CAPS 390 - Lecture 01

Sept 07, 2016

Today	*-Course Intro/Syllabus* *-Histology Defined* *(Cal Roskelley)*	*Ch 1 pp 1-12 (Text)*
Friday	*-Cell Structure I* *-Membranes* *(Chris Loewen)*	*Ch 2, 3*

On CAPS 390 'UBC Connect':

- Lecture powerpoints posted 1-2 days before each lecture.

- Summaries of lectures (with main points and explanations) posted after each lecture.

CAPS390

Human Microscopic Anatomy

(Fall 2016, 3 credits)

A Lecture Course: examining the microscopic structure and function of cells, tissues and organs (histology)

Lectures: Monday, Wednesday, & Friday @ 10:00am, IRC 2

Textbook:

Title:	Colour Textbook of Histology (4th Edition)
Authors:	LP Gartner
Publisher:	Saunders Elsevier, ISBN 978-1-4160-2945-8

3rd Edition of Gartner is OK, but page numbers will be slightly out of register.

Netter's 'Essential Histology' (by Ovalle & Nahirney = Summer Course Textbook), is an excellent book, especially the images, but the text is cryptic

Expecation is that students have a basic knowledge of cell biology (ie. BIOL 200 is recommended). If you have not taken a cell biology course you may need to do extra reading

CAPS 390 Instructors

Chris Loewen
Cell Biology

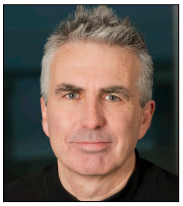
Guy Tanentzaph
Adhesion/ECM

Hakima Moukhles
Muscle

Victor Viau
Neuro/Endocrine

Tim O'Connor
Embryology/Development

Janel Kopp
Digestive Glands



Cal Roskelley
Epithelium/CTissue/
Cartilage/Bone
Blood/Lymph/Resp/GI/
Urinary/ Repro

Other Course Info

Website: UBC Connect (syllabus, lecture powerpoints, lecture summaries, sample questions, bulletin board)

Course Director:
Cal Roskelley, Life Sciences Building, Room 3456, roskelly@mail.ubc.ca

Lecturers:

Dr. Chris Loewen	Cell Structure
Dr. Guy Tantentzapf	Cell Adhesion, Extracellular Matrix
Dr. Hakima Moukhles	Muscle
Dr. Tim O'Connor	Development/Embryology
Dr. Victor Viau	Nervous Tissue, Endocrine
Dr. Janel Kopp	GI (Glands)
Dr. Cal Roskelley	Epithelium, Connective Tissue, Cartilage, Bone, Blood, Hematopoiesis, Circulation, Lymphoid, Respiratory, GI, Urinary, Repro

Course Director Office Hours - **Scheduling/Conflicts** (Life Science Center Rm 3456)
- Thursdays 10am to 11am (Starting Thursday, Sept 15th)

Office Hours - **Course Material** (Life Science Center, Rm 1410)
- Fridays 4pm to 5pm (Starting Friday Sept 16th)

Bulletin Board - **Content Questions and Discussion** (Online, starting Monday Sept 12th)
- Checked by Instructors and TA Monday, Wednesday and Friday of each week

Quizzes and Exams

Quizzes and Exams:
- All Quizzes and Exams are mandatory
- Exam marks will only be deferred with doctor's note due to illness, demonstrable hardship/scheduling conflict, or prior permission of the course director
- Deferred status for the course will only be granted on the recommendation of the student's faculty

Quizzes	4 Quizzes (5% of course mark per quiz)	20% of Total Course Mark
Midterm Exam	40 Questions (32 mult. choice; 8 sh. answers)	20% of Total Course Mark
Final Exam (cumulative)	120 Questions (96 mult. choice; 24 sh. answers)	60% of Total Course Mark

Quizzes are meant to be homework assignments; They are not timed, but once you start the quiz online you have to finish it. Working together as you do the quiz is fine, but please then pass answers on for classmates to get a freebie.

Sample exam questions (not graded/not for marks) are also provided throughout the course for your information so that you can gauge depth of knowledge expected on exams. These are the same format and level of difficulty as the midterm and final exams.

First set of sample exam questions will be uploaded to CONNECT next week.

Schedule Before Midterm

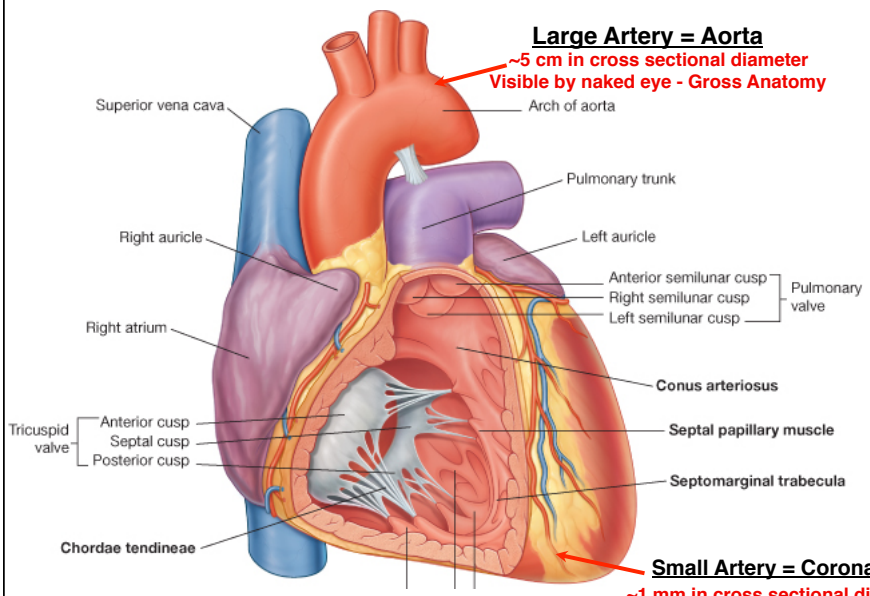
Lec #		Day	Subject	Chapter	Lecturer
01	Wed	Sept 07	Introduction	1	Roskelley
02	Fri	Sept 09	Cell Structure I (Membranes)	2,3	Loewen
03	Mon	Sept 12	Cell Structure II (Cytoplasm/Nucleus)	2,3	Loewen
04	Wed	Sept 14	Cell Structure III (Transport)	2,3	Loewen
05	Fri	Sept 16	Cell Adhesion	2,5	Tanentzapf
06	Mon	Sept 19	Extracellular Matrix ***Open Online Practice Quiz***	4	Tanentzapf
07	Wed	Sept 21	Epithelium & Connective Tissue	5,6	Roskelley
08	Fri	Sept 23	Cartilage	7	Roskelley
09	Mon	Sept 26	Bone ***Close Practice Quiz***	7	Roskelley
10	Wed	Sept 28	Muscle I (Skeletal)	8	Moukhles
11	Fri	Sept 30	Muscle II (Cardiac/Smooth)	8	Moukhles
12	Mon	Oct 03	Nerve I ***Open Online Quiz #1***	9	Viau
13	Wed	Oct 05	Nerve II	9	Viau
14	Fri	Oct 07	Development I (Primary Germ Layers)	Notes	O'Connor
	Mon	*Oct 10*	*Thanksgiving (No Lecture)* ***Close Quiz #1 (5% of Grade)***		
15	Wed	Oct 12	Development II	Notes	O'Connor
16	Fri	Oct 14	Blood	10	Roskelley
	Mon	**Oct 17**	**MIDTERM EXAM *(40 Questions, 20% of Grade)***		

Schedule After Midterm

17	Wed	Oct 19	Hematopoiesis	10	Roskelley
18	Fri	Oct 21	Circulatory System	11	Roskelley
19	Mon	Oct 24	Lymphoid System ***Open Online Quiz #2***	12	Roskelley
20	Wed	Oct 26	Endocrine I	13	Viau
21	Fri	Oct 28	Endocrine II	13	Viau
22	Mon	Oct 31	Endocrine III ***Close Quiz #2 (5% of Grade)***	13	Viau
23	Wed	Nov 02	Skin	14	Roskelley
24	Fri	Nov 04	Respiratory I (Upper/Conducting)	15	Roskelley
25	Mon	Nov 07	Respiratory II (Lower/Respiratory) ***Open Online Quiz #3***	15	Roskelley
26	*Wed*	*Nov 09*	GI I (Oral Cavity)	16	Roskelley
	Fri	*Nov 11*	*Remembrance Day (No Lecture)*		
27	Mon	Nov 14	GI II (Alimentary Canal) ***Close Quiz #3 (5% of Grade)***	17	Roskelley
28	Wed	Nov 16	GI III (Glands)	18	Kopp
29	Fri	Nov 18	Urinary I	19	Roskelley
30	Mon	Nov 21	Urinary II ***Open Online Quiz #4***	19	Roskelley
31	Wed	Nov 23	Male Repro I	21	Roskelley
32	Fri	Nov 25	Male Repro II	21	Roskelley
33	Mon	Nov 28	Female Repro I ***Close Quiz #4 (5% of Grade)***	20	Roskelley
34	Wed	Nov 30	Female Repro II	20	Roskelley
35	Fri	Dec 02	Review/Exam Prep (final exam is cumulative)	Notes	Roskelley
Exam Period		**Date TBA**	**FINAL EXAM *(120 Questions, 60% of Grade)***		

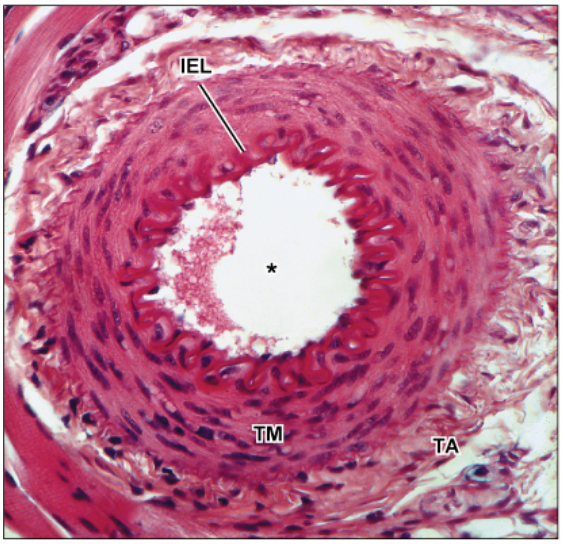
Final Exam is Cumulative

Gross Anatomy – Visible by Naked Eye



Microscopic Anatomy – Not Visible by Naked Eye

- Small Artery: 1mm cross sectional diameter, barely visible by naked eye = Gross Anatomy
- Visualizing tissue organization of arterial wall requires microscopy = Histology = CAPS390



Light Microscopic image of H&E-stained paraffin section

Histology
(definition)

Study of Cells, Tissues and Organs At the Microscopic Level

Tissue
(definition)

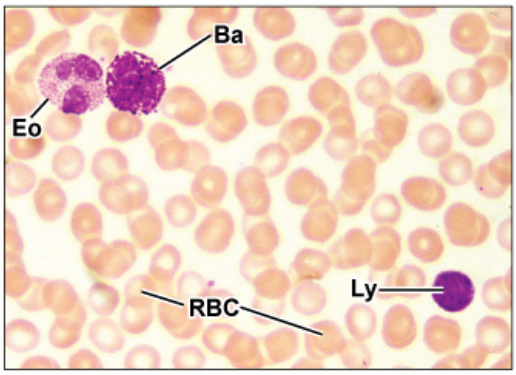
Aggregation of Similar Cells and Intervening Extracellular Matrix
That Serves A Specific Function or Related Functions

Organ
(definition)

Groups of Tissues That Are Assembled Into Units
That Serve Broad Functions

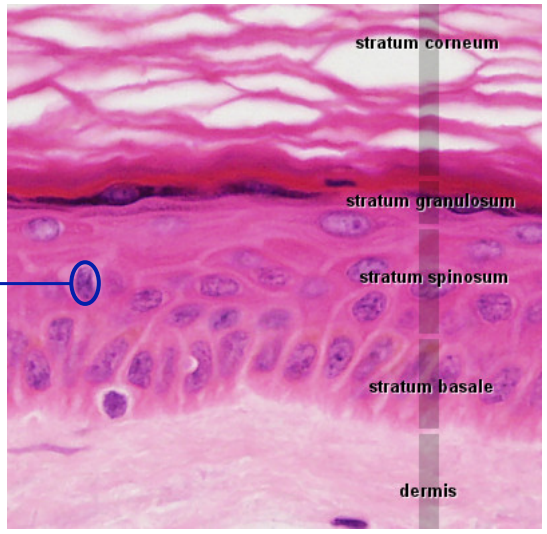
Blood Smear

- Cells ~10 μm in diameter
- Visible by light microscopy



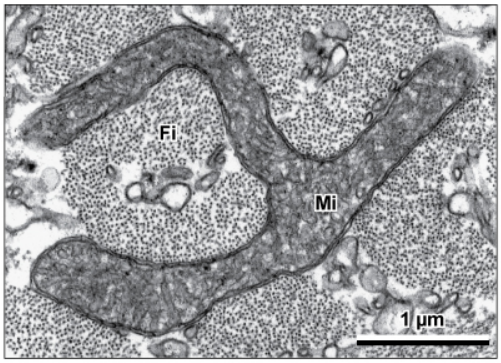
Integument = Skin Organ

- Nuclei ~3 μm
- Visible by light microscopy



Subcellular Organelles

Greater than 0.25 μm resolvable by both light microscopy (LM) & electron microscopy (EM)
Less than 0.25 μm resolvable only by electron microscopy (EM)
(Resolution = ability to distinguish two separate objects on image)



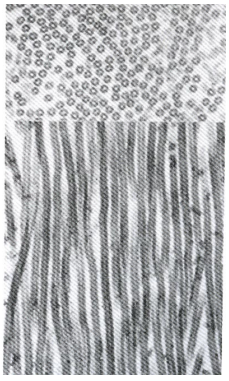
Mi = Mitochondria; 0.2μm to 3μm (visible by both LM & EM)
Fi = Individual Cytoskeletal Filaments; .005μm to .01μm in diameter (visible by EM only)

Subcellular Organelles & Macromolecular Complexes

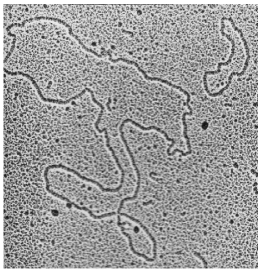
Greater than 0.2 nm; resolvable by electron microscopy

Cross Section

Longitudinal Section



Microtubules –polymers of tubulin
(25 nm diameter)



DNA Double Helix
(2 nM across)

'Processing' Tissues For Histology

(or routine pathology = abnormal histology)

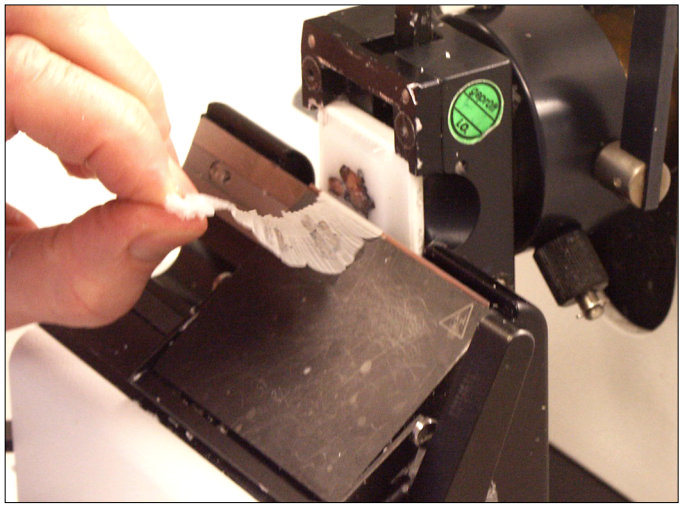
Fixation -Cross-link proteins and macromolecules with aldehydes
-Maintains tissue architecture for microscopic examination

Dehydration -Remove water, usually with alcohols

Embedding -L.M. in paraffin/wax (soft)
-E.M. in plastic/resin (hard)

Sectioning -L.M. 5 to 10 μm (thick)
-E.M. 25 to 100 nm (thin)

Sectioning Fixed & Embedded Tissue



Microtome: cutting thin, paraffin-embedded sections for light microscopy

Staining Tissue Sections For Light Microscopy

(or routine pathology = abnormal histology)

Histochemical – based on charge; low specificity

Immunochemical – based on antibodies binding to specific antigens, usually 'tagged' with coloured 'chromophores'; high specificity

Fluorescent Tags – can be linked to various stains/antibodies, facilitates 'optical sectioning' and tissue reconstructions in 3-dimensions

Histochemical Staining

(light microscopy of skin; 'H&E' staining)

Hematoxylin - blue 'basic' dye - binds nucleic acids/acidic glycoproteins
Eosin - pink 'acid' dye - binds basic proteins

The University of Western Australia School of Anatomy

Immunostaining

(light microscopy of skin; 'chromophore'-stained antibody to adhesion molecules)

Keratin 'Squames'

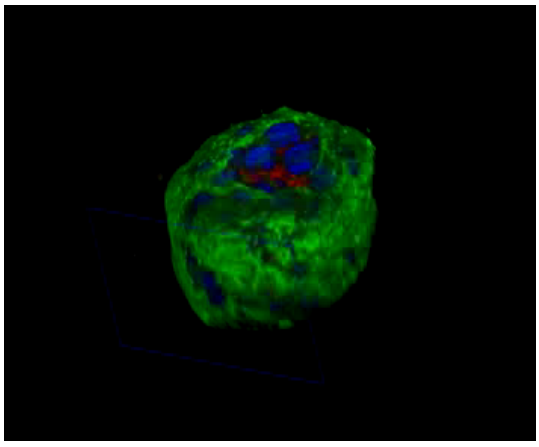
Epithelium

Connective Tissue (Dermis)

Brown = Chromophore-labelled antibody specifically bound to cell adhesion 'integrins' in epithelial cells that bind to extracellular matrix interface with connective tissue 'dermis'

Fluorescent Tags

(confocal laser light microscopy of cell adhesion proteins and nuclei in a spherical breast lobule; can be optically sectioned and then reconstructed digitally in 3-dimensions)



Green = Tagged to cell adhesion molecule integrins; bind to surrounding extracellular matrix
Red = Tagged to cell-cell adhesion molecule cadherins; hold cells of lobule together
Blue = Tagged to DNA in the nucleus of individual breast epithelial cells

Staining Tissue Sections For Electron Microscopy

(structures smaller than 0.25 μm)

Generally – 'Heavy Metal' stains to provide contrast in black & white images

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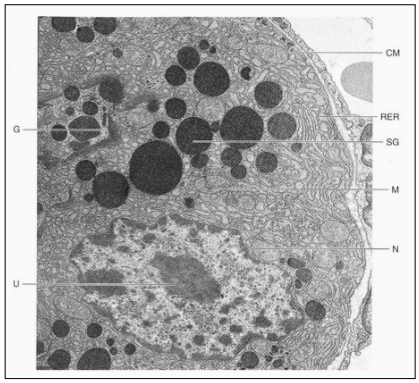
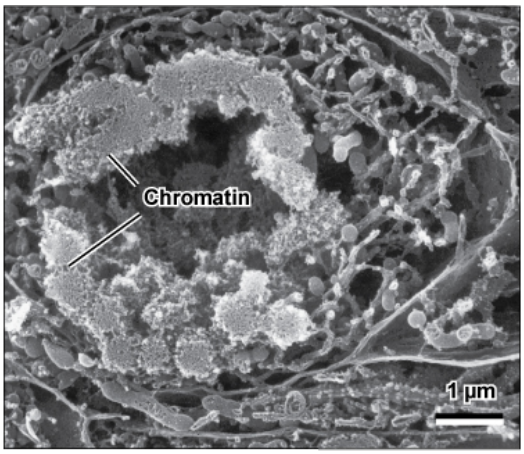
Osmium Tetroxide Stain For Transmission E.M.

(High magnification images from ultrathin sections for small subcellular organelles)



Enhances contrast of greyscale images binds strongly to lipids

Gold Coating For Scanning E.M.



Nuclear Structures
(Heavy metal coating generates 3-dimensional E.M. images where surface topography of sub-cellular structures is enhanced)