u>	<u>Crse</u>	<u>Sect</u>	<u>Course title</u>	<u>Units</u>	<u>Days</u>	<u>Time</u>	<u>Bldg</u>	<u>Rm</u>	<u>Instructor</u>
45630	BIO	577	01	TEM Techniques	2.0	MW	1100-1150	3	138	Dr. G. Kageyama
45631	BIO	577L	01	TEM Techniques Lab	3.0	TBA	TBA	8	34A	Jeremy Burton Kevin Franke

Professor: Dr. Glenn H. Kageyama Office hours: MTWF 10-11 a.m.
8-129, (909) 869-5305 (leave voice mail message)
e-mail: ghkageyama@csupomona.edu and ghkageya@uci.edu

Prerequisites: a. BIO 115, BIO 310, BIO 423 or BIO 435, or equivalent
b. Chemistry, through Organic Chemistry
c. A proficiency in basic Biology, Chemistry and Physics

Required reading: a. Bozzola and Russell, Electron Microscopy, 1st or 2nd Eds, 1992, 1999
b. Selected TEM research papers, to be selected by student or assigned by Dr. Kageyama

Laboratories: Lab coat; scientific or statistical calculator.

Course Objectives: To give students an exposure to basic principles of electron microscopy, accomplished by classroom lecture-discussions, laboratory exercises, readings in the basic literature of the field, and the presentation of research articles by students.

Hopefully, students will develop an appreciation for a basic understanding of electron microscopy. Through a review of the history of electron microscopy and hands-on training, the student will develop the ability to prepare specimens for electron microscopy and a working knowledge of the use of and operation of the transmission electron microscope.

General Requirements and Policies: Students should read text assignments before lectures so that they may better understand lectures and participate in class discussions. Questions and curiosity are important aspects of learning. Students are required to attend all laboratories (except for illness or other valid reason), do all the experiments assigned.

Schedule of Exams: Three examinations: two midterms and one final. The general nature of the exams will be announced. The exams missed due to unavoidable events such as accidents, illness, etc. can be made up later at the Learning Resource Center (15-4, bottom floor of library; Laura at x3503).

Examination Method: Each exam will include fill-in, calculations, multiple choice, matching and/or short answer questions on lecture and lab. (Contact Dr. Kageyama prior to the scheduled exam time to schedule a make-up exam.)

Grading: Midterm I & II will be worth 50 points each. The second midterm will include material covered in the first exam. A student presentation of an EM research paper will be worth 50 points. The final (100 points) will be comprehensive and will include material covered in the student presentations. Three laboratory practicals, each worth 50 points will be given at intervals throughout the quarter. A laboratory project will be worth 100 points. An incomplete (I) or a lower grade will be assigned if these requirements are not met.

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Lecture units (3.0)			Laboratory units (2.0)		
Midterm I	50 points	20%	Laboratory practicum I	50 points	20%
Midterm II	50 points	20%	Laboratory practicum II	50 points	20%
Student presentation	50 points	20%	Laboratory practicum III	50 points	20%
Final Examination	100 points	40%	Laboratory project	100 points	40%
Total	250 points	100%	Total	250 points	100%

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Lecture/Lab Schedule

Dr. Glenn H. Kageyama
Office: 8-129; 869-5305

Date	D	#	Topic	No	Laboratory Exercise (tentative)
<u>Week 1: Historical Perspective and Specimen Preparation</u>					<u>Introduction, Fixation, Sectioning</u>
9/24	M	1	Historical Perspective (Ch. 1: 2-12)	1	Introduction, Safety rules,
9/26	W	2	Specimen Preparation: Fixation (Ch. 2: 17-36)		Fixation, Thick sectioning
<u>Week 2: Specimen Prep.: Embedding and Sectioning</u>					<u>Embedding, Ultramicrotomy</u>
10/1	M	3	Dehydration and Embedding (Ch. 2: 36-46)	2	Osmication & Embedding
10/3	W	4	Ultramicrotomy (Ch. 4: 74-109)		Glass knives, Semi-thin sectioning
<u>Week 3: Specimen Prep.: Staining and Artifacts</u>					<u>Thin Sectioning</u>
10/8	M	5	Specimen Staining (Ch. 5: 121-145)	3	Grid prep., Thin-sectioning
10/10	W	6	Interpretation and Artifacts (Ch. 19: 443-475)		Grid Staining
<u>Week 4: Midterm and Survey of Ultrastructure</u>					<u>Electron Microscope operation</u>
10/15	M		Midterm I (TEM Prep)	4	Demonstration and instruction
10/17	W	7	Cell Surface (Ch. 20: 477-505; 571-8; 583-4)		Hands of use of controls
<u>Week 5: Survey of Ultrastructure: Cell Interior</u>					<u>Electron Microscope operation</u>
10/22	M	8	The Nucleus (Ch. 20: 513-527)	5	Demonstration and instruction
10/24	W	9	Intracell. Membrane (Ch. 20: 535-48; 556-62)		Hands of use of controls
<u>Week 6: Cytoskeletal and Motility Systems</u>					<u>Darkroom techniques</u>
10/29	M	10	The Cytoskeleton (Ch. 20: 506-513)	6	Photographic principles
10/31	W	11	Cilia and Flagella (Ch. 20: 549-555)		Printing Electron Micrographs
<u>Week 7: Organelle Structure and Labeling Techniques</u>					<u>Work on projects</u>
11/5	M	12	Organelles (20: 528-34; 563-70; 579-82; 585-607)	7	Student TEM projects
11/7	W	13	Enzyme Cytochemistry (Ch. 10: 282-289)		
<u>Week 8: Labeling Techniques (Research papers)</u>					<u>Work on projects</u>
11/12	M		Midterm II	8	Student TEM projects
11/14	W	14	Immunocytochemistry (Ch. 9: 262-278)		
<u>Week 9: Labeling Techniques (Research papers)</u>					<u>Analysis of Electron Micrographs</u>
11/19	M	15	Horseradish Peroxidase (Ch. 10: 282-289)	9	Critique of Student projects
11/21	W	16	Autoradiography (Ch. 11: 292-307)		(Suggestions for improvement)
<u>Week 10: Labeling Techniques (Research papers)</u>					<u>Student Presentations & Evaluation</u>
11/26	M	17	Other Tracer Techniques (Ch. 17: 406-413)	10	Critique of Student projects
11/28	W	18	Combined Labeling Techniques		(Suggestions for improvement)
<u>Week 11: Final Exams Week</u>					Student Projects due
12/5	W		Cumulative Final Exam (Rm 3-138; 11:30 - 1:30 p.m.)		

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Name (print) _____ Major: _____

Student ID# _____ Phone # _____ e-Mail: _____

Have you taken BIO 310 or any other Biochemistry or Molecular Biology course? _____

Have you taken BIO 423? _____ BIO 435? _____ BIO 535? _____

Do you have good eye-hand coordination (Can you pass a thread through the eye of a needle?) _____

What are your professional goals? _____

Indicate your level of expertise in the boxes below (**0** = none, **1** = some, **2** = routine, **3** = expert):

Student name	PC	Mac	MS Word	Data-base	MS Excel	Inter-NET	HTML	Power-point	Group (leave blank)

Pre-Entry Exam (Not to be counted toward your grade):

1. Draw a typical prokaryotic cell and label all of its basic parts:

2. Draw a typical eukaryotic cell and label all of its basic parts:

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Book: Bozzola & Russell, Electron Microscopy, Principles and Techniques for Biologists, 1999, Jones and Bartlett, Boston.

Tentative Lecture Outline (subject to change)

Week: Topic (Chapter, pages)

Week 1: Historical Perspective and Specimen Preparation for TEM

9/25 1: Historical Perspective (Ch. 1: 2-12)

9/27 2: Specimen Preparation for TEM: Fixation (Ch. 2: 17-36)

Week 2: Specimen Preparation for TEM: Embedding and Sectioning

10/2 3: Dehydration and Embedding (Ch. 2: 36-46)

10/4 4: Ultramicrotomy (Ch. 4: 74-109)

Week 3: Specimen Preparation for TEM: Staining and Artifacts

10/9 5: Specimen Staining (Ch. 5: 121-145)

10/11 6: Interpretation and Artifacts (Ch. 19: 443-475)

Week 4: Midterm I and Survey of Ultrastructure

10/16 **Midterm I** (TEM Prep)

10/18 7: The Cell Surface & Extracellular Compartment (Ch. 20: 477-505; 571-578; 583-584)

Week 5: Survey of Ultrastructure: Cell Interior

10/23 8: The Nucleus (Ch. 20: 513-527)

10/25 9: Endomembrane System (Ch. 20: 535-548; 556-562)

Week 6: Cytoskeletal and Motility Systems

10/30 10: The Cytoskeleton (Ch. 20: 506-513)

11/1 11: Cilia and Flagella (Ch. 20: 549-555)

Week 7: Organelle Structure and Midterm II

11/6 12: Organelles, Bacteria, Viruses (Ch. 20: 528-534; 563-570; 579-582; 585-607)

11/8 **Midterm II** (Normal Ultrastructure)

Week 8: Labeling Techniques (Research papers presented by students)

11/13 13: Enzyme Cytochemistry (Ch. 10: 282-289)

11/15 14: Immunocytochemistry (Ch. 9: 262-278)

Week 9: Labeling Techniques (Research papers presented by students)

11/20 15: Horseradish Peroxidase (Ch. 10: 282-289)

11/22 16: Autoradiography (Ch. 11: 292-307)

Week 10: Labeling Techniques (Research papers presented by students)

11/27 17: Other Tracer Techniques (Ch. 17: 406-413)

11/29 18: Combined Labeling Techniques Used in the CNS