

HISTOTECHNIQUES
GEORGE MASON UNIVERSITY
Spring Semester 2022
3 Credit Hours

BIOL 413 002 (CRN 19643)/EVPP 413 002 (CRN 22582)

EXPL 2602 (Lectures), DKH 3060–3061 (Labs)
Location varies with date (see schedule below)
1:30–4:10 p.m. Mondays

Instructor: Dr. Esther Peters
703-624-0143 (cell)
epeters2@gmu.edu

Office Hours, DK 3050: 4:30–5:30 p.m. Mondays, or by appointment*

*Please let Dr. Peters know by e-mail if you are coming or schedule other times in-person or in-Blackboard BY APPOINTMENT (send email request to Dr. Peters)

Sign up for Mason Alert (e.g., weather closings, emergencies) at
<https://alert.gmu.edu>

See Emergency Preparedness Guides at (http://ehs.gmu.edu/guides_EP.html)

Course Description

Students will examine the science of histotechnology and apply these methods to prepare plant or animal tissue samples for the study of cells, tissues, organs, and organ systems using microscopy. The function and condition of cells and tissues are reflected in their microscopic structure and composition and these visual records augment investigations in many disciplines, including botany, zoology, taxonomy, systematics, ecology, microbiology, molecular biology, biochemistry, physiology, toxicology, psychology, and pathology. This is an introductory course to enable students to use this tool in their research, as well as to prepare anyone interested in further study to obtain the HT or HTL certification for a career in histotechnology after completion of their undergraduate degree. Histotechnologists are in great demand in human and veterinary medicine (hospitals and diagnostic laboratories), industry (pharmaceutical and biomedical device development), and academic and applied research.

Course Objectives

The goals of this course are for students to be able to:

Use various criteria to select techniques to prepare tissues for study by light and electron microscopy;

Know the physics and chemistry behind fixing, processing, and staining different tissue samples for different study objectives;

Prepare tissue samples for examination using light microscopy by hands-on application of protocols, including fixation, processing, paraffin embedding, and staining; and

Collect data from tissue sections and integrate the concepts of histology and histopathology in research.

Due to time constraints, this course will not cover histology (microscopic anatomy, the study of the structure and composition of the cells and tissues as they relate to metabolic function and organismal processes). I teach Histology during fall semesters at GMU (BIOL 465). I recommend that students take Histotechniques after Histology, but it is not a requirement.

Course Format

The lecture sessions will be held face-to-face in a lab room (EXPL 2602). **All students taking courses with a face-to-face component must follow the university's public health and safety precautions and procedures (<https://www.gmu.edu/safe-return-campus>) and complete the Mason COVID Health Check daily, seven days a week.** The COVID Health Check system uses a color code system and students will receive either a **Green**, **Yellow**, or **Red** email response. Only students who receive a "green" notification are permitted to attend courses with a face-to-face component. If you suspect that you are sick or have been directed to self-isolate, please quarantine or get testing. Faculty are allowed to ask you to show them that you have received a Green email and are thereby permitted to be in class. Please be sure you wear your mask during our sessions. Use the hand sanitizer from the dispenser on entering the room (and as you need it!).

The laboratory sessions will meet in the GMU Histology Laboratory (DK3060 and DK3061) after we have covered the basic theory and practice of histotechniques in lectures. I will determine the best and safest strategy so that you will have time to learn and practice different skills after we have completed the lectures and it will depend on how many students take the course. Stay tuned!

Course Expectations

Each 2-hour 45 minute session may combine lectures, laboratory techniques, or slide reading, but this will vary. We will start by meeting in EXPL 2602 for lectures, but most sessions will be held in DKH 3060 and DKH 3061. In the lab, students will rotate among activities as needed, thus permitting more hands-on opportunities with equipment under the instructor's supervision. For example, rotations might occur among (1) self-study of a procedure or preparing an assignment, (2) learning microtomy, and (3) participating in sample processing with the instructor, so each person has approximately equal time in each activity each week. The successful student **must read assignments, study supporting materials, and prepare assignments outside of class.**

Self-directed study skills are important. Students need to organize material logically and communicate well orally and in writing. **The emphasis will be on understanding the basics.**

Class Preparation

“He who hesitates is lost....”

Reading, research, and assignments are detailed on the following class outlines. Any concerns about keeping up with assignments should be discussed with Dr. Peters prior to class.

More students are juggling work, research, internships, shadowing, and families, as well as COVID-19 issues. Please note “employment must not take priority over academic responsibilities. Students employed more than 20 hours a week are strongly urged not to attempt a full-time academic load. Students employed more than 40 hours a week should attempt no more than 6 credits per semester. Students who fail to observe these guidelines may expect no special consideration for academic problems arising from the pressures of employment.” (University catalog, section AP.1.2. Academic Load, see: <http://catalog.gmu.edu/content.php?catoid=27&navoid=5365#attendance>). Please consider your responsibilities and interests and plan accordingly to protect your health and GPA!

Class Participation

Students should be ready to participate in all activities (assignments completed prior to class). **Wear long pants and closed-toe shoes with non-slip soles. I will provide a lab coat and safety glasses or goggles if you don't wear glasses (you can buy your own in the GMU Bookstore in the Johnson Center).** Other personal protective equipment will be provided as needed. Please turn off cell phones or pagers before class begins. **Professional behavior and adherence to the GMU Honor Code are expected.**

Because this class will cover material and procedures that need to be personally experienced to demonstrate proficiency, **absenteeism should be limited to illness or emergencies.** Students should notify the instructor before class whenever possible if they must miss a class. Students will need to work with the instructor to determine whether class activities can be made up later, although this is likely to be difficult due to schedule conflicts. Students should contact classmates to obtain notes and assignments.

Students may record the lectures (sound) and may take pictures of selected PowerPoint slides. However, they should also take notes and make sketches of what is presented, which will help them study for the mid-term and final exams. If using electronic devices (such as laptops, notebooks, tablets), please be respectful of your peers and your instructor and do not engage in activities that are unrelated to class. Such disruptions show a lack of professionalism and can affect your grade.

If you are a student with a disability and you need academic accommodations, please see Dr. Peters and contact Disability Services (ODS) at 703-993-2474. All academic accommodations must be arranged through the ODS.

Assignments and Due Dates

Research, writing, problem set, and other assignments and their due dates are detailed on the following class schedule. Please note the following:

Assignments should be prepared neatly (either hand- or type-written or computer-generated). Be sure to proofread your work to double-check facts, grammar, and spelling; use spell-check if possible. (Sloppily prepared assignments can adversely affect your grade, especially if improvement is not noted during the course).

Missed Exams

Mid-term and final exams will be given. If a student is seriously ill or must miss the test for another reason, notify Dr. Peters and options for completing the test later will be discussed.

Course Textbooks and Materials

Additional notes, reading materials, and problem sets to be completed will be posted on Blackboard during the course. The textbook we will use for the course is:

Suvarna, K.S., C. Layton, and J.D. Bancroft. 2012. Bancroft's Theory and Practice of Histological Techniques, 7th edition. Churchill Livingstone.

This is the version that the GMU Library was able to purchase for us when we pivoted to online due to COVID-19. A direct link to it is provided in Course Content in Blackboard. You may download it or read it online. It contains a lot of material that you will not need to know for this course. But it will help you to understand more about the subject. Dr. Peters will provide advice on using the book and whether any sections are "must read" or just "nice to know about."

A more recent version (2018) is available for purchase at Amazon.com, as well as what has been considered to be the best text in this subject: Carson, F.L., 2020, *Histotechnology: A Self-Instructed Text*, 5th edition, American Society of Clinical Oncology. But that now costs \$206.70 (or more) and is only available in hardcover! I have copies of the Carson and Hladik book (3rd edition) in the lab that you can read either in class or at other times and one copy is available in the library for checkout. I have posted Peters' Pointers notes to guide your review on Blackboard. **The exams are based on Peters' Pointers and PowerPoint lectures and lab instruction.**

HistoNet (<http://www.histosearch.com/listserver.html>) is helpful to learn about all kinds of procedures, ask questions, and obtain more help:

To post a message: Histonet@lists.utsouthwestern.edu

To join and manage your participation: <http://lists.utsouthwestern.edu/mailman/listinfo/histonet>

To search all old messages: <http://www.histosearch.com/histonet.html>

The National Society for Histotechnology (www.nsh.org) also offers many resources and now has a question posting/answering service for members (which I can use, if you have a question I can't answer!).

E-mail Communications

Dr. Peters will send e-mail messages only to your GMU e-mail account. Students must use their Mason email accounts to receive important University information, including messages related to this class. Please be sure you check it often and respond to queries from Dr. Peters! If you are not getting messages, please send Dr. Peters an alternate e-mail address.

Course Requirements

All students will read textbook chapters, listen to lectures and laboratory instructions, learn how to write standard operating procedures, study histoslides to learn about slide preparation quality, and complete two problem sets provided on handouts for solving common histology laboratory calculations.

All students will also participate in preparing tissue samples provided by the instructor to make stained histoslides. Students will be learning “the ropes,” including cleaning glassware, ordering supplies, maintaining laboratory records, logging in and tracking samples, and troubleshooting to correct problems and meet quality criteria. In short, everything they might be required to do when working in a histology laboratory. Graduate students will contribute images, text, and creativity to document the histoslide preparation steps in a poster to be prepared for a scientific meeting.

Grading Criteria

The total grade received for this course will be based on the following assignments and assessments:

<u>Activity</u>	<u>Percent Contribution to Total Grade</u>
Class Participation (participate in assigned tasks)	15
Lab Safety Exercise	5
Problem Sets (two, combined grade)	10
Standard Operating Procedure	10
Guided Research Paper Analysis	10
Final Laboratory Report	10
Mid-Term Exam	20
Final Exam	20
TOTAL	100

The final grade will be based on this scale:

A+ = 100(+)-98, A = 97-90, A- = 89-88, B+ = 87-86, B = 85-80, B- = 79-78, C+ = 77-76, C = 75-70, C- = 69-68, D = 67-60, F ≤ 60

For graduate students the activities are slightly modified and a different grading scale is used:

<u>Activity</u>	<u>Percent Contribution to Total Grade</u>
Class Participation (participate in assigned tasks)	5
Lab Safety Exercise	5
Problem Sets (two, combined grade)	10
Standard Operating Procedure	10
Guided Research Paper Analysis	10
Poster on Histoslides Preparation	10
Final Laboratory Report	10
Mid-Term Exam	20
Final Exam	20
TOTAL	100

The final grade will be based on this scale:

A+ = 100(+)-98, A = 97-90, A- = 89-88, B+ = 87-86, B = 85-80, B- = 79-78, C+ = 77-76, C = 75-70, F ≤ 69

Honor Code

The GMU code of honor states that **cheating and attempted cheating, plagiarism, lying, and stealing will not be tolerated**. Honor code violations discovered by either students, staff, or faculty will be referred to the Honor Committee. Exams will be completed in the classroom; unless otherwise noted by the instructor prior to the exam, these assessments will be taken without the use of study aids, memoranda, textbooks, other books, data, or other information available. The purpose of these assessments is to evaluate the student's progress in understanding the material.

It is important to note that materials produced for this course require creativity in organization and presentation, but that the information presented within the paper or other product must be properly acknowledged as to its source. For example, discussing how histology is used in physiology might include historical information, case studies, detailed methodologies, quotations, and/or data. Statements of a general nature or that synthesize information from several sources need not be attributed to a specific source; however, statements of specific details or direct quotations ("between quotation marks") from books, journals, newspaper or other media articles, Internet web pages, or other authorities must be identified with the name of the author and year in the text and the full citation provided in the Literature Cited section at the end of the paper.

Other Useful Campus Resources

NAME AND PRONOUN USE: If you wish, please share your name and pronouns with me and how best to address you in class and via email. I use “she/her/hers” for myself and you may address me as “Dr. Peters” in email and verbally.

WRITING CENTER: <https://writingcenter.gmu.edu>

UNIVERSITY LIBRARIES: “Ask a Librarian” <https://library.gmu.edu/tutorials/librarians-help>

COUNSELING AND PSYCHOLOGICAL SERVICES (CAPS): <https://caps.gmu.edu>

DISABILITY SERVICES: <https://ds.gmu.edu>

LEARNING SERVICES: 703-993-2999; <http://caps.gmu.edu/learningservices/>; offers many good study skills workshops!

The University Catalog, <http://catalog.gmu.edu>, is the central resource for university policies affecting student, faculty, and staff conduct in university academic affairs. Other policies are available at <http://universitypolicy.gmu.edu/>. All members of the university community are responsible for knowing and following established policies.

Student communication of e-mail information (Opt-in Form):
<https://provapps.gmu.edu/hblapp/>.

NAMES AND PHONE NUMBERS OF CLASSMATES:

Notes:

Histotechniques Assignments and Assessments at a Glance

(Subject to Change)

Week	Date	Assessment or Assignment Due	Lecture or Lab Topics	Assignments for Next Week
1 EXPL 2602	January 24		<p>Introduction to the course, Syllabus review and discussion</p> <p>What are Histology and Histotechniques?</p> <p>Video</p> <p>Tour of Lab (today or as soon as possible)</p>	<p>Blackboard: Peters' Pointers: Histology Basics; Laboratory Safety, Fixation, Post-Fixation Procedures</p> <p>Blackboard: Peters' Pointers: Trim, Process, Embed</p> <p>Lab Safety Assignment</p> <p>Textbook Chapter 2 on Safety and Ergonomics in the Laboratory</p> <p>Textbook Chapter 4 on Fixation of Tissues</p>
2 EXPL 2602 (move to DKH 3060)	January 31 <i>Last Day to Add</i>		<p>Laboratory Safety, Use of Chemicals, Laboratory Basics, SOPs</p> <p>Fixation and Post-Fixation</p> <p>Tissue Trimming and Decalcification</p> <p>Tissue Processing and Embedding</p>	<p>Blackboard: Peters' Pointers: Microtomy-Immunohistochemistry</p> <p>Problem Set 1</p> <p>Textbook Chapter 5, The Gross Room/Surgical Cut-up</p> <p>Textbook Chapter 16, pages 323–330 on Decalcification</p> <p>Textbook Chapter 6 on Tissue Processing</p> <p>Textbook Chapter 7 on Microtomy: Paraffin and Frozen</p>
3 EXPL 2602	February 7 <i>Last Day to Drop</i>	Lab Safety Assignment	<p>Lab Problem Solving</p> <p>Microtomy/Sectioning</p> <p>Nuclear and Cytoplasmic</p>	<p>Appendix III, Appendix IV</p> <p>Textbook Chapter 9: How Histological Stains Work</p>

Week	Date	Assessment or Assignment Due	Lecture or Lab Topics	Assignments for Next Week
(move to DKH 3060)			Staining (H&E) Assigned Skills Practice in the Lab	
4 DKH 3060	February 14 <i>Unrestricted Withdrawal Period February 15–March 1</i>	Problem Set 1	Assigned Skills Practice in the Lab	Textbook Chapter 10 on The Hematoxylin and Eosin Continue reading previous textbook chapters
5 DKH 3060	February 21		Return and discuss Problem Set 1 Discuss Staining (H&E) Assigned Skills Practice in the Lab (perform H&E staining)	Read SOPs on trimming tissues and processing tissues for paraffin embedding Blackboard (Week 6): Read Peters' Pointers, view pre-recorded PowerPoint lecture on H&E staining, read SOP preparation materials and class SOPs Edit WORD VERSION of Harris's H&E SOP in Blackboard SOPs folder to use for Mayer's H&E Continue reading previous textbook chapters
6 EXPL 2602 (move to DKH 3060)	February 28 <i>Selective withdrawal March 2–April 11</i>	Mayer's H&E edited SOP	Review H&E slides stained in the lab Slide Quality, QA and QC Discuss Mid-Term Exam and review material, answer questions Assigned Skills Practice in the Lab	STUDY FOR MID-TERM EXAM: Peters' Pointers Lecture PowerPoints and your notes What you have done in the lab sessions
7 EXPL 2602	March 7		MID-TERM EXAM	Open book, but timed, provided in Blackboard

Week	Date	Assessment or Assignment Due	Lecture or Lab Topics	Assignments for Next Week
8	March 14	NO CLASS DUE TO SPRING BREAK		
9 EXPL 2602	March 21		Return graded mid-term exams and discuss Histochemical Stains Immunohistochemistry	Problem Set 2 Textbook Chapter 11 on Connective and Mesenchymal Tissues with Their Stains Textbook Chapter 12 Carbohydrates
10 DKH 3060	March 28		Assigned Skills Practice in the Lab (Will work on special stains: Cason's, Giemsa, PAS/AB this and following weeks)	Textbook Chapter 15 Microorganisms Textbook Chapter 13 Pigments, Minerals, Cytoplasmic Granules
11 DKH 3060	April 4	Problem Set 2	Assigned Skills Practice in the Lab	Textbook Chapter 17 on Techniques in Neuropathology Guided Research Paper Analysis
12 DKH 3060	April 11		Return and discuss Problem Set 2 Assigned Skills Practice in the Lab	Textbook Chapters 18 and 20 on immunohistochemistry and in situ hybridization
13 DKH 3060	April 18		Assigned Skills Practice in the Lab	Prepare short Final Lab Report on what you have learned this semester
14 EXPL 2602	April 25	Guided Research Paper Analysis	Immunohistochemistry In situ Hybridization Review stained histoslides Review for Final Exam	STUDY FOR FINAL EXAM
15 EXPL 2602	May 2	Final Lab Report		STUDY FOR FINAL EXAM
Monday, May 16 FINAL EXAM: All Lectures and Lab Procedures ONLINE Time:1:30–4:15 PM				

