UNSW SYDNEY

PATH3210

Visualising Disease

Course Outline

Term 1, 2022

School of Medical Sciences

Faculty of Medicine & Health

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1. Staff

Position	Name	Email	Consultation times and locations	Contact Details
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2. Course information

Units of credit: 6

Pre-requisite(s): 72 UOC including one of these courses: ANAT2111/1521/2241/2521/2341/2511, BABS2011/2202/2204, BIOC2181/2101, MICR2011, NEUR2201, PATH2201, PHAR2011, PHSL2101/2121/2201/2221, CHEM2041, NANO2002

Teaching times and locations:

http://www.timetable.unsw.edu.au/2022/PATH3210.html

Lectures - Tuesday 10.00-11.00 and Friday 9.00-10.00 - ONLINE

TUT/PRACS- Tuesday 16.00-18.00 and Friday 11.00 –13.00 – K- Wallace Wurth G17 Hybrid Lab

2.1 Course summary

PATH 3210 will provide you with an understanding of how different imaging techniques work and how to apply them to obtain multidimensional data about disease processes. You will gain insight into how images are formed and processed for analysis, and in turn how to critically evaluate the quality of an imaging experiment. Key topics that will be covered include sample preparation, effective use of imaging instruments, the use of artificial intelligence for segmentation and how to obtain quantitative data from imaging experiments.

Building on this knowledge we explore how to apply imaging technologies for fundamental biomedical research and within the clinical environment. Collectively this provides a solid basis for future careers in biomedical imaging in research, the clinic or in industry. This course is a revised version of a previous course coded as ANAT3212.

2.2 Course aims

There are four key aims of the course.

1. Be able to identify the strengths and limitations of key imaging techniques that can be employed to study, diagnose and treat diseases.
2. Be able to design an imaging experiment to evaluate a hypothesis.
3. Develop skills to critically analyse and quantify disease processes from images generated by different imaging modalities.
4. Develop oral and written communications skills that underpin the dissemination of research using imaging.

2.3 Course learning outcomes (CLO)

At the successful completion of this course you (the student) should be able to:

1. Critically evaluate the use of an imaging technique to obtain data on a disease-associated process.
2. Process images to obtain quantitative data about an object of interest.
3. Interpret images and assess the quality of imaging data.
4. Communicate concepts of microscopy and biomedical imaging used by researchers and clinicians.

2.4 Relationship between course and program learning outcomes and assessments

Course Learning Outcome (CLO)	LO Statement	Related Tasks & Assessment
CLO 1	Critically evaluate the use of an imaging technique to obtain data on a disease-associated process.	Assessments 1, 2, 3, 4
CLO 2	Process images to obtain quantitative data about an object of interest.	Assessments 1, 2, 3, 4
CLO 3	Interpret images and assess the quality of imaging data.	Assessments 1, 2, 3, 4
CLO 4	Communicate concepts of microscopy and biomedical imaging used by researchers and clinicians.	Assessments 2, 3, 4

3. Strategies and approaches to learning

3.1 Learning and teaching activities

The course content will be delivered using the following format

1. Lectures - These will be delivered online by researchers and clinicians with an active profile in imaging and cancer. Additionally, guest lectures from industry will be brought in to discuss imaging careers within their professions. The lectures will be grouped in themes to provide a learning trajectory of the concepts. Additionality, how the themes relate to each other will be provided through concept maps at the beginning and end of the course. Generally, a single theme will run for a one-week period with the first lecture outlining the basic concepts and the second applying these concepts to given problems that may include some of the personal research of the lecturer.

2. Tutorials– will be held face to face where possible. These will provide an opportunity to examine specific imaging techniques and how they can be applied to a given lecture theme. Each presentation will be followed by a series of collaborative peer discussions or activities (including virtual activities) to reinforce concepts.

3. Practicals - will be held face to face where possible. Students will be split into groups to perform tasks - from conducting imaging through to analysing and interpreting data. These practicals will be carried out sequentially following the lecture series and seminar. Here they will interact with researchers, technical staff and industry representatives.

4. Learning is supported via **Moodle and Microsoft TEAMS,** where announcements, timetable, lecture slides and other resources will be made available.

3.2 Expectations of students

Students are reminded that UNSW recommends that a 6 units-of-credit course should involve about 150 hours of study and learning activities. The formal learning activities total approximately 56 hours throughout the term and students are expected (and strongly recommended) to do at least 94 additional study and work on their assessments.

Specific to PATH3210, we have the following expectations of students

1. You will participate in peer assessment in the oral presentation assessment

2. You will attend and engage in discussion in tutorials and practicals

3. For practicals in weeks 2, 3 and 7 you will need to wear close toed shoes and have long hair tied back.

4. You will attend the online lectures where possible and ask questions either in person with your video on or via messaging.

5. When emailing or contacting a lecturer/ lead you will state your name and zID. Please allow 48 hours for a response.

6. All communication will be courteous and abide by the UNSW code of conduct.
https://www.gs.unsw.edu.au/policy/documents/codeofconduct.pdf

4. Course schedule and structure

This course consists of 56 hours of class contact hours. You are expected to take an additional 94 hours of non-class contact hours to complete assessments, readings and exam preparation.

Week	Topic	Lecturer/ Leads	Venue
Week 1 Tuesday 15/2 10.00-11.00	Lecture 1: Introduction - Overview of course and abrief in cell biology	Peter Gunning, Edna Hardeman and Renee Whan	Online-TEAMS
Tuesday 15/2 16.00-18.00	Tutorial 1: Overview of microscopy techniques	Michael Carnell	WW G16/17
Friday 18/2 9:00-10.00	Lecture 2: Visualising Disease	Peter Gunning Edna Hardeman	Online-TEAMS
Friday 18/2 11.00-13.00	Tutorial 2: Fluorescence Microscopy	Renee Whan	WW G16/17
Week 2 Tuesday 22/2 10.00-11.00	Lecture 3: Specimen preparation for Light Microscopy	Renee Whan	Online-TEAMS
Tuesday 22/2 16.00-18.00	Practical 1: Labelling cancer cells and QUIZ 1	Renee Whan	WW G16/17
Friday 25/3 9:00-10.00	Lecture 4: Electron Microscopy	Joanna Richmond	Online-TEAMS
Friday 25/3 11.00-13.00	Practical 2: virtual/visit electron microscopy	Joanna Richmond	WW G16/17
Week 3 Tuesday 1/3 10.00-11.00	Lecture 5: What makes up an image?	Michael Carnell	Online-TEAMS
Tuesday 1/3 16.00-18.00	Practical 3: Processing and Analysing Data and QUIZ 2	Michael Carnell	WW G16/17
Friday 4/3 9:00-10.00	Lecture 6: Confocal microscopy	Renee Whan	Online-TEAMS
Friday 4/3 11.00-13.00	Practical 4: Myscope virtual microscopy and or Using confocals	Sandra Fok Michael Carnell	WW G16/17 and *KGLMF
Week 4 Tuesday 8/3 10.00-11.00	Lecture 7: Co-localisation	Michael Carnell	Online-TEAMS
Tuesday 8/3 16.00-18.00	Practical 5: Image Analysis and QUIZ 3	Michael Carnell	WW G16/17
Friday 11/3 9:00-10.00	Lecture 8: Requirements for live cell imaging	Sandra Fok	Online-TEAMS

Friday 11/3 11.00-13.00	Tutorial 3: Imaging cell division, migration and drug distribution and accumulation	John Lock, Peter Gunning and Edna Hardeman	WW G16/17
Week 5 Tuesday 15/3 10.00-11.00	Lecture 9: Intravital imaging of cancer growth and movement	Peter Gunning Edna Hardeman	Online-TEAMS
Tuesday 15/3 16.00-18.00	Tutorial 4: Microscopy of metastasis - which dimension?	Peter Gunning Edna Hardeman	WW G16/17
Friday 18/3 9:00-10.00	Lecture 10: Multiplex labelling and systems approaches	John Lock	Online-TEAMS
Friday 18/3 11.00-13.00	Practical 6: The use of AI in image analysis and QUIZ 4	John Lock	WW G16/17
Week 7 Tuesday 29/3 10.00-11.00	Lecture 11: Advanced microscopy techniques 1	Alex Macmillan	Online-TEAMS
Tuesday 29/3 16.00-18.00	Group assessment – Oral Presentations	Peter Gunning, Edna Hardeman, Renee Whan	WW G16/17
Friday 1/4 9:00-10.00	Lecture 12: Advanced microscopy techniques 2	Elvis Pandzic	Online-TEAMS
Friday 1/4 11.00-13.00	Practical 7: Advanced Microscopy	Alex Macmillan Elvis Pandzic	WW G16/17 and *KGLMF
Week 8 Tuesday 5/4 10.00-11.00	Lecture 13: Overview of medical Imaging techniques Part 1	Daniel Moses	Online-TEAMS
Tuesday 5/4 16.00-18.00	Tutorial 5 : How to image a patient	Daniel Moses	WW G16/17
Friday 8/4 9:00-10.00	Lecture 14 Overview of medical imaging techniques Part 2	Daniel Moses	Online-TEAMS
Friday 8/4 11.00-13.00	Practical 8: Diagnosing patients using imaging	Daniel Moses	WW G16/17
Week 9 Tuesday 12/4 10.00-11.00	Lecture 15: Functional Clinical Imaging	Daniel Moses	Online-TEAMS
Tuesday 12/4 16.00-18.00	Tutorial 6: Interpreting clinical data and QUIZ 5	Daniel Moses	WW G16/17
Week 10 Tuesday 19/4 10.00-11.00	Lecture 16: Image Guided Therapy	Daniel Moses	Online-TEAMS

Tuesday 19/4 16.00-18.00	Tutorial 7: Career Development: Q and A with panel of researchers, industry representatives and clinicans.	Peter Gunning, Edna Hardeman, and Renee Whan	WW G16/17
Friday 22/4 9:00-10.00	Lecture 17: Personalised Medicine – Emerging imaging approaches for treatment	Peter Gunning	Online-TEAMS
Friday 22/4 11.00-13.00	Tutorial 8: Course Revision	Peter Gunning, Edna Hardeman, Renee Whan, Michael Carnell, Daniel Moses and John Lock	WW G16/17

*KGLMF- Katharina Gaus Light Microscopy Facility

Exam Period: 29 April – 12 May
Supplementary Exam Period: 23 May – 27 May

5. Assessment

5.1 Assessment tasks

Assessment task	Length	Weight	Due date and time
Assessment 1: Quizzes - Where the best 4 out of 5 contribute to mark	10 min	10%	Weeks 2, 3, 4, 5 and 9
Assessment 2: Oral Presentation -Literature Research - GROUP	8 minutes	20%	Week 7
Assessment 3: Written report - Literature Research- Individual	1500 words	30%	Week 9
Assessment 4: Exam	2 hours	40%	Exam Period

5.2 Assessment tasks details

5.2.1 **Quizzes**

Team and individual quizzes will be held in the tutorial/practical sessions, consisting of MCQs. The quizzes are intended to allow you to review information from the lectures and practicals, in addition to allowing feedback and revision of topics. Students need to provide a reason to Professor Gunning for a missed quizz via email. There will be 5 quizzes of which the four top marks will contribute to the overall assessment percentage. The quizzes will be held in the tutorial/prac sessions in the timetable on Moodle in **Weeks 2, 3, 4, 5 and 9 as noted in the timetable**.

5.2.2 **Analysis of a Research Paper**

You will be provided with a list of 10 papers which can be found via LEGANTO on Moodle at the end of week 1. Papers include imaging methods that have been used to examine a disease, including;

I. Multi-labelling immunofluorescence

II. Confocal Microscopy and Live cell imaging

III. Image Analysis

IV. Medical Imaging

Provide your first three preferences for the journal articles to the convenors **by the end of week 2 via Moodle**. Note that only 2 students per article will be permitted. You will receive a confirmation at the beginning of week 3 as to the research paper that forms the basis of your assessment.

Purpose: To critically evaluate the imaging method used in the paper and address the following questions:

1. Justify the imaging methods chosen to answer the researcher's question?
2. What could be modified to this imaging approach to visualise the disease in question?
3. Predict the outcome of your modification to the imaging method?

5.2.2.1 Group Presentation

You will present your findings to the group and a panel of examiners. The presentation will be 8 minutes.

All students are expected to complete a peer assessment feedback form for a fellow student. This will be randomly delegated by the examiners at the time of the presentations. Marks will be based on the quality of the feedback provided.
NOTE: The contribution of the peer assessment is worth 25% of the Research Paper Presentation. The examiners assessment is worth 75% of the Research Paper Presentation for a total of 20% of your overall mark.

The presentation will be assessed by your peers and the examiners according to the following criteria:

1. CLARITY AND STRUCTURE: Oral presentation was clear, well-structured and easily understood.
2. TIMING: Timing was controlled so that most aspects were covered.
3. UNDERSTANDING and EVALUTION: Presenter appeared to have an excellent understanding of the topic, provided a robust evaluation and were able to justify their approach.
4. STIMULATED LEARNING: The presenters were able to compose suitable responses to questions, generated an interesting talk and that engaged the audience

Presentations will be in **week 7** in the scheduled class times shown in the timetable.

5.2.2.2 Written Report

Your individual written report (30%) should be 1500 words maximum in length excluding references. Insert relevant images and diagrams to support your evaluation of the paper.

The Due Date is THURSDAY 14th April (the end of week 9) NO LATER THAN 6 pm. Assignments are to be submitted via Moodle.

For all submitted reports should clearly state your Name and Student number

5.2.3. Exam

During the exam period, an 'open book' 2-hour exam (40%) will be held in the form of multiple choice and short answers online via the Inspera platform (further details will be provided via Moodle). It will cover material presented in both lectures and practical classes.

You will be given a series of questions to answer, and examples of questions will provided to students prior to the exam.

A supplementary may be scheduled for special consideration. Please liaise with the course convenors.

Further information

UNSW grading system: https://student.unsw.edu.au/grades

UNSW assessment policy: https://student.unsw.edu.au/assessment

5.3 Assessment criteria and standards

The rubrics for the assessment tasks can be found on the Moodle page of this course.

5.4 Submission of assessment tasks

Students should submit all assessments.

For assessment task 1 (quizzes 10%), these will be submitted and conducted online on Moodle in the designated timetable slot. Should you miss one of these quizzes, please contact Renee Whan

For assessment task 2 (group oral presentation 20%) will be conducted in-front of the class in Week 7 in the session noted in the timetable. Peer assessment will also be conducted in the session and the marked rubrics will be handed to the convenors at the end of each talk. Should you be unable to attend the presentation please contact Renee Whan. (please see special consideration below)

For assessment task 3 (written report 30%) –reports should be in a PDF format and submitted via Moodle prior to the 14th April 6pm. The report should note your Name and zID. Should you submit late the below penalization will apply without special consideration.

For assessment task 4 (exam- 40%)- will conducted in Inspera Platform at a date to be provided in Moodle. A supplementary exam may be available for those who apply for Special Consideration in the week 23-27 May.

Late Submission

Late submissions will be penalized at 5% per day capped at five days (120 hours). Students will not be permitted to submit their assessments after this date.

Special Consideration

If you experience a short-term event beyond your control (exceptional circumstances) that impacts your performance in a particular assessment task, you can apply for Special Considerations.

You must apply for Special Consideration **before** the start of your exam or due date for your assessment, except where your circumstances of illness or misadventure stop you from doing so.

If your circumstances stop you from applying before your exam or assessment due date, you must **apply within 3 working days** of the assessment, or the period covered by your supporting documentation.

More information can be found on the Special Consideration website.

5.5. Feedback on assessment

Feedback on your assessments will be provided in multiple ways.

- For the Quizzes, you will be provided will real-time feedback upon completing the quiz and youwill also be contacted on Moodle for discussion.

- For the presentations you will be provided with Feedback from you're Peers and Lecturers atthe end of your talk.
- For your reports you will be given individual written feedback two weeks following submission.
- For the exam, you will be provided with practise questions which you can gain insight into howthe questions are marked and what can be improved in the final session in the imetable or by appointment.

6. Academic integrity, referencing and plagiarism

Referencing is a way of acknowledging the sources of information that you use to research your assignments. You need to provide a reference whenever you draw on someone else's words, ideas or research. Not referencing other people's work can constitute plagiarism.

Please use Vancouver referencing style for this course.
https://www.ncbi.nlm.nih.gov/books/NBK7256/

Further information about referencing styles can be located at https://student.unsw.edu.au/referencing

Academic integrity *is fundamental to success at university. Academic integrity can be defined as a commitment to six fundamental values in academic pursuits: honesty, trust, fairness, respect, responsibility and courage.*[1] *At UNSW, this means that your work must be your own, and others' ideas should be appropriately acknowledged. If you don't follow these rules, plagiarism may be detected in your work.*

Further information about academic integrity and ***plagiarism*** *can be located at:*

- *The Current Students site* https://student.unsw.edu.au/plagiarism*, and*
- *The ELISE training site* http://subjectguides.library.unsw.edu.au/elise/presenting

The Conduct and Integrity Unit provides further resources to assist you to understand your conduct obligations as a student: https://student.unsw.edu.au/conduct.

7. Readings and resources

a. https://myscope.training/. Electron and Light Microscopy modules
b. https://www.cell.com/fulltext/S0092-8674(11)00127-9. The Hallmarks of Cancer
c. https://www.thermofisher.com/order/fluorescence-spectraviewer#!/
d. http://zeiss-campus.magnet.fsu.edu/

[1] International Center for Academic Integrity, 'The Fundamental Values of Academic Integrity', T. Fishman (ed), Clemson University, 2013.

8. Administrative matters

Student enquiries should be submitted via student portal https://portal.insight.unsw.edu.au/web-forms/

9. Additional support for students

- The Current Students Gateway: https://student.unsw.edu.au/
- Academic Skills and Support: https://student.unsw.edu.au/academic-skills
- *Student Wellbeing and Health* https://www.student.unsw.edu.au/wellbeing
- UNSW IT Service Centre: https://www.myit.unsw.edu.au/services/students
- *UNSW Student Life Hub:* https://student.unsw.edu.au/hub#main-content
- *Student Support and Development:* https://student.unsw.edu.au/support
- *IT, eLearning and Apps:* https://student.unsw.edu.au/elearning
- *Student Support and Success Advisors:* https://student.unsw.edu.au/advisors
- *Equitable Learning Services (Formerly Disability Support Unit)*: https://student.unsw.edu.au/els
- *Transitioning to Online Learning* https://www.covid19studyonline.unsw.edu.au/
- *Guide to Online Study* https://student.unsw.edu.au/online-study