

Introduction to Fish and Aquatic Invertebrate Histology

FAS 6256 (3 credits), Spring, 2019

Course Description

This course teaches basic interpretation of the normal histology (fixed tissue microanatomy and physiology) of fish, bivalves, and corals, and introduces common histopathologic (disease) findings.

Instructor

Course Coordinator: Dr. Roy Yanong
Tropical Aquaculture Laboratory, Program in Fisheries and Aquatic Sciences (FAS),
School of Forest Resources and Conservation, University of Florida, 1408 24th St.
Southeast, Ruskin, FL 33570
Office phone – 813-671-5230 extension 104
Work cell – 813-833-0172
E-mail – rpy@ufl.edu
Office Hours – generally available via e-mail or course mail M-F 8am – 5pm.

Student Learning Outcomes

At the end of this course, each student will be able to:

- Describe and understand proper tissue processing methods for histology of finfish, and select invertebrates (bivalves and corals) and how improper processing leads to tissue artifacts
- Identify from gross and histologic specimens, major organ systems, organs, tissues, and important cell types in normal histologic specimens of finfish and select aquatic invertebrates
- Identify from histologic specimens, common pathologic (disease) findings in representative finfish and select aquatic invertebrates
- Describe how the microanatomy seen in histologic specimens of normal and diseased animals correlates with physiology and pathophysiology (function) in that tissue, organ, and organism
- Interpret tissues from other species of finfish and aquatic invertebrates using a comparative histologic approach
- Understand the relevance of histology for research and diagnostics
- Appreciate and be comfortable with use of virtual slide (Aperio) imaging technology

Course Meeting Times

This is a distance education, online course. Lectures and reading materials will be made available online, and weekly, 2-hour discussions (Wednesdays, 12:50-2:50) will allow for participatory review of lectures and associated materials and digital slide evaluation.

Required Texts/Readings

- 1) USFWS CD Rom (photomicrographs and text), *Fish Histology*, Mumford et al.; also available online for download at: <https://training.fws.gov/resources/course-resources/fish-histology/index.html>
- 2) *Atlas of Fathead Minnow Normal Histology*, Yonkos, Fisher, Reimschuessel, and Kane; available online at: <http://aquaticpath.phhp.ufl.edu/fhm/index.html>
- 3) *Histological Atlas of Florida Surgeonfish*, Tilghman, Floyd, and Klinger; available online at: http://aquacomm.fcla.edu/2059/1/FLSG_TP123.pdf
- 4) *Histological Techniques for Marine Bivalve Molluscs: Update*; NOAA Technical Memorandum NOS NCCOS 27; available online at: <https://marine.rutgers.edu/pubs/private/HistopathTechMemoFinal.pdf>
- 5) *Coral Disease and Health Workshop: Coral Histopathology II*, NOAA Technical Memorandum NOS NCCOS56; also available online for download at: <https://repository.library.noaa.gov/view/noaa/478>
- 6) Digital microscopy – the upcoming revolution in histopathology teaching, diagnostics, research and quality assurance (Krenacs et al 2010): <http://www.formatex.info/microscopy4/965-977.pdf>
- 7) Improving UNC Medical Education with a Hosted Aperio ePathology Solution: https://thepathologist.com/fileadmin/issues/App_Notes/Leica5_Improving_medical_education.pdf

**Course coordinator and individual instructors may provide additional references, and other suggested references are listed further below

Class Format, Policies on Attendance and Make-up Exams

The format of the class will focus to a large extent on recorded lectures, reading from book chapters or primary scientific literature on the topic for a given class, and scheduled online digital slide laboratories/chats. For each module, students will need to complete a self test quiz. The lectures are taped lectures given by individuals from UF-SFRC-Fisheries and

Aquatic Sciences; One Water, One Health; UF-College of Vet Med; Wildlife Conservation Society/New York Aquarium; Fishhead Laboratories; FL Dept. of Agriculture and Consumer Services; Roger Williams University; and Experimental Pathology Laboratories, and discussion sessions are led by these instructors. Students will be expected to review the reading material and the Canvas lectures, then complete the module or lecture quiz and related homework assignments. A final quiz will be available online at the end of the course.

This course is intended to introduce the basic histology of clinically normal fish, bivalves, and corals, and to demonstrate common histopathology of diseased specimens. We include striped bass, pinfish, and common carp as our fish models, but other species may be used or substituted as needed. (Our bivalve models will be determined by Drs. Baker and Smolowitz, crustacean models by Dr. Jamie Bojko, cephalopod models by Dr. Dill-Okubo, horseshoe crab model by Dr. Newton, and coral models by Drs. Berzins and Yanong.)

A teaching digital slide set will be available with online access and use will be described by way of a tutorial and a scheduled online discussion period. Additional slides and digital images will be made available as per each instructor. Weekly online discussions are scheduled to review lectures and associated materials for that week and to examine digital slides. It is important that students keep up with each module and assignment to optimize the learning experience. **For interactive discussion sessions, Canvas software will be used and students should have access to a computer with audio input and output (or have a compatible headset with a microphone) for these sessions.**

Upon completion of this course, students are expected to: be familiar with, and describe basic routine histological processing; understand how gross anatomy correlates with microscopic anatomy, explain the relevance of histology for both research and diagnostic work; identify normal microanatomical structures and their functions for a number of different aquatic vertebrate and invertebrate species; understand common physiological and pathophysiological processes and how they alter microanatomy; and learn how to approach the microanatomy of other species based on similarities and differences between those studied in this course.

Delivery:

On the first day of class, log in with your gatorlink information here: <http://elearning.ufl.edu/> Click the orange LOG INTO ELEARNING button. Please check the eLearning course often for Announcements.

Technical Considerations:

There are some technical requirements/expectations that you must meet in order to be successful in this course. In general you must have reliable access to a high-speed non-wireless connection, especially for taking exams and quizzes. Most recorded lectures are streamed, not downloaded-- so reliable, fast internet is a requirement for distance students. You should have hardware capable of installing the latest version of multiple web browsers, e.g. Internet Explorer and Mozilla Firefox, Google Chrome, or Safari as some course content delivery methods work better in different browsers. You should also have access to and

familiarity with MS Office Suite, webcams, microphones, and updated versions of AntiVirus software, Java and Flash.

There is a Technical Support Discussion Board within the course monitored by technical staff. However, for time-sensitive questions or problems, you must call the UF Helpdesk. The Helpdesk can help you in real-time and will provide a service ticket, which is necessary in the event of technical difficulties during a quiz or exam.

Call the UF HELP Desk for immediate help if time-sensitive technical difficulties occur while taking a quiz or exam: <http://helpdesk.ufl.edu/> (352)-392-4357.

Assignments

- Students will be expected to review relevant online lectures as scheduled, prior to the week's two-hour online discussion.
- Online quizzes will follow each module or lecture
- Homework will be assigned and posted periodically (approximately every two modules)
- A final quiz will be available for completion online during the end of course exam period

Evaluation of Student Learning

| | | |
|------------|---|--|
| 95% | Performance & Knowledge of Subject Area | |
| | Ability to satisfactorily integrate reading material, discussions, and homework assignments as demonstrated | |
| | 50% | Completing self test quizzes |
| | 20% | Homework assignments equally weighted |
| | 25% | Final Exam |
| 5% | Personal Profile | |
| | 5% | Regular access, enthusiasm, and attitude |

Grading Scale

Note – Items completed past the due date will automatically be graded -10% as late. Points will continue to be removed over time past the due date an additional -10% per day.

If there are problems and you find yourself falling behind, contact me ASAP. Notifying me after the fact will not add points back that have already been removed.

All work conducted should be done independently unless specifically indicated in the assignment directions. Any writing should be your own thoughts or a summary of other reading material. Plagiarism will result in a "o" for the assignment.

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|----|---------|
| A | 94 -100 |
| A- | 93-90 |
| B+ | 89-87 |
| B | 86-83 |
| B- | 82-80 |
| C+ | 79-77 |
| C | 76-73 |
| C- | 72-70 |
| D+ | 69-67 |
| D | 66-63 |
| D- | 62-60 |
| E | 59 -0 |

* NOTE: Students in the CE/non-credit section will not be graded and thus may be exempt from exams and homeworks; however, homework and exams will help with the learning process, so students in the CE/non-credit section are encouraged to participate in these course activities

Schedule of Class Topics/Modules/Online Discussions

Please note that the schedule below may be amended due to lecturer availability, with appropriate notification to students ahead of time

The two-hour scheduled online discussions run from 12:50 pm to 2:50 pm on the dates indicated below, except in cases when a schedule change may be necessary due to unforeseen instructor conflicts. Primary instructor Roy Yanong will be present at most online discussion sessions, but discussion leads are indicated below:

Module 1, Week 1: Course Introduction:

- a) General Principles and Tissue Types (Roy Yanong, FAS);
- b) Use of Digital Slides and the Aperio System (Roy Yanong, FAS)

NO SCHEDULED ONLINE DISCUSSION/LAB- WEEK 1

Module 2, Week 2: Basic Finfish Biology, Necropsy, and Processing:

- a) Comparative Finfish Anatomy and Physiology (Roy Yanong, FAS);
- b) Finfish Necropsy (Roy Yanong, FAS);
- c) Histological Processing (Ilze Berzins, One Water, One Health)

Two-hour scheduled online discussion, January 16- Roy Yanong

Module 3, Week 3: Pathology and Immunology:

- a) Pathology and Causes of Disease (Roy Yanong/Ilze Berzins);
- b) Fish Immunology (Roy Yanong)

Homework Assignment 1 due

NO SCHEDULED ONLINE DISCUSSION/LAB - WEEK 3

Module 4, Week 4: Response to Injury and Neoplasia:

c) Cellular and Tissue Responses to Injury (Roy Yanong);

d) Introduction to Neoplasia (Ilze Berzins)

Two-hour scheduled online discussion, January 30- Roy Yanong and Ilze Berzins

Module 5, Week 5: Skin, Gills, and Pseudobranch (one lecture) (Ruth Francis-Floyd, Vet Med, FAS)

Homework Assignment 2 due

Two-hour scheduled online discussion, February 6- Ruth Francis-Floyd

Module 6, Week 6: Musculoskeletal System (Harley Newton, Wildlife Conservation Society)

Two-hour scheduled online discussion, February 13- Harley Newton

Module 7, Week 7: Finfish Nervous System:

a) Introduction to Fish Neurobiology (Daryl Parkyn, FAS);

b) Histological Features of the Finfish Nervous System (Susan Fogelson, Fishhead Labs)

Homework Assignment 3 due

Two-hour scheduled online discussion, February 20-Daryl Parkyn and Susan Fogelson

Module 8, Week 8: Hematopoietic, Circulatory, and Excretory Systems:

a) Blood, Lymph, RE System, and CV System (Jenny Dill-Okubo, FL Dept of Agriculture and Consumer Services);

b) Kidney, Spleen, Hematopoiesis (Jenny Dill-Okubo)

Two-hour scheduled online discussion, February 27- Jenny Dill-Okubo

Module 9, Week 9: Digestive System I:

a) Gastrointestinal Tract (Taylor Lipscomb, FAS)

Two-hour scheduled online discussion, March 13- Taylor Lipscomb

Module 9, Week 10: Digestive System II and Swim Bladder:

b) Liver, Gall Bladder, Pancreas, and Swim Bladder (Ilze Berzins)

Two-hour scheduled online discussion, March 20- Ilze Berzins

Module 10, Week 11: Mollusca: Bivalves

a) Normal Bivalve Anatomy and Physiology and Histology (Shirley Baker, FAS)

b) Histopathology of Representative Bivalve Diseases (Roxanna Smolowitz, Roger Williams University)

Homework Assignment 4

Two-hour scheduled online discussion, March 27- Shirley Baker/Roxanna Smolowitz

Module 11, Week 12: Crustacea

a) Normal Crustacean Anatomy, Physiology, and Histology (Jamie Bojko, FAS)

b) Histopathology of Representative Crustacean Diseases (Jamie Bojko)

Two-hour scheduled online discussion, April 3- Jamie Bojko

Module 12, Week 13: Endocrine and Reproductive System of Fish (Jeff Wolf, Experimental Pathology Laboratories)

Homework Assignment 5 due

Two-hour scheduled online discussion, April 10- Jeff Wolf

Module 12, Week 14: Coral and Horseshoe Crabs

a) Coral Anatomy, Histology, and Representative Diseases (Ilze Berzins)

b) Histology of Horseshoe Crabs (Harley Newton)

Two-hour scheduled online discussion, April 17- Ilze Berzins and Harley Newton

Module 13, Week 15: Review

Two-hour scheduled online discussion, April 24- Roy Yanong

Final Quiz available, online during end-of-course exam period, to be completed by 11:00 pm (Date TBD- will be announced by Week 1 of course)

Additional References

Suggested References

1. *Biology of the Hard Clam*, Kraeuter and Castagna
2. *Systemic Pathology of Fish*, Ferguson

Additional References

1. *Wheater's Functional Histology, 4th Edition*, Young and Heath, Churchill/Livingstone, 2000
2. *Color Atlas of Veterinary Histology*, Bacha and Wood, Lea and Febiger, 1990
3. *Histology and Cell Biology: An Introduction to Pathology*, Kierszenbaum;
4. *Fish Medicine*, Stoskopf (Fish Histology chapter)
5. *Fish Disease, Diagnosis and Treatment, 2nd edition*, Noga
6. *Fish Pathology*, Roberts
7. *Molecular Biology of the Cell*, Alberts, et al.
8. *Atlas of Tilapia Histology*, Morrison et al, World Aquaculture Society

Other Information

Academic Honesty, Software Use, UF Counseling Services, Services for Students with Disabilities

In 1995 the UF student body enacted an [honor code](#) and voluntarily committed itself to the highest standards of honesty and integrity. When students enroll at the university, they commit themselves to the standard drafted and enacted by students.

In adopting this honor code, the students of the University of Florida recognize that academic honesty and integrity are fundamental values of the university community. Students who enroll at the university commit to holding themselves and their peers to the high standard of honor required by the honor code. Any individual who becomes aware of a violation of the honor code is bound by honor to take corrective action. The quality of a University of Florida education is dependent upon community acceptance and enforcement of the honor code.

The Honor Pledge: We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity.

On all work submitted for credit by students at the university, the following pledge is either required or implied: **"On my honor, I have neither given nor received unauthorized aid in doing this assignment."**

The university requires all members of its community to be honest in all endeavors. A fundamental principle is that the whole process of learning and pursuit of knowledge is diminished by cheating, plagiarism and other acts of academic dishonesty. In addition, every dishonest act in the academic environment affects other students adversely, from the skewing of the grading curve to giving unfair advantage for honors or for professional or graduate school admission. Therefore, the university will take severe action against dishonest students. Similarly, measures will be taken against faculty, staff and administrators who practice dishonest or demeaning behavior.

Students should report any condition that facilitates dishonesty to the instructor, department chair, college dean or Student Honor Court.

(Source: 2010-2011 Undergraduate Catalog)

It is assumed all work will be completed independently unless the assignment is defined as a group project, in writing by the instructor.

This policy will be vigorously upheld at all times in this course.

Software Use:

All faculty, staff and students of the university are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages

and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken as appropriate.

Campus Helping Resources

Students experiencing crises or personal problems that interfere with their general well-being are encouraged to utilize the university's counseling resources. The Counseling & Wellness Center provides confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance.

- *University Counseling & Wellness Center, 3190 Radio Road, 352-392-1575, www.counseling.ufl.edu/cwc/*

Counseling Services

Groups and Workshops

Outreach and Consultation

Self-Help Library

Training Programs

Community Provider Database

- *Career Resource Center, First Floor JWRU, 392-1601, www.crc.ufl.edu/*

Students with Disabilities

The Disability Resource Center coordinates the needed accommodations of students with disabilities. This includes registering disabilities, recommending academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services and mediating faculty-student disability related issues.

0001 Reid Hall, 352-392-8565, www.dso.ufl.edu/drc/