1-2015

BIOB 440.01: Biological Electron Microscopy

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BIOB 440 Biological Electron Microscopy

Spring semester, 2015

Instructor: Dr. W.O. Granath
HS 306; 243-2975
bill.granath@mso.umt.edu

Lecture: MW, 11:10-12:00 PM, Room: HS 411

Office hrs: By appointment


Handouts: Will be provided by instructor. Bring to each class.

Resources:

Journals dealing with electron microscopy currently available at the Mansfield Library:
- Journal of Electron Microscopy
- Ultramicroscopy
- Journal of Cell Biology
- Cell Structure and Function
- Tissue and Cell
- Histochemical Journal
- Journal of Ultrastructural Research
- Journal of Subcellular Cytology
- Journal of Cell Science
- Cell and Tissue research
- Biology of the Cell
- Histology and Cytology

General References:

"Biological Electron Microscopy." B.L. Gabriel.

Also, see references listed at end of each chapter in your textbook and p. 13 of your textbook and the "links" section on the EMtrix web page.

Grading:
- Exam I: 30%
- Exam II: 30%
- Final Exam: 40%

ATTENTION:
All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the University.

All students need to be familiar with the Student Conduct Code. The Code is available for review online at http://www.umt.edu/SA/VPSA/index.cfm/page/1321.

**SYLLABUS (l.o. =learning outcome)**

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Chapter</th>
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<tbody>
<tr>
<td>Jan 26</td>
<td>Introduction to electron microscopy</td>
<td>none</td>
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<tr>
<td></td>
<td>l.o.: Goals and expectations of the class will be explained.</td>
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<tr>
<td>28</td>
<td>Tour of EM facility</td>
<td>none</td>
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<td></td>
<td>l.o.: Become acquainted with the major pieces of equipment we will be discussing.</td>
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<tr>
<td>Feb 2</td>
<td>Principles of optics</td>
<td>6, handouts</td>
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<td></td>
<td>l.o.: Be able to describe the fundamentals of geometrical optics and how visible light and electrons are similar and different as they pass through a lens.</td>
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<td>4</td>
<td>Principles of optics (cont'd)</td>
<td>6, handouts</td>
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<tr>
<td></td>
<td>l.o.: Be able to describe the fundamentals of physical optics and how visible light and electrons are similar and different as they pass through a lens.</td>
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<td>9</td>
<td>Development of the EM</td>
<td>1, handouts</td>
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<td></td>
<td>l.o.: Be able to document the various discoveries that led to the development of the first electron microscope.</td>
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<tr>
<td>11</td>
<td>Types of EMs</td>
<td>7,15, handouts</td>
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<td>l.o.: Be able to describe and diagram the various types of electron probe instruments and be able to discuss what type of information each one provides.</td>
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<td>16</td>
<td>President's Day – No Class</td>
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<td>18</td>
<td>Magnetic lenses</td>
<td>6, handouts</td>
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<td>l.o.: Be able to describe how a magnetic lens works and associated aberrations that may arise.</td>
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<td>23</td>
<td>Image formation</td>
<td>6, handouts</td>
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<td>l.o.: Be able to list and discuss the parameters that are used to form an image in electron microscopes.</td>
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<tr>
<td>25</td>
<td>Vacuum system</td>
<td>6, handouts</td>
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<td>l.o.: Be able to describe the components and theory of operation of a vacuum system including the various pumps and measuring devices.</td>
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</table>
Mar 2  Catch-up/Review - come prepared with questions

4  Test I: covers material through Mar 2

9  Specimen preparation: fixation 2,3, handouts
l.o.: Be able to differentiate electron histology for the particulate method including when you would use each, be able to list the steps in electron histology and be able to describe the properties of common fixatives and their appropriate use (continued in next lecture).

11  Specimen preparation: fixation (cont'd); dehydration 2,3, handouts
l.o.: Continue with objectives of previous lecture and be able to list common dehydrating agents, their properties and appropriate application.

16  Specimen preparation: embedding/critical point drying 2,3
l.o.: Be able to describe the properties of various embedding media and their applications. Be able to describe the principles of critical point drying and its application.

18  Specimen preparation: sectioning and/or mounting 3,4, handouts
l.o.: Be able to describe the properties of glass and diamond knives, the ultramicrotome and proper sectioning technique. Be able to describe proper mounting of ultrathin sections of grids.

23  Specimen preparation: staining/coating 5
l.o.: Be able to describe common stains and methods for staining thick and thin sections.

25  Some biological methods for use with the EMs 9,10,11,12, 16, handouts
l.o.: Be able to describe the principles and applications of the HVEM, electron histochemistry, immunoelectron microscopy and autoradiography at the EM level.

Mar 30 – Apr 3  SPRING BREAK!

Apr 6  Photography 8
l.o.: Be able to describe the principles of conventional and digital photography.

8  Ultrastructure 19,20, projection slides
l.o.: The objective is to give you an overview of the images you can get of various samples using the methods previously discussed in class.

13  Catch-up/Review - come prepared with questions,
Sign-up for demonstration/use of EMs

15  Test II: covers material of Mar 9 – Apr 13
Apr 16 to May 5

Demonstrations

1.0.: On an individual basis, you will learn the basic operations of the major specimen preparation equipment, SEM and TEM.

6 Wrap-up: questions/discussion/summary

14 Final exam: (10:10-12:10 am), essentially comprehensive.