

Cover Sheet: Request 9532

BMS4xxx Human Histology

Info

Process	Undergraduate Courses
Status	Tabled
Submitter	Aris, John Phillip johnaris@ufl.edu
Created	8/28/2014 3:34:24 PM
Updated	11/19/2014 11:56:02 AM
Description	This course will present the biology of tissues of the human body and is designed for pre-professional students. Lectures will emphasize the biology of cells and extracellular components that underlie tissue function. Laboratories will emphasize visualization of corresponding structures by light microscopy, with correlation to images acquired by electron microscopy.

Actions

Step	Status	Group	User	Comment	Updated
Department	Approved	MED - Anatomy and Cell Biology 312926000	Daaka, Yehia		8/28/2014
College	Approved	MED - College of Medicine	Gulig, Paul A		8/28/2014
University Curriculum Committee	Comment	PV - University Curriculum Committee (UCC)	Morrison, Lee Shaw	Added to September agenda.	9/3/2014
University Curriculum Committee	Conditional Approved	PV - University Curriculum Committee (UCC)	Gebhardt, Susan	Has any program agreed to count this course as a major elective? UCC1: In the prereqs, BSC 2011/L is already a prereq for PCB 3023 (so the latter would seem to be functionally redundant), and most students who take PCB 3134 have already completed BSC 2011/L, so almost all students would meet the prereqs for the proposed course with BSC 2011. However, the intent appears to be that a cell biology course should be a prereq. Suggest removing BSC 2011/L from prereq option. Syllabus: Note that course number in syllabus is missing "C" designation, and the schedule of topics makes no reference to the required textbook.	9/18/2014

Step	Status	Group	User	Comment	Updated
College	Approved	MED - College of Medicine	Aris, John Phillip	The revised packet of documents for the Human Histology course contains all of the revisions suggested at the recent meeting of the UCC (on Sept 19, 2014). This course has not yet been adopted as a major elective. It is under consideration as an elective for the biology major.	9/25/2014
University Curriculum Committee	Approved	PV - University Curriculum Committee (UCC)	Gebhardt, Susan	Met conditions for approval	9/30/2014
SCNS Approval	Recycled	REG - Office of the Registrar (OUR)	Garfield, Wanda	Recycled back to UCC per Susan Gebhardt's request.	9/30/2014
University Curriculum Committee	Recycled	PV - University Curriculum Committee (UCC)	Gebhardt, Susan	Clarification needed of the purpose of the course & if a program has agreed to count this as a major elective	10/1/2014
College	Approved	MED - College of Medicine	Aris, John Phillip	Please see the Human Histology Supplemental Info PDF file for the clarification items requested by the UCC.	10/13/2014
University Curriculum Committee	Comment	PV - University Curriculum Committee (UCC)	Gebhardt, Susan	added to the November agenda	10/29/2014
University Curriculum Committee	Tabled	PV - University Curriculum Committee (UCC)	Gebhardt, Susan	To be discussed by concerned groups in advance of the December UCC meeting	11/19/2014
University Curriculum Committee	Tabled	PV - University Curriculum Committee (UCC)			11/19/2014
SCNS Approval					
Student Academic Support System Implementation					

Department Name and Number Anatomy and Cell Biology / 312926000			
Recommended SCNS Course Identification			
Prefix	B M S	Level	4
Course Number	X X X	Lab Code	Combined (C)
Full Course Title Human Histology			
Transcript Title (please limit to 21 characters) Human Histology			
Effective Term and Year Spring 2015		Rotating Topic <input type="checkbox"/> yes <input checked="" type="checkbox"/> no	
Amount of Credit 4	Contact Hour: Base 4	or Headcount	___
S/U Only <input type="checkbox"/> yes <input checked="" type="checkbox"/> no			
Repeatable Credit <input type="checkbox"/> yes <input checked="" type="checkbox"/> no If yes, ___ total repeatable credit allowed			
Variable Credit <input type="checkbox"/> yes <input checked="" type="checkbox"/> no If yes, ___ minimum and ___ maximum credits per semester			
<p>Course Description (50 words or less)</p> <p>This course will present the biology of tissues of the human body and is designed for pre-professional students. Lectures will emphasize the biology of cells and extracellular components that underlie tissue function. Laboratories will emphasize visualization of corresponding structures by light microscopy, with correlation to images acquired by electron microscopy.</p>			
Prerequisites		Co-requisites	
Essential Cell Biology (PCB 3023) or Eukaryotic Cell Structure and Function (PCB 3134)		None	
Degree Type (mark all that apply) <input checked="" type="checkbox"/> Baccalaureate <input type="checkbox"/> Graduate <input type="checkbox"/> Professional <input type="checkbox"/> Other ___			
Category of Instruction <input type="checkbox"/> Introductory <input type="checkbox"/> Intermediate <input checked="" type="checkbox"/> Advanced			

Rationale and place in curriculum	
<p>This course is designed to serve pre-professional students interested in a career in a health care field. Prerequisite courses will provide a necessary foundation in the basic biology of eukaryotic cells. Topics presented in Human Histology will bridge between the molecular / cellular and anatomical / organismal levels of knowledge. As such, this course will complement a number of courses, including Applied Human Anatomy with Laboratory (APK 2100C), Applied Human Physiology with Laboratory (APK 2105C), Human Physiology (BSC 3096), Cellular and Systems Physiology (PCB 3713C), and Physiology and Molecular Biology of Animals (PCB 4723C).</p>	

Department Contact	Name Yehia Daaka, PhD, Professor and Chair		
	Phone 352-273-8112	Email ydaaka@ufl.edu	
College Contact	Name Joseph C. Fantone, MD, Professor and Senior Associate Dean for Educational Affairs		
	Phone 352-273-7925	Email jfantone@ufl.edu	

All UCC1 forms and each UCC2 form that proposes a change in the course description or credit hours must include this checklist in addition to a complete syllabus. Check the box if the attached syllabus includes the indicated information.

Syllabus MUST contain the following information:

- ☒ Instructor contact information (and TA if applicable)
- ☒ Course objectives and/or goals
- ☒ A weekly course schedule of topics and assignments
- ☒ Required and recommended textbooks
- ☒ Methods by which students will be evaluated and their grades determined
- ☒ A statement related to class attendance, make-up exams and other work such as: "Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found in the online catalog at: <https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>."
- ☒ A statement related to accommodations for students with disabilities such as: "Students requesting classroom accommodation must first register with the Dean of Student Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the instructor when requesting accommodation."
- ☒ Information on current UF grading policies for assigning grade points. This may be achieved by including a link to the appropriate undergraduate catalog web page <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>.
- ☒ A statement informing students of the online course evaluation process such as: "Students are expected to provide feedback on the quality of instruction in this course based on 10 criteria. These evaluations are conducted online at <https://evaluations.ufl.edu>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu>."

It is recommended that syllabi contain the following information:

1. Critical dates for exams and other work
2. Class demeanor expected by the professor (e.g., tardiness, cell phone usage)
3. UF's honesty policy regarding cheating, plagiarism, etc. Suggested wording: UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students 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." The Honor Code (<http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obliged to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor of TAs in this class.
4. Phone number and contact site for university counseling services and mental health services: 392-1575, <http://www.counseling.ufl.edu/cwc/Default.aspx>
University Police Department: 392-1111 or 9-1-1 for emergencies.

The University's complete Syllabus Policy can be found at:
http://www.aa.ufl.edu/Data/Sites/18/media/policies/syllabi_policy.pdf

HUMAN HISTOLOGY COURSE SYLLABUS

Course name: Human Histology
Course number: BMS 4xxx C
Credit hours: 4

I. Course Overview

This combined (C) lecture and laboratory course presents the structure and function of human cells and tissues in the context of modern molecular cell biology. The overall goals are to encourage students to (1) develop an intellectual understanding of the functions of human cells and tissues in lecture and (2) develop a visual and spatial appreciation of the structures of human cells and tissues in the laboratory. Put simply, students will correlate what they understand from lecture with what they see in lab. This course will emphasize function / structure relationships that are hallmark features of all biological systems. As such, this course integrates with, and builds on, many other courses in the biological sciences at UF.

This course will focus on blending modern molecular cell biology with traditional histology. Thus, some aspects of traditional histology will not be emphasized. For example, traditional terminology (e.g., ergastoplasm) and staining properties (e.g., metachromatic staining by toluidine blue) will not be emphasized. Rather, topics in modern molecular cell biology will be emphasized. For example, the functional effects of mutations in the cystic fibrosis transmembrane conductance regulator will be used to illustrate aspects of epithelial cell and tissue function. This course will emphasize function-structure relationships in normal human tissues. However, correlations to disease mechanisms and pathological processes will be made where appropriate to promote application of knowledge.

II. Course Prerequisites

Students must complete either Essential Cell Biology (PCB 3023) or Eukaryotic Cell Structure and Function (PCB 3134) with at least a C grade before enrolling in the Human Histology course.

III. Course Director and Manager

Course director
John P. Aris, PhD
Associate Professor
Department of Anatomy and Cell Biology
johnaris@ufl.edu
352-273-6868

Course manager
Kimberly Hodges
Program Assistant
Department of Anatomy and Cell Biology
kahodges@ufl.edu
352-273-8473

IV. Course Objectives

The overarching learning objectives for this course are:

1. Describe the basic structure and function of human cells, organelles, and cell specializations.
2. Explain the organization and function of cells and extracellular components in human tissues.
3. Discuss the structural and functional features of the four classic tissues (epithelium, connective tissue proper, muscle, nerve) and specialized connective tissues (adipose, blood, bone, cartilage).
4. Compare the structural integration and functional roles of the classic and specialized connective tissues in different body systems (integumentary, lymphatic, cardiovascular, respiratory, digestive, urinary, endocrine, and reproductive).

V. Course Format

This is a 4-credit hour course that consists of 20 lectures, 18 laboratories, and 4 exams. Students should expect to spend a total of approximately 180 hours of time on in-class and outside-of-class

activities for this course. In other words, students should expect to spend about 120 hours of time outside of class (i.e., reviewing, studying) to achieve a reasonable mastery of course content.

Each course topic has both lecture and laboratory components. Lectures are 50 minutes in length and precede laboratories that are 100 minutes in length. Lectures will focus on key functions that are correlated with structures that are the focus of the corresponding laboratories. Four exams will be given. The final exam will be partly comprehensive.

VI. Laboratories

Laboratory Presentation

The first 50 minutes of the laboratory will consist of a presentation by a faculty member. During the presentation, histological slides are projected on a large screen and tissue structure and function is discussed. Lab presentations will include both didactic and interactive approaches.

Laboratory Exercise

The second 50 minutes of the lab will consist of a self-guided student exercise that is described in the laboratory manual. Faculty will be present in lab to answer student questions during exercises.

Laboratory Manual

A laboratory manual is provided as a downloadable PDF file. It contains a table of contents, a multi-page write-up for each lab, and appendices with helpful information. Each lab write-up lists learning objectives, required slides and electron micrographs (EMs), as well as optional review (self-test) slides and EMs. Each required slide and EM has a narrative description of key teaching points and a checklist of identification items. Each lab write-up concludes with optional review (self-test) questions and a comprehensive list of checklist items from all of the required slides and EMs in the laboratory.

Slides and Microscopes

Students will be assigned a Zeiss light microscope and a box set of slides. During the first lab, students will be instructed in the use of the microscope and slides. Proper use and care of the microscope and slide set are the responsibility of the student. At the discretion of the course director, inappropriate use or damage of microscopes or slides may result in a reduced course grade.

VII. Textbooks

Required text: *Histology – A Text and Atlas*, Ross and Pawlina, 6th Edition, 2011.

A comprehensive histology text and atlas is required. Bring your histology text to all lectures and laboratories for use as a reference. Reading assignments will be listed in lecture handouts.

Recommended texts: Recent editions of *Molecular Biology of the Cell* by Alberts et al or *Molecular Cell Biology* by Lodish et al are recommended for understanding cell biology concepts in lecture.

VIII. Examinations

Four exams will be given. Each lecture or laboratory will be assessed with six questions. All exam questions will have equal weight. In general, lecture questions will be multiple-choice whereas laboratory questions will be short answer (fill in the blank). All lab questions, whether identification or structure-function, will be based on checklist items in lab write-ups. Lecture and laboratory questions may include images or illustrations. The final exam will include 12 comprehensive questions (*).

Exam	Number of lectures or labs	Number of questions	Relative weight of exam
1	11	66	27.5%
2	8	48	20%
3	11	66	27.5%
4	8	60*	25%
Totals	38	240	100%

Make-up Exams

Make-up examinations may be given to students whose absence is excused by the course director. Students are expected to adhere to the UF Academic Honesty Policies and not give or accept unauthorized aid for make-up examinations. See the Policies section below.

Discrepancies

Students may uncover discrepancies between information presented in (1) lecture and laboratory, (2) required textbooks, (3) other textbooks, (4) online content (e.g., Wikipedia), and/or (5) personal communications. In these instances, students are encouraged to communicate discrepancies to the instructor and course director. However, for the purposes of examinations and grading, discrepancies in course and exam content will be resolved by the instructor and the course director.

IX. Grading

Grades will be based on the percentage of examination questions answered correctly. The following grades can be earned based on the cumulative performance on all four exams:

<u>Grade</u>	<u>Range</u>	<u>Grade</u>	<u>Range</u>	<u>Grade</u>	<u>Range</u>
A	90 - 100	B-	77 - 79.99	D+	63 - 66.99
A-	87 - 89.99	C+	73 - 76.99	D	60 - 62.99
B+	83 - 86.99	C	70 - 72.99	D-	57 - 59.99
B	80 - 82.99	C-	67 - 69.99	E	<57

The grading policies for this course are consistent with UF grading policies, which are available online in the undergraduate catalog (<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>).

X. Policies

Academic Honesty

All students should be familiar with and adhere to the UF academic honesty policy and to understand what constitutes a policy violation (<http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code>). For all exams, the following pledge is implied: *On my honor, I have neither given nor received unauthorized aid in doing this assignment.*

Attendance

Attendance of lectures is highly encouraged but not required. UF policies for absences, religious events, and illness are online (<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>).

Accommodations

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.

Evaluations

Students are expected to provide feedback on the quality of instruction in this course. Evaluations are conducted online at the UF Evaluations Web Page (<https://evaluations.ufl.edu>). Evaluations are typically open during the last 2-3 weeks of the semester, but students will be given specific times when they are open. Evaluation results are available to students at the UF Evaluations Web Page.

UF Counseling and Mental Health Services

UF counseling and mental health services can be reached at 392-1575 or www.counseling.ufl.edu. The University Police Department can be reached at 392-1111 or 9-1-1 for emergencies.

Human Histology - Sample Course Schedule - Fall 2014

Two classes will be held each Tuesday and Thursday (e.g., periods 8-9, 3-5 PM). Two lectures or one laboratory will be given each day. Labs will consist of a 50-minute faculty presentation plus a 50-minute student exercise. Reading assignments will be from chapters in the required textbook (*Histology – A Text and Atlas*, Ross and Pawlina, 6th Edition, 2011).

Date	Day	Lecture	Lab	Exam	Title	Chapter(s)
8/26	T	1			Microscopy	1
		2			Cells	2-3
8/28	R		1		Microscopy and Cells	1-3
9/2	T	3			Epithelial Tissues	4-5
		4			Connective Tissue	6
9/4	R		2		Epithelial Tissue	4-5
9/9	T		3		Connective Tissue	6
9/11	R	5			Integument	15
		6			Cartilage and Bone	7-8
9/16	T		4		Integument	15
9/18	R		5		Cartilage and bone	7-8
9/23	T			1	(11 classes)	
9/25	R	7			Muscle Tissue	11
		8			Nerve Tissue	12
9/30	T		6		Muscle Tissue	11
10/2	R		7		Nerve Tissue	12
10/7	T	9			Blood	10
		10			Lymphatic System	14
10/9	R		8		Blood	10
10/14	T		9		Lymphatic System	14
10/16	R			2	(8 classes)	
10/21	T	11			Cardiovascular System	113
		12			Respiratory System	19
10/23	R		10		Cardiovascular System	13
10/28	T		11		Respiratory System	19
10/30	R	13			Digestive System I	16-17
		14			Digestive System II	18
11/4	T		12		Digestive System I	16-17
11/6	R		13		Digestive System II	18
11/11	T	15			Endocrine System	21
		16			Cell Signaling	21
11/13	R		14		Endocrine System	21
11/18	T			3	(11 classes)	
11/20	R	17			Urinary System	20
		18			Male Reproductive System	22
11/25	T		15		Urinary System	20
12/2	T		16		Male System	22
12/4	R	19			Female Reproductive System I	23
		20			Female Reproductive System II	23
12/9	T		17		Female Reproductive System I	23
12/11	R		18		Female Reproductive System II	23
12/16	T			4	(8 classes)	

External Consultation Results (departments with potential overlap or interest in proposed course, if any)

Department Biology	Name and Title Dr. Marta Wayne, Chair
Phone Number 352-392-9925	E-mail mlwayne@ufl.edu
<p>Comments</p> <p>Dr. Yehia Daaka, Chair of Anatomy and Cell Biology, met with Dr. Wayne to discuss: (1) listing Integrated Principles of Biology 2 / Laboratory 2 (BSC 2011 / BSC 2011L) or Essential Cell Biology (PCB 3023) as a prerequisite for the Human Histology course, and (2) designating Human Histology as an elective for the Biology major that is offered jointly between CLAS and CALS. Dr. Wayne expressed her support for listing BSC 2011 / BSC 2011L or PCB 3023 as a prerequisite for Human Histology.</p>	

Department Microbiology and Cell Science	Name and Title Dr. Eric Triplett, Chair
Phone Number 352-392-1906	E-mail ewt@ufl.edu
<p>Comments</p> <p>Dr. Yehia Daaka, Chair of Anatomy and Cell Biology, met with Dr. Triplett to discuss: (1) listing Eukaryotic Cell Structure and Function (PCB 3134) as a prerequisite for Human Histology and (2) designating Human Histology as an elective for the Biology major that is offered by CALS and CLAS. Dr. Triplett expressed his support for listing PCB 3134 as a prerequisite for Human Histology and agreed that a histology course would fill a gap in the current undergraduate curriculum and would not be redundant with existing courses offered by Microbiology and Cell Science.</p>	

Department Applied Physiology and Kinesiology	Name and Title Christopher Janelle, PhD, Associate Dean, HHP
Phone Number 352-294-1718	E-mail cjmj@hhp.ufl.edu
<p>Comments</p> <p>Dr. Yehia Daaka, Chair of Anatomy and Cell Biology, met with Dr. Janelle to discuss the Human Histology course and its place in the broader undergraduate curriculum. Dr. Janelle indicated that the course would likely appeal to HHP students, particularly those in Applied Physiology and Kinesiology. Given its focus on histology, Dr. Janelle agreed that the course would fill a void in the current undergraduate curriculum and would not be redundant with existing courses in HHP.</p>	

Department Food Science & Human Nutrition	Name and Title Dr. Elaine Turner, Dean, CALS
Phone Number	E-mail
<p>Comments</p> <p>Dr. Yehia Daaka, Chair of Anatomy and Cell Biology, met with Dr. Turner to discuss the Human Histology course and its place in the broader undergraduate curriculum. Dr. Turner indicated that this course would likely appeal to CALS students, especially those in pre-professional majors such as Biology, Animal Sciences, and Microbiology and Cell Science. Given the focus on histology, Dr. Turner agreed that this course would fill a gap in the current undergraduate curriculum and would not be redundant with existing CALS courses.</p>	

Department	Name and Title
Phone Number	E-mail
Comments	

Department	Name and Title
Phone Number	E-mail
Comments	

Human Histology - Sample Laboratory - Laboratory 2 - Epithelium

A. Reading: *Histology*, Ross and Pawlina, 6th Ed, Chapters 4-5.

Objectives

1. Identify and classify epithelia visible by light and electron microscopy.
2. Identify named epithelia (endothelium and mesothelium).
3. Correlate the functions of epithelia with their specific structural features and specializations.
4. Identify junctions required for the structural integrity of epithelia.
5. Identify cell specializations such as microvilli and cilia.
6. Identify different types of glands such as unicellular and multicellular glands.

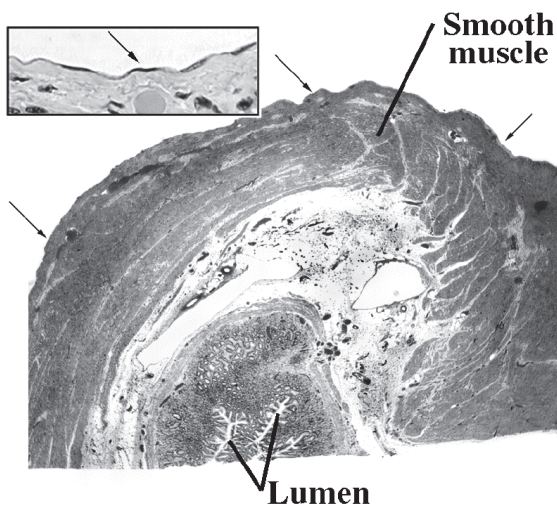
B. Summary of Laboratory Slides

Slide 55d, Pyloric stomach, plastic, H&E
Slide 82a, Thyroid gland, H&E
Slide 56l, Small intestine, monkey, Masson
Slide 56c, Small intestine, rat, toluidine blue
EM 3, Small intestine, absorptive cells
Slide 70c, Esophagus & trachea, rabbit, H&E
Slide 70a, Trachea, human, H&E
Slide 77b, Bladder, monkey, H&E

C. Microscope Slide Review

Slide 55d, Pyloric stomach, plastic, H&E

Ross, Fig. 17.01 and 17.15



The specimen on this slide is a cross-section of the pyloric portion of the monkey stomach. With the lowest power objective, find the outer surface of the stomach, which is on the side of the stomach wall opposite from the lumen. In the figure above, arrows point to the outer surface of the stomach. The arrow in the high magnification inset points to a mesothelial cell

nucleus (dark flat structure). At higher power, examine the outer surface for the cytoplasm of the mesothelial cells (a thin eosinophilic line) with occasional basophilic flat-shaped nuclei. **Mesothelium** is the term for the **simple squamous epithelium** lining large body cavities. The basement membrane of the mesothelium and the connective tissue layer below it are too thin to be identified. The thick eosinophilic layer deep (internal) to the epithelium consists mainly of smooth muscle.

Checklist for Slide 55d:

- endothelium
- lumen
- mesothelial cell and nucleus
- mesothelium
- serosa / serous membrane
- simple squamous epithelium

Slide 82a, Thyroid gland, H&E

Ross, Fig. 21.13, Plate 83

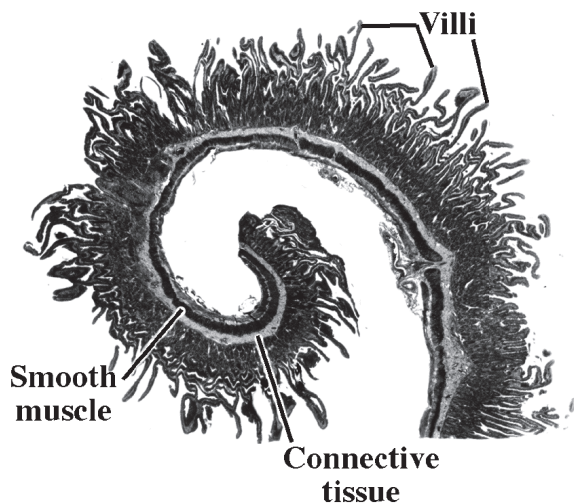
The thyroid consists principally of epithelium-lined "follicles" that contain eosinophilic "colloid". The cells lining the follicles form a **simple epithelium**. In some follicles the epithelium appears cuboidal; in others it appears squamous. In some areas the epithelium appears stratified. How do you explain this appearance?

Checklist for Slide 82a:

- colloid
- follicle
- simple cuboidal epithelium
- simple squamous epithelium

Slide 56l, Small intestine, monkey, Masson

Ross, Fig. 2.2, 17.18, 17.19; Plates 59 and 60



Locate the villi of the small intestine. They are finger-like processes visible with the naked eye and project into the lumen. Villi are covered on the outside by an absorptive **simple columnar epithelium**, which can be seen with the 10X objective lens. Using the 40X objective lens, study the tall columnar cells of the epithelium. Scan the epithelium to identify longitudinally sectioned cells (cells that appear in their full length) and cross-sectioned cells. Note the presence of absorptive cells and mucus containing goblet cells, which are named for their shape. Find a goblet cell visible from basal to apical surface to observe the goblet shape. Mucus in the mucous cup stains pale green. With the 40X objective inspect the apical surface of longitudinally sectioned cells and identify the striated border at this free surface. The "striations" are prominent and can be visualized with the 40X objective when you focus up and down. What would the striated border look like in the transmission EM? What is its function? Can you locate and classify the mesothelium on this slide?

Checklist for Slide 56L:

- absorptive epithelium
- apical surface of epithelial cell
- basal surface of epithelial cell
- endothelium
- goblet cell
- mucosa / mucous membrane
- mucus
- simple columnar epithelium
- striated border
- villi

Slide 56c, Small intestine, rat, toluidine blue
 Ross, Fig. 2.2, 5.1, 5.8, 17.18 and 17.19;
 Plates 59 and 60

This slide contains a small fragment of a portion of the rat small intestine that was embedded in plastic and stained with toluidine blue. Because it is a thin plastic section, it shows more cellular detail than tissue embedded in paraffin. This slide is similar to slide 56i. Identify the villi and note that they are lined by a **simple columnar epithelium** with a striated border. Look at the apical surface of the cells, near the junction of the striated border with the rest of the epithelial cell, and try to find small dark dots at the apical-lateral surfaces between adjacent cells. These represent sections through terminal bars and are best observed with the oil immersion lens. Terminal bars appear as dots when the section is cut perpendicular to the basement membrane and through this region. When the cut through the apical surface of these epithelial cells is parallel to the basement membrane, the terminal bar appears like a dark blue line surrounding each cell. What would this region look like in the EM? What is the function of the terminal bar? Identify goblet cells that are cut longitudinally and in cross-section. See Ross, Fig 5.8 for another view of terminal bars in an H&E preparation.

Checklist for Slide 56c:

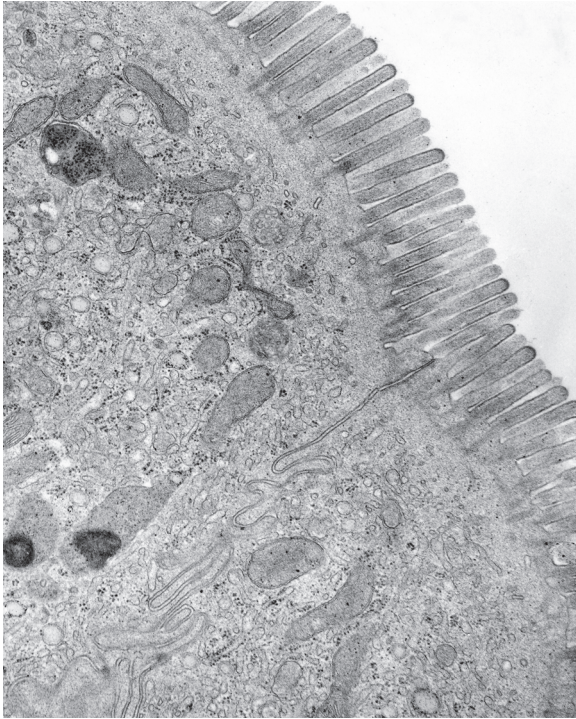
- absorptive cell
- goblet cell
- simple columnar epithelium
- striated border
- terminal bar
- villi

EM 3, Small intestine, absorptive cells

Ross, Fig. 2.48, 5.2, 5.3, 5.14 and 5.24

This EM shows the apical surface of two absorptive cells of the small intestine. The junctional complex is found where the plasma membranes of these two cells make contact. Both apical and lateral plasma membranes are visible. Identify the components of the junctional complex. Can you find the intercellular space between the two cells? The striated border seen with the LM corresponds to the numerous microvilli that project from the

apical surface of absorptive cells. Bundles of microfilaments (actin) extend from each microvillus into a region of the cell devoid of organelles, known as the terminal web. Since these cells are actively transporting proteins, numerous small vesicles (endosomes or secretory vesicles) are also visible.



Checklist for EM 3:

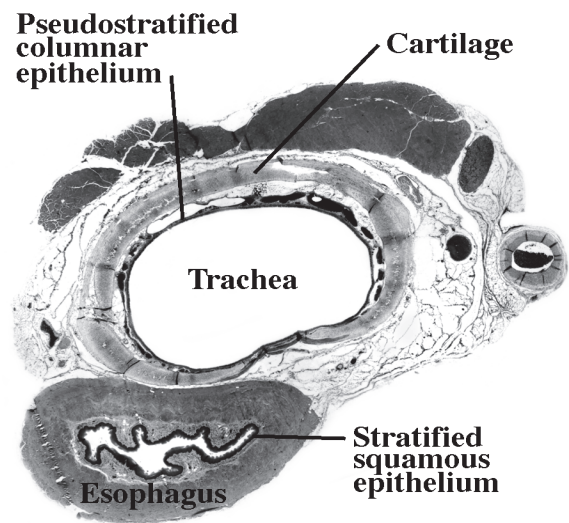
- membrane vesicle
- intercellular space
- junctional complex
- lateral plasma membrane
- microfilament bundles
- microvilli
- mitochondria
- terminal web

Slide 70c, Esophagus, trachea, rabbit, H&E

Ross, Fig. 17.2, 17.4, 19.6, 19.7; Plates 54, 71

This slide shows good examples of both a non-keratinized **stratified squamous epithelium** (SSE) (lining the esophagus) and a ciliated **pseudostratified columnar epithelium** (lining the trachea). Identify the esophagus with your naked eye; it is the pink staining structure that has an irregular-shaped lumen. Note the differences in shape, staining properties of cytoplasm and nuclear morphology between basal, intermediate and apical (surface) cells

within this epithelium. Where would you expect to find stem cells? Note that this epithelium is not keratinized. On this same slide, study the pseudostratified columnar epithelium with cilia. Most of the nuclei in this epithelium are elongate and located near the surface of the epithelium. Observe the cilia and the red stained region containing basal bodies at the base of the cilia. Nuclei of goblet cells and basal cells are also present at the base of the epithelium. Goblet cells, which are unicellular glands, are large cells that are filled with pale staining secretory granules. Why is this epithelium classified as pseudostratified rather than stratified?



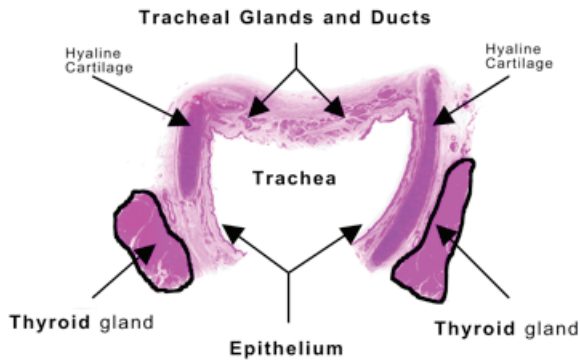
Slide 70c

Checklist for Slide 70c:

- basal, intermediate, apical cells of SSE
- basal bodies
- basal cells
- cilia
- esophagus
- goblet cells
- non-keratinized
- stratified squamous epithelium (SSE)
- pseudostratified columnar epithelium
- lumen
- nuclei of goblet cells
- trachea
- unicellular gland

Slide 70a, Trachea, human, H&E

Ross, Fig. 19.6, 19.7 and 19.9; Plate 71



Slide 70a shows good examples of epithelia in the thyroid glands and trachea, including in the connective tissue associated with the trachea. The airway of the trachea is lined by a ciliated **pseudostratified columnar epithelium**. It contains three epithelial cell types: basal cells, ciliated columnar cells, and goblet cells. This epithelium is anchored to a basement membrane, a pink-stained region at the base of the epithelium, where it meets underlying connective tissue. The connective tissue contains mixed glands containing mucous-secreting cells and serous-secreting cells. Mixed glands typically produce serous demilunes as a fixation artifact. Secretions are released into the airway of the trachea via ducts that are lined by simple or stratified cuboidal or columnar epithelium.

Checklist for Slide 70a:

- glandular epithelium
- mixed gland
- mucous-secreting cells
- serous demilune
- serous-secreting cells
- stratified columnar duct

Slide 77b, Bladder, monkey, H&E - Ross, Fig. 20.25 and 20.26; Plates 78 and 79

With the reversed ocular, identify the epithelium that lines the lumen of the bladder; this **transitional epithelium** appears as a dark pink wavy band. Study the large surface cells and compare dome-shaped cells, which are frequently binucleate, with the more flattened ones. Note that in a transitional epithelium the number of layers of deep cells is variable, depending on the state of distention of the organ (bladder). Where do you find simple squamous epithelia on this slide?

Checklist for Slide 77b:

- binucleate cells
- dome-shaped cells
- transitional epithelium

D. Self Test

Slide 57c, Appendix, human, H&E (terminal bars in luminal epithelium) - Ross Plate 63

Slide 54b, Esophagus, dog, Masson - Ross Fig. 17.2 and 17.4 Plate 54

EM 5, Pancreas, Ross Fig. 18.21, 18.22, 18.26

Slide 90b, Oviduct, human, H&E, Ross Fig. 23.13, Plate 95

Slide 56j, Small intestine, monkey, H&E

Slide 56k, Small intestine, monkey, PAS-H

E. Subject Review

1. What are the major structural and functional characteristics of an epithelium?
2. Relate the structure of an epithelium to its function. Where would you expect to see different epithelia in the body, such as, for example, a simple squamous epithelium or a keratinized stratified squamous epithelium?
3. How are epithelia classified? Name and describe the three types of simple epithelia.
4. Define terminal bar, terminal web, and junctional complex. What does each look like in the LM and EM level?
5. What are the functions of the basement membrane? How is it attached to the epithelium and underlying connective tissue?

F. Summary Terms

absorptive cell
 acinus
 actin filaments
 apical surface of epithelial cell
 basal cells
 basal bodies
 basal lamina / basement membrane
 basal surface of epithelial cell
 brush border
 cellular morphology
 cilia

ciliated cell
columnar cell
cuboidal cell
endothelium
goblet cell (unicellular gland)
gland
Golgi complex
junctional complex
nonkeratinized stratified squamous epithelium
lateral surface of epithelial cell
mesothelium
microfilaments
microtubules
microvilli
mucosa
mucus gland

myoepithelial cells
pseudostratified columnar epithelium
simple cuboidal epithelium
simple columnar epithelium
simple squamous epithelium
stratified cuboidal epithelium
stratified squamous epithelium
serosa
serous gland
serous demilune
squamous cell
stem cell
striated border
terminal bar
terminal web

Human Histology Course - Supplemental Information

Rationale

The purpose of the Human Histology course is to enhance the education of undergraduate students that are interested in careers in the health professions. The Human Histology course will highlight mechanisms of normal tissue function as well as provide clinically relevant disease correlations. As such, this course fits into the broader pre-health undergraduate curriculum at UF by laying a solid foundation of key concepts regarding normal tissue function and introducing connections to anomalies in human disease. The Human Histology course will build on cell biology topics taught in Essential Cell Biology (PCB 3023) and Eukaryotic Cell Structure and Function (PCB 3134), either of which will satisfy the prerequisite requirement for the Human Histology course. Importantly, this course will include a laboratory component in which undergraduate students will use light microscopes and histology slides to study human tissue structure and function. The laboratory will be tightly integrated with lecture content and will have an active learning emphasis: students will work with lab partners in their lab groups to navigate histological slides, identify checklist items, and answer structure-function correlation questions. Active learning in laboratories is a hallmark of undergraduate courses at UF and the Human Histology course will contribute to the undergraduate curriculum by including a strong active learning emphasis. Finally, it is worth noting that many universities around the country offer similar courses; a few examples are listed below (from a list of dozens of undergraduate histology courses that we have compiled). Thus, the Human Histology course will enhance the ability of undergraduate students who have completed prehealth majors to participate in the competitive application process for continuing their education in a health profession after graduation from UF.

Harvard University - Cell Biology Through the Microscope - MCB 68
University of Arizona - Human Histology - CMM 410
University of Chicago - Mammalian Histology - BIOS 424
University of Massachusetts - Histology - BIOL 523
University of Michigan - Histology and Organology - BIO 418
University of North Carolina - Vertebrate Histology - BIO 415
University of Pennsylvania - Histology - BIOL 306

Major Elective

The Human Histology course is not approved as an elective for a major at this time, but it is under consideration by the Biology Major Executive Committee.