



**The University of New South Wales
School of Medical Sciences
Department of Anatomy**

**ANAT 2241 Histology: Basic and
Systematic**

Semester 1, 2013

Laboratory Handbook

Edited by: P. de Permentier, Course Convenor

Index

General Information	3
General Student Information about the Course and Histology	4
Timetable	4
Assessments	5
Textbooks, Study & revision facilities	5
Plagiarism	6
H&S, Consideration and Equity & Diversity	7
General advice for studying slides and histology resources	11
Laboratory Classes:	
Week 1 A: The Virtual Microscope, Histological techniques, Artefacts, Stereology Electron microscopy and Cell Ultrastructure	13
Week 1 B: Covering and lining epithelia	19
Week 2 A: Glandular epithelia	21
Week 2 B: Connective tissue I: Components	24
Week 3 A: Connective tissue II: Types	26
Week 3 B: Blood and Blood formation	28
Week 4 A: Bone, Bone Formation and Joints	31
Week 5 A: Muscle	34
Week 5 B: Nervous tissue	36
Week 6 A: Cardiovascular System	39
Week 6 B: Respiratory System	42
Week 8 A: Integumentary System	45
Week 8 B: Gastro-Intestinal System I	48
Week 9 A: Gastro-Intestinal System II	51
Week 9 B: Liver, Gallbladder, and Pancreas	53
Week 10 A: Lymphatic tissue and the Immune system	55
Week 10 B: Endocrine System	58
Week 11 A: Urinary System	60
Week 11 B: Female Reproductive System	62
Week 12 A: Male Reproductive System	65
Week 12 B: Special Sense Organ: The Eye	67

ANAT2241 Histology: Basic and Systematic

COURSE CONVENER and LECTURER: Patrick de Permentier,
Room 112, First Floor,
30 Botany St, Randwick.
Telephone: 9385 2465
Email: p.depermentier@unsw.edu.au

COURSE CO-CONVENER and LECTURER: Dr Thomas Fath
Room G21 Wallace Wurth building
Telephone: 9385 9690
Email: t.fath@unsw.edu.au

TUTOR:

Colin Yeo.

UNITS OF CREDIT

ANAT2241 Histology: Basic and Systematic is a 6UOC course. It is offered in the Anatomy major in the BSc and BMedSc programs. As a pre-requisite to PATH2201 Processes in Disease, it provides a vital link to the study of disorders when examined microscopically. Students need to understand normal histological morphology of cells, tissues and organs before they can appreciate pathological conditions of tissues under the virtual microscope.

COURSE AIM AND STUDENT LEARNING OUTCOMES

The aim of this course is to provide students with a thorough understanding of the microscopic appearance and function of normal structures in the human body. This allows students to integrate this information with other disciplines such as Gross Anatomy, Pathology, and Physiology.

The **Basic Histology component** of the course will concentrate on the microanatomy of the **four basic tissues**, namely: epithelial tissue, including glandular tissue, connective tissue, muscular tissue, and nervous tissue. **Lectures** will give you the outline of the topic, but you are expected to supplement the information with private study. The **laboratory sessions** are directly linked to the lectures. At the end of each laboratory class, make sure you have covered, and understand, the specific objectives. Discussion during the class is encouraged. Each laboratory class may have one or more questions to be answered. These questions are meant to promote enquiry and discussion. The teachers act as facilitators, to guide you.

The **Systematic Histology component** of the course will investigate how these basic tissues combine to form **organs**, which operate together to maintain homeostasis. By convention, organs, which work together to achieve a particular function are grouped together as **systems** (e.g. respiratory system, etc.). You are encouraged to use the computers during class and for private revision. In addition, external virtual microscopy databases are continually being installed in the computers to allow greater access to a variety of microscopic material.

GENERAL INFORMATION ABOUT HISTOLOGY

Anatomy is the study of the structure of organs and tissues at the **MACROSCOPIC (or gross) level**. Histology is the study of organ and tissue structure at the **MICROSCOPIC level** - it can be considered as microanatomy. Histology provides an insight into how cellular components are structurally and functionally related. It draws its foundations in Biochemistry, Molecular Biology and Physiology as well as Gross Anatomy. Histology provides valuable information on why tissues and organs are shaped as they are. Histology is one of the bases of biomedical sciences. Modern histological techniques allow us to explore and gain understanding of biochemical and physiological processes and how these are changed when structure is changed, as occurs, for instance, in many disease processes. By the end of this course, students should have a thorough understanding of the tissues and systems of the body by microscopic examination and to apply their knowledge to functional states examined in Physiology and diseased states examined in Pathology.

Histology of Basic Tissues and Systems		
Week	Lecture Dates	Lecture and Laboratory Class Topics
1 A	4/3	Introducing the course
1 B	5/3	Covering and Lining Epithelia
2 A	11/3	Glandular Epithelia
2 B	12/3	Connective tissue I: Components
3 A	18/3	Connective tissue II: Types
3 B	19/3	Blood and Blood Formation
4 A	25/3	Bone, Bone Formation and Joints
Mid-Semester recess is Monday April 1 to Friday April 5.		
5 A	8/4	Muscle
5 B	9/4	Nervous tissue
6 A	15/4	Cardiovascular System
6 B	16/4	Respiratory system
Mid-Session Theory Examination on Monday April 22 from 9 am – 10 am (Biomed D and G2/G4) and Practical Examination on Tuesday April 23 from 5 pm – 6.30pm (G2/G4).		
8 A	29/4	Integumentary system
8 B	30/4	Gastro-intestinal system I
9 A	6/5	Gastro-intestinal system II
9 B	7/5	Liver, Gallbladder and Pancreas
10 A	13/5	Lymphatic tissue and the Immune system
10 B	14/5	Endocrine system
11 A	20/5	Urinary system
11 B	21/5	Female reproductive system
12 A	27/5	Male reproductive system
12 B	28/5	Eye
13		REVISION
Final Practical Examination (date, time and place to be announced)		

PLEASE NOTE:

- 1) **Week 6 there is No lecture on Tuesday 26 March** as one of the laboratory sessions supporting this material is on Good Friday. This also means that the Thursday March 28 laboratory class will NOT be conducted.
- 2) **Week 7 is for Mid-Session exams only**, which are held in the lecture time slots and there are NO laboratory sessions in this week.

COURSE FORMAT

The course involves **6 hours per week** of instruction in two three-hour blocks. Each block involves a 1-hour lecture followed by a 2-hour practical class where students under the guidance of demonstrators will employ a computer to examine virtual slides of microscopic material.

TIMETABLE

Lectures

Monday 9 am – 10 am, Biomed Theatre D

AND

Tuesday 5 pm – 6 pm, Biomed Theatre D

Laboratory Sessions

Group A

Monday 10 am – 12 noon, Rooms G2, G4, Wallace Wurth Building

AND

Friday 12 noon – 2pm Rooms G2, G4, Wallace Wurth Building

Please note that these 2 sessions in Group A are NOT repeated material.

Group B

Tuesday 3 pm – 5 pm Rooms G2, G4, Wallace Wurth Building

AND

Thursday 11 am – 1pm, Rooms G2, G4, Wallace Wurth Building

Please note that these 2 sessions in Group B are NOT repeated material.

NOTE: You must remain in your allocated Laboratory timeslots.

ASSESSMENTS

1. Practical exams

There will be TWO practical exams, a Mid-Session one (**Monday April 22**) and a Final practical exam at the end-of-Session.

2. Written examinations

There will be TWO written papers. The first one is in Mid-Session (**1 hour in duration, Tuesday April 23**) and the second one is at the end of the Session.

	Marks
Mid-Session Practical Exam	10%
Mid-Session Theory Exam	20%
Final Practical Exam	30%
Final Theory Exam	40%

Practical and theory examinations are based on specific objectives, learning activities and lecture material. In practical examinations, you will be expected to be able to identify microscopic structures (cells and tissues) studied during the laboratory sessions as well as provide some brief functions. The end of session (2 hour) theory examination will include 1 long answer, 3 short answers, 2 histological drawings and 2 questions comparing and contrasting tissues in a table format. The examination is designed to test the understanding of the microscopic organisation of the normal tissues of the human body and relate them to their functional importance.

TEXTBOOKS

Several books provide adequate coverage of the material in this course. A number of suggestions have been included on the following list. An atlas on its own will usually only cover the practical part of the course, so you will need access to a textbook to cover the theory part of the course.

Combined Texts and Atlas

Young, B., Lowe, J., Stevens, A. & Heath, J. (2006) *Wheater's Functional Histology. A Text and Colour Atlas* 5th ed. Churchill Livingstone, Edinburgh. ISBN 0-443-06850X.

Junqueira L. (2009) *Basic Histology Text & Atlas* 12th ed, McGraw-Hill, ISBN 9780071630207

Textbook

Kerr, J. B. (2010) *Functional Histology* 2nd ed. Mosby Elsevier. ISBN 9780729538374.

Atlas

Eroschenko, V.P. (2008) *di Fiore's Atlas of Histology*. 11th ed Lippincott, Williams & Wilkins Int., Baltimore. ISBN 9781608314928.

ATTENDANCE

In accordance with University regulations, students must attend at least 80% of all scheduled learning activities (lectures and practicals).

STUDY AND REVISION FACILITIES

The histology labs in rooms G2 and G4 of the Wallace Wurth building are generally open from about 8 am to 5.30 pm Monday to Friday.

They may be used by students during these hours, provided the rooms are not required for other classes. The laboratories are closed on weekends and public holidays. Laboratory coats are NOT required in the histology laboratories. Food and drinks are NOT allowed in the laboratories.

OFFICIAL COMMUNICATION BY EMAIL

All students in the course ANAT2241 Histology: Basic and Systematic are advised that email is now the official means by which the School of Medical Sciences at UNSW will communicate with you.

All email messages will be sent to **your official UNSW email address** (e.g., z1234567@student.unsw.edu.au) and, if you do not wish to use the University email system, you **MUST** arrange for your official mail to be forwarded to your chosen address.

The University recommends that you check your mail at least every other day. Facilities for checking email are available in the School of Medical Sciences and in the University library.

Further information and assistance is available from DIS-Connect, Tel: 9385 1777. Free email courses are run by the UNSW Library.

ACADEMIC HONESTY AND PLAGIARISM

The School of Medical Sciences will not tolerate plagiarism in submitted written work. The University regards this as academic misconduct and imposes severe penalties. Evidence of plagiarism in submitted assignments, etc. will be thoroughly investigated and may be penalized by the award of a score of zero for the assessable work. Flagrant plagiarism will be directly referred to the Division of the Registrar for disciplinary action under UNSW rules.

What is plagiarism?

Plagiarism is the presentation of the thoughts or work of another as one's own*
Examples include:

- direct duplication of the thoughts or work of another, including by copying work, or knowingly permitting it to be copied. This includes copying material, ideas or concepts from a book, article, report or other written document (whether published or unpublished), composition, artwork, design, drawing, circuitry, computer program or software, web site, Internet, other electronic resource, or another person's assignment without appropriate acknowledgement;

- paraphrasing another person's work with very minor changes keeping the meaning, form and/or progression of ideas of the original;
- piecing together sections of the work of others into a new whole;
- presenting an assessment item as independent work when it has been produced in whole or part in collusion with other people, for example, another student or a tutor; and,
- claiming credit for a proportion a work contributed to a group assessment item that is greater than that actually contributed.† Submitting an assessment item that has already been submitted for academic credit elsewhere may also be considered plagiarism.

The inclusion of the thoughts or work of another with attribution appropriate to the academic discipline does *not* amount to plagiarism. Students are reminded of their Rights and Responsibilities in respect of plagiarism, as set out in the University Undergraduate and Postgraduate Handbooks, and are encouraged to seek advice from academic staff whenever necessary to ensure they avoid plagiarism in all its forms. The Learning Centre website is the central University online resource for staff and student information on plagiarism and academic honesty. It can be located at: www.lc.unsw.edu.au/plagiarism

The Learning Centre also provides substantial educational written materials, workshops, and tutorials to aid students, for example, in:

- correct referencing practices;
- paraphrasing, summarizing, essay writing, and time management;
- appropriate use of, and attribution for, a range of materials including text, images, formulae and concepts.

Individual assistance is available on request from The Learning Centre. Students are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting, and the proper referencing of sources in preparing all assessment items.

* Based on that proposed to the University of Newcastle by the St James Ethics Centre. Used with kind permission from the University of Newcastle.

† Adapted with kind permission from the University of Melbourne.

Appropriate citation of sources therefore includes surrounding any directly quoted text with quotation marks, with block indentation for larger segments of directly quoted text. The preferred format for citation of references is an author-date (APL) format with an alphabetically arranged bibliography at the end of the assignment. Note that merely citing textbooks or website URLs is unlikely to yield a bibliography of satisfactory standard. The Internet should be avoided as a primary source of information. Inclusion of appropriate journal articles, both primary research publications and reviews, is usually expected.

HEALTH AND SAFETY GUIDELINES

Generic Safety rules for the School of Medical Sciences can be found at the following URL: <http://medicalsciences.med.unsw.edu.au/SOMSWeb.nsf/page/OHS>

Science Teaching
Laboratory
Student Risk
Assessment

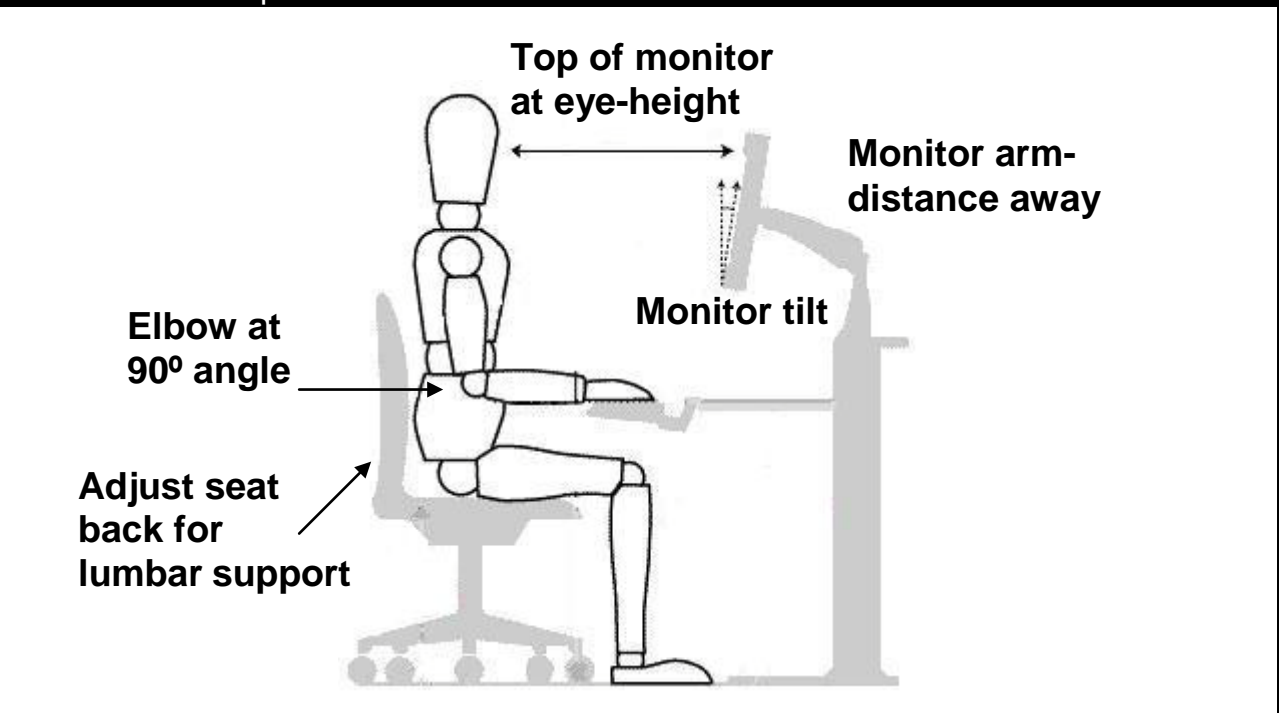


UNSW
THE UNIVERSITY OF NEW SOUTH WALES

ANAT2241 in G2/G4 Wallace
Wurth building
Practicals from weeks 1 to 13
in Semester 1, 2013.

Hazards	Risks	Controls
Ergonomics	Musculoskeletal pain.	Correct workstation set-up.
Electrical	Electrical shock/fire	Check electrical equipment in good condition before use. All portable electrical equipment tested and tagged.

Workstation set-up



Personal Protective Equipment

Not necessary in these practicals.

Emergency Procedures

In the event of an alarm, follow the instructions of the demonstrator. The initial sound is advising you to prepare for evacuation and during this time start packing up your things. The second sound gives instruction to leave. The Wallace Wurth assembly point is the lawn in front of the Chancellery. In the event of an injury, inform the demonstrator. First aiders and contact details are on display by the lifts. There is a first aid kit in the laboratory and the Wallace Wurth security office.

Clean up and waste disposal

No apparatus or chemicals used in these practicals.

Declaration

I have read and understand the safety requirements for these practical classes and I will observe these requirements.

Signature:.....Date:.....
Student Number:.....

Failure to complete an assessment

Failure to sit a test without lodgement of an application for Special Consideration with Student Central will lead to automatic failure of the test. A student may be required to sit a separate exam or written assignment in place of a missed test.

Applications for Special Consideration

Instructions and rules for submitting applications for Special Consideration can be found at: <https://my.unsw.edu.au/student/atoz/SpecialConsideration.html>. Some information from this website is reproduced below.

Applications for Special Consideration are accepted in the following circumstances only:

Where academic work has been hampered to a substantial degree by illness or other cause. Except in unusual circumstances a problem involving only three consecutive days or a total of five days within the teaching period of a semester is not considered sufficient grounds for an application.

The circumstances have to be unexpected and beyond your control. Students are expected to give priority to their University study commitments and any absence must clearly be for circumstances beyond your control. Work commitments are not normally considered a justification.

An absence from an examination must be supported by a medical certificate or other document, which clearly indicates you were unable to be present. A student absent from an examination or who attends an examination and wants to request special consideration is normally required to provide a medical certificate dated the same day as the examination.

It is intended that supplementary exams for the School of Medical Sciences in Semester 1, 2013 will be held in the week commencing Monday 8th July, 2013.

An application for Special Consideration must be provided within three working days of the assessment to which it refers. In exceptional circumstances an application may be accepted outside the three-day limit.

Please note: Students cannot claim consideration for conditions or circumstances that are the consequences of their own actions or inactions.

SOMS Guidelines on Extra-curricular activities affecting attendance

Background to Guidelines

This policy relates to the following extra-curricular activities:

Employment.

Voluntary work.

Sport, music or other recreational activities.

Student-related activities e.g. conferences, courses

Academic activities e.g. conferences, courses.

Guidelines

Failure to meet attendance requirements because of extra-curricular activities will not be accepted unless prior approval is obtained.

Failure to meet assessment requirements (e.g. failing to submit assignment by deadline, failing to attend an examination) because of extra-curricular activities will not be accepted unless prior approval is obtained.

Under no circumstances will external work requirements be accepted for non-attendance. The School understands the need for many students to work part-time but this must be arranged so as it does not affect attendance.

Approval for non-attendance will be considered for the following activities:

A single, significant activity related to voluntary work. Note that regular voluntary work will not be accepted for recurrent absences.

A single, significant activity related to sport, music or other recreational activity being undertaken at an elite or semi-professional level. Note that regular sporting or other recreational activities will not be accepted for recurrent absences.

Attendance at student-related conferences/courses organised by student organisations or health professional groups and national or international education meetings.

Attendance at conference for academic purposes including presenting papers from Honours projects.

Approval to attend an extra-curricular activity must be obtained before the event and will not be taken into consideration retrospectively if a student has failed to meet attendance or assessment requirements.

Approval to attend an extra-curricular activity does not exempt a student from meeting attendance or assessment requirements. Approval will depend on:

The overall impact on attendance and whether class or other teaching activities can be made up at an alternative time to ensure that the course requirements have been met. Students requesting long periods of absence will be required to take leave and attempt the course later.

The nature of the assessment and whether an alternative mechanism is available to meet the assessment requirement. This may include extension of a deadline for submission of an assignment or sitting an examination at a later time. As a rule, additional examinations cannot be held and a student would be required to sit a missed examination when supplementary or later rounds are being conducted. This may delay a student's progress.

Approval will not be granted if alternative arrangements for meeting attendance or assessment requirements cannot be made.

Approval will also depend on the student's academic performance and will not be granted if disruption to the student's progress would be considered disadvantageous.

Obtaining permission to attend extra-curricular activities

Approval to be absent from a course for one week or more, or when the 80% attendance rule may be contravened, must be obtained from the Course Convenor. Students must contact the Course Convenor as early as possible to ensure that alternative arrangements can be made. Late requests are unlikely to be approved, as alternate arrangements cannot be made without sufficient notice.

If temporary absence from a course is approved, the student must inform the School of Medical Sciences student administrator (Carmen Robinson).

The School of Medical Sciences will not consider financial consequences to students (e.g. loss of registration fees for conference, loss of grant) if students have already made arrangements to attend extra-curricular activities without approval.

EQUITY AND DIVERSITY ISSUES

Those students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course convenor prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the EADU 9385 4734 or www.equity.unsw.edu.au/disabil.html. Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made.

GRIEVANCE OFFICER

If you have any problems or grievances with the course you should, in the first instance, consult the Course Organiser. If you are unable to resolve the difficulty, you can consult the Head of Teaching in the Department, Professor Ken Ashwell, First Floor, 30 Botany Street, Randwick (Room 113), or the Department of Anatomy's nominated Grievance Resolution Officer, Dr Priti Pandey, Ground Floor, 32 Botany Street, Randwick (Email: p.pandey@unsw.edu.au)

GENERAL ADVICE IN HISTOLOGY

In Histology, you are expected to study the features of histological preparations as virtual images, which were scanned from real stained sections, which were mounted on glass slides and listed in the Learning Activities. In these classes you may encounter structures and terminology not defined in lectures. **You will need to read about these structures in your textbooks.** Histological sections, which are slices of tissue usually from 5-8 μ m thick (see Dimensions below), can be examined efficiently as follows:

1. Use the Slide Catalogue at the end of this handbook to determine:

- a. The animal from which the section is taken.
- b. The stains used (thereby defining the colours of the major tissue components).

Note that stains are not examinable.

2. Low power sketches or notes made may help you to remember the main histological features of a section, e.g., which major tissue components are present.
3. Note the 2-D shapes in the section and the major tissue components present and try to determine the approximate 3-D shape of the whole organ from which the section was taken. Is the section cut randomly through the organ? Is there an obvious lumen in the section?

Abbreviations:

- XS - cross section
- TS - transverse section
- LS - longitudinal section
- LM - light microscope or light micrograph
- EM - electron microscope, or electron micrograph
- 2-D = 2-dimensional/ 3-D = 3-dimensional

Dimensions: $1\text{mm} = 10^3$ micrometres (μm) = 10^6 nanometres (nm)

Note: A micrometre is often called a "micron" (μm); $1\mu\text{m} = 10^{-6}\text{m}$

Resolving Powers:

Unaided eye - approx. $0.1\text{mm} = 100\mu\text{m}$

Light microscope - approx. $0.1\mu\text{m} = 100\text{nm}$

Electron microscope - approx. 1nm

Useful Histology resources to employ during the practicals or for revision.

After entering the Menu, go to Class Program and then to Anatomy

- a) Fabric of Life
- b) Neocortex Virtual Microscope-Histology-Zurich
- c) Dr Lazer's Histology Drawings
- d) Digital Atlas of Electron Microscopy
- e) www.histology-world.com/stains/stains.htm