

# Introduction to Fish and Aquatic Invertebrate Histology - FAS 6256

## 1 Course Overview

### Course description:

Introduction to Fish and Aquatic Invertebrate Histology (FAS 6256) teaches basic interpretation of the normal histology (fixed tissue microanatomy and physiology) of select finfish and aquatic invertebrates (bivalves, crustaceans, horseshoe crabs, corals), and introduces common histopathologic (disease) findings.

FAS 6256, a 3 credit course taught in Spring 2021, is taught 100% online and can be taken asynchronously, but attendance at synchronous discussion sessions to review lecture materials and digital slides is highly recommended. Synchronous discussion sessions are recorded for those unable to attend.

<http://elearning.ufl.edu/>

**Course Prerequisites:** none

### Instructor:

Course Coordinator: Dr. Roy Yanong

### Contact Information

- Tropical Aquaculture Laboratory, Program in Fisheries and Aquatic Sciences (FAS), School of Forest Resources and Conservation, IFAS, University of Florida, 1408 24<sup>th</sup> St. Southeast, Ruskin, FL 33570
- Please use the Canvas message/Inbox feature for fastest response.
- Office phone – 813-671-5230 extension 104
- E-mail – rpy@ufl.edu

Office Hours – generally available via e-mail or course mail M-F 8am – 5pm.

### Teaching Assistants:

Joe Henry Email: henry8404@ufl.edu	Aaron Pilnick Email: apilnick@ufl.edu
---------------------------------------	--

**Textbook(s) and/or 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](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://repository.library.noaa.gov/view/noaa/9282>
- 5) *A histological atlas for the Palinuridae (Crustacea: Decapoda: Achelata): A guide to parasite discovery and spotting the abnormal in spiny lobsters*, Ross et al 2019: **provided in course materials**
- 6) *Clinical Evaluation, Common Diseases, and Veterinary Care of the Horseshoe Crab, Limulus Polyphemus*, Nolan and Smith, 2009, In *Biology and Conservation of Horseshoe Crabs*: **provided in course materials**
- 7) *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>
- 8) Digital microscopy – the upcoming revolution in histopathology teaching, diagnostics, research and quality assurance (Krenacs et al 2010): **provided in course materials**

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

## 2 Learning Outcomes

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

- Describe and understand proper tissue processing methods for histology of finfish, and select aquatic invertebrates 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

## 3 Course Logistics

### 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 pm) will allow for participatory review of lectures and associated materials and digital slide evaluation. Participation in these 2-hour discussions is highly recommended, but they will be recorded for those unable to attend.

### **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-IFAS-SFRC-Fisheries and Aquatic Sciences; One Water, One Health; UF-College of Vet Med; Disney EPCOT Living Seas; Fishhead Laboratories; FL Dept. of Agriculture and Consumer Services; US Fish and Wildlife Services; Roger Williams University; Teesside University, UK; 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, 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; participation is encouraged by discussions will be recorded. 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; be comfortable with use of digital slides; 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 finfish and aquatic 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.

- A computer or mobile device with high-speed internet connection.
- A webcam, headset and/or microphone, and speakers.
- Latest version of web browser. Canvas supports only the two most recent versions of any given browser. [What browser am I using?](#)
- Installation of proctoring software may be required and will be provided if so.

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.

**Synchronous online sessions may be recorded.** By sharing your video, screen, or audio during any synchronous online class sessions, you are consenting to being recorded for the benefit of students who cannot attend live as well as for class review during the current semester. If you have special circumstances or concerns about privacy, it is your responsibility to discuss it with your instructor.

## **3.1 Description of Assessments & Activities**

- 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

## **3.2 Grades & Grading Scale**

<b>95%</b>	<b>Performance &amp; Knowledge of Subject Area</b>	
	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
<b>5%</b>	<b>Personal Profile</b>	
	5%	Regular access, enthusiasm, and attitude

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.

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

For information on current UF policies for assigning grade points, see <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

\* 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

## 4 Learning Content

\*\*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);

NO SCHEDULED ONLINE DISCUSSION/LAB- WEEK 1 (January 13)

### **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 20- 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 (January 27)

### **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, February 3- 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 10- Ruth Francis-Floyd

**Module 6, Week 6: Musculoskeletal System** (Harley Newton, Disney EPCOT Living Seas)

Two-hour scheduled online discussion, February 17- 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 24-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, March 3- Jenny Dill-Okubo

**Module 9, Week 9: Digestive System I:**

a) Gastrointestinal Tract (Taylor Lipscomb, USFWS)

Two-hour scheduled online discussion, March 10- 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 17- Ilze Berzins

**Module 10, Week 11: Endocrine and Reproductive System of Fish** (Jeff Wolf, Experimental Pathology Laboratories)

Homework Assignment 4 due

Two-hour scheduled online discussion March 26 - Jeff Wolf

**Module 11, Week 12: Crustacea**

a) Normal Crustacean Anatomy, Physiology, and Histology (Jamie Bojko, Teesside University, UK)

b) Histopathology of Representative Crustacean Diseases (Jamie Bojko)

Two-hour scheduled online discussion, March 31 - Jamie Bojko

**Module 12, Week 13: 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 5

Two-hour scheduled online discussion, April 7- Shirley Baker/Roxanna Smolowitz

### **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 14- Ilze Berzins and Harley Newton

### **Module 13, Week 15: TBD + Review**

Two-hour scheduled online discussion, April 21- TBD + Roy Yanong

## 4.1 Readings

### Suggested References

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

### Additional References

1. *Wheater's Functional Histology, 4<sup>th</sup> 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, 2<sup>nd</sup> edition*, Noga
6. *Fish Diseases and Medicine*, Smith
7. *Fish Pathology*, Roberts
8. *Molecular Biology of the Cell*, Alberts, et al.
9. *Atlas of Tilapia Histology*, Morrison et al, World Aquaculture Society

## 5 Policies and Requirements

This course plan and syllabus are subject to change in response to student and instructor needs. Any changes will be clearly communicated in advance through Canvas.



## 5.1 Late Submissions & Make-up Requests

It is the responsibility of the student to access on-line lectures, readings, quizzes, and exams and to maintain satisfactory progress in the course. Requirements for class attendance and make-up exams, assignments and other work are consistent with university policies that can be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

Computer or other hardware failures, except failure of the UF e-Learning system, will not excuse students for missing assignments. Any late submissions due to technical issues **MUST** be accompanied by the ticket number received from the Helpdesk when the problem was reported to them. The ticket number will document the time and date of the problem. You **MUST** e-mail your instructor within 24 hours of the technical difficulty if you wish to request consideration.

For computer, software compatibility, or access problems call the HELP DESK phone number—352-392-HELP = 352- 392-4357 (option 2).

## 5.2 Communication Courtesy and Professionalism

Just as in any professional environment, meaningful and constructive dialogue is expected in this class and requires a degree of mutual respect, willingness to listen, and tolerance of opposing points of view.

**Respect for individual differences and alternative viewpoints will be maintained in this class at all times.** All members of the class are expected to follow rules of common courtesy, decency, and civility in all interactions. Failure to do so will not be tolerated and may result in loss of participation points and/or referral to the Dean of Students' Office.

## 5.3 Semester Evaluation Process

Student assessment of instruction is an important part of efforts to improve teaching and learning.

**At approximately the mid-point of the semester**, the School of Forest Resources & Conservation will request anonymous feedback on student satisfaction on various aspects of this course. These surveys will be sent out through Canvas and are not required but encouraged. This is not the UF Faculty Evaluation!

**At the end of the semester**, students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

## 5.4 Academic Honesty Policy

As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following 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."*

You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of Florida, the following pledge is either required or implied: *"On my honor, I have neither given nor received unauthorized aid in doing this assignment."*

It is assumed that you will complete all work independently in each course unless the instructor provides explicit permission for you to collaborate on course tasks (e.g. assignments, papers, quizzes, exams). Furthermore, as part of your obligation to uphold the Honor Code, you should report any condition that facilitates academic misconduct or appropriate personnel. It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated.

Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For more information regarding the Student Honor Code, please see:

<http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code>.

## 5.5 Inclusive Learning Environment

This course embraces the University of Florida's Non-Discrimination Policy, which reads,

*The University shall actively promote equal opportunity policies and practices conforming to laws against discrimination. The University is committed to non-discrimination with respect to race, creed, color, religion, age, disability, sex, sexual orientation, gender identity and expression, marital status, national origin, political opinions or affiliations, genetic information and veteran status as protected under the Vietnam Era Veterans' Readjustment Assistance Act.*

If you have questions or concerns about your rights and responsibilities for inclusive learning environment, please see the instructor or refer to the Office of Multicultural & Diversity Affairs website:

<http://multicultural.ufl.edu>.

## 5.6 Services for 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. Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation. 0001 Reid Hall, 352-392-8565, [www.dso.ufl.edu/drc/](http://www.dso.ufl.edu/drc/)

## 5.7 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.

## 6 Campus Helping Resources

For issues with technical difficulties for e-learning in Canvas, please post your question to the Technical Help Discussion in your course, or contact the UF Help Desk at:

- [Learning-support@ufl.edu](mailto:Learning-support@ufl.edu) | (352) 392-HELP - select option 2 | <http://elearning.ufl.edu>
- Library Help Desk support <http://cms.uflib.ufl.edu/ask>
- SFRC Academic Hub <https://ufl.instructure.com/courses/303721>

### 6.1 Student Life, Wellness, and Counseling Help

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.

- Counseling and Wellness resources <http://www.counseling.ufl.edu/cwc/>
- U Matter, We Care <http://www.umatter.ufl.edu/>
- Career Connections Center <http://career.ufl.edu/>
- Other resources are available at <http://www.distance.ufl.edu/getting-help> for online students.

### 6.2 Student Complaint Process

The School of Forest Resources & Conservation cares about your experience and we will make every effort to address course concerns. We request that all of our online students complete a course satisfaction survey each semester, which is a time for you to voice your thoughts on how your course is being delivered.

If you have a more urgent concern, your first point of contact should be the SFRC Academic Coordinator or the Graduate/Undergraduate Coordinator for the program offering the course. You may also submit a complaint directly to UF administration:

- Students in online courses: <http://www.distance.ufl.edu/student-complaint-process>
- Students in face-to-face courses: <https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>