CANCER SCIENCES

(Course Code: PATH 3208)

2012 (Version 1)

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Faculty of Medicine Course Manual

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PREFACE

This is the first version of the manual for the Cancer Sciences Course (PATH 3208). It contains important information regarding many aspects of the course. Please note that information may be subject to alteration after printing. We welcome comments from staff and students regarding errors of fact, content or style, so that these may be corrected in subsequent editions.

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Course Introduction

Cancer Sciences Course (PATH3208) is an undergraduate course for 3rd year (stage 3b) students. It is run jointly by:

[1] the School of Prince of Wales Hospital (Adult Cancer Program of Lowy Cancer Research Centre),
[2] the School of Medical Science (SoMS), and
[3] the School of Biotechnology and Biomolecular Sciences (BABS).

It aims to help students develop independent research ability, so as to set up a bridge between scientific studies and research practice. It suits all research students, and in particular potential honours candidate students.

Course administration

Administrative questions related to this course should be directed to the SOMS Student Advisor, Ms Carmen Robinson. Ms Robinson is responsible for administration of undergraduate programs, and student support within the School of Medical Sciences, but will assist in the administration of this course run through the Prince of Wales Clinical School. Issues related to attendance, or the content and conduct of the course, can in the first instance be addressed by consulting one of the course convenors.

Course Convenors

A/Prof Jia-Lin Yang (Convenor)
Associate Professor, Prince of Wales Clinical School and Adult Cancer Program of Lowy Cancer Research Centre

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Prof Nicholas Hawkins (Co-convenor)
Professor of Pathology and Head of School of Medical Science
Email: N.Hawkins@unsw.edu.au

Course Student Advisor

Ms Carmen Robinson
Student Advisor, School of Medical Science
BSB Student Office, Room G27, Ground Floor, Biological Sciences Building
Email: Carmen.Robinson@unsw.edu.au
Phone: 9385-2464

Students wishing to see their tutors or other members of staff should call in at the BSB (BABS/SOMS/ BEES) student office and make an appointment with the student support staff. If students have difficulties of a personal nature, they should contact the School of Medical Science Grievance Officer, Dr Priti Pandey.

Should a student feel that there are particular circumstances that have affected their performance in the course, they should lodge an application for special consideration. The procedures involved in

this are outlined in the UNSW Student Guide, and special forms are widely available on campus e.g. Student Health Centre, Student Centre. All students in the PATH3208 course are advised that email is the official means by which the Course Convenor and administrative staff will communicate with them. All email messages will be sent to the student's official UNSW email address (e.g., z1234567@student.unsw.edu.au). If a student does not wish to use the University email system, they MUST arrange for their official mail to be forwarded to your chosen address. The University recommends that students check their mail at least every other day. Facilities for checking email are available in SoMS, BABS, and in the University library. Further information and assistance is available from DIS-Connect (Phone 9385-1777). The UNSW Library runs free email courses.

Course staff

A/Prof **Jia Lin Yang** (Course convenor; Sarcoma Research Group Leader, ACP, LCRC, POWCS)

School of Medical Sciences

Professor **Nicholas Hawkins** (Course Co-convenor; Head of School, SoMS)
Dr **Patsie Polly** (Senior Lecturer, SoMS)

School of Biotechnology and Biomolecular Sciences

A/Prof **Noel Whitaker** (Deputy Head of School, BABS)
Prof **Marc Wilkins** (Director of NSW System Biology Initiative)
Dr **Louise Lutze-Mann** (Senior Lecturer, BABS)
Dr **Helen Speirs** (Senior Research Associate, BABS)

Prince of Wales Clinical School

Prof **Robyn Ward** (Head of POWCS; Head of ACP, LCRC, Medical Oncologist)
Prof **Phillip Crowe** (Head of Surgery, POWCS)
Prof **Phillip Hogg** (Director, LCRC; Head of Molecular Innovation Section, ACP, LCRC)
Prof **David Goldstein** (Medical Oncologist)
Prof **Sue Wilson** (Biostatistician, ACP, LCRC)
A/Prof **Claire Vajdic** (Cancer Aetiology and Prevention Group Leader, ACP, LCRC)
Dr **Anthony Don** (Bioactive Lipid Signalling Group Leader, ACP, LCRC)
Dr **Carl Power** (Head of Biomedical Resources and Imaging Laboratory, LCRC)
Dr **Caroline Ford** (Wnt Signalling and Metastasis Group Leader, ACP, LCRC)
Dr **Barbara-Ann Adelstein** (Health Services Research, POWCS)
Dr **Jason Wong** (Bioinformatics Group Leader, ACP, LCRC)
Dr **John Pimanda** (Stem Cell Research Group Leader, ACP, LCRC)
Dr **Kerrie McDonald** (Cure for Life Neuro-Oncology Group Leader, ACP, LCRC)
Dr **Luke Hesson** (Molecular and Cellular Oncology Group Leader, ACP, LCRC)
Ms **Marylyn Emanuel** (Radiation Therapist)
Ms **Meg Schneider** (Chief Radiation Therapist)
Dr **Michael Jackson** (Head of Radiation Oncology)
Dr **Melvin Chin** (Medical Oncologist)
Dr **Shing Wong** (Surgical Oncologist)
Mr **Simon Downes** (Director of Medical Physics)

Dr **Sheri Nixdorf** (Gynaecological Cancer Research Group, ACP, LCRC)
Dr **Robert Rapkins** (Medical Epigenetics Group, ACP, LCRC)
Ms **Weini Samuel** (ACP Manager, LCRC)

Guest Lecturers/Instructors/tutors

Dr **Xuchuan Jiang** (School of Materials Science and Engineering)
Dr **Renee Whan** (Head of Biomedical Imaging Facility)
Ms **Mita Das** (Career and Employment)
Ms **Fiona Thurn** (Learning & Teaching Unit)

Course details, structure and prerequisites

This course is offered during semester 2 and has six unit of credit (UOC).

It will involve a significant group work component related to the development of experimental strategies in cancer research. Group work contributes over half of all assessment items.

Successful completion of at least 18 UOC from any Level 2 subject (such as BABS2202 or PATH2201 or MATH2081 or MATH2901) offered by the Faculty of Science is a prerequisite for enrolment to the course. Given the strong research focus of this course, there is no specific need for prior completion of Stage II or III subjects in Pathology.

Course objectives

Students undertaking PATH3208 will gain a basic knowledge of cancer biology, including aetiology and risk factors. They will also learn the scientific rationale underpinning current and future practices in cancer management (diagnosis and treatment), and the concept of 'personalised' cancer medicine. At the same time, students will develop an understanding of modern experimental approaches to important questions in common cancers. This will include coverage of the design, measurement and evaluation of translational cancer studies and clinical trials.

A fundamental aim of this course is for students to identify relevant career goals, and to accumulate and present evidence of achievement in these goals in the form of an online resume.

This course specifically focuses on the design, measurement and evaluation of research projects in the field of human cancer. For those wishing to pursue a career in basic or clinical cancer research, the course will emphasise experimental approaches to cancer aetiology, as well the translational research strategies that use knowledge of cancer biology to improve diagnosis and management of that disease. Similarly, for those who may wish to pursue a career in the health sciences, the course will provide an understanding of cancer research and research methods.

Student learning outcomes

At the completion of this course a successful student will be able to:

1. Describe the causes and risk factors for common cancers, and relate these to known pathogenetic mechanisms.
2. Describe current approaches to the diagnosis and treatment of common cancers.
3. Describe research techniques and experimental strategies that are commonly used in both basic and clinical cancer research.
4. Describe how to measure and evaluate common experimental strategies or clinical studies in the field of cancer.
5. Work independently to identify and critically analyse articles from the current cancer research literature.
6. Work as part of a team to identify a valid research question in the field of cancer, and frame it within the context of existing literature.
7. Work as part of a team to design and document a research strategy that will potentially answer that question.
8. Present cancer research questions and research strategies to their peers.
9. Effectively assess research presentations made by their peers.
10. Develop evidence of achievement in relevant career goals, and record this evidence in a personal online resume.

Graduate attributes

Students will be encouraged to develop the following Graduate Attributes by undertaking the selected activities and knowledge content. These attributes will be assessed within the prescribed assessment tasks (see Assessment):

1. An in-depth engagement with the relevant disciplinary knowledge in its interdisciplinary context.
2. The capacity for analytical and critical thinking, as well as for creative problem-solving.
3. The ability to engage in independent and reflective learning.
4. The skills of effective communication.
5. Employability, as well as career and self awareness.

Course Design

Table 1. PATH3208 Course Design and Assessment Planner

Changes in the timetable will be announced on Blackboard. All locations to be confirmed.

Week	Lectures (Table 4 in details)	Tutorials (Table 6)	Practicals (Table 7)	Assessment tasks (deadline)
1	L1. Overview of PATH3208 L2. Stats thinking in design	T1 Moodle Mahara E-portfolio Resume "Review"	P1 Practical groups (PG1-4) have 2 students from individual tutorial groups (a-f)	1st Questionnaire (17/7) Online Quiz 1 (27/7) Individual assignment: critical appraisal of a research paper (3/8)
2	L3. Basic cancer biology L4. Colorectal & lung cancer	T2 (Groups 1-8 in pairs in four different rooms)	P2 - (Et) in class (WW G2/G4 computer lab)	
3	L5. Common lab techniques L6. Breast & ovarian cancer	T3 Resume "Review"	P3 - (A, B, C, D)	
4	L7. Animal models in cancer research L8. Epidemiology, Environment & Cancer	T4 (Groups 1-8 in pairs in four different rooms)	P4 - (F1) in ½ class (ACP, Lowy)	Online Quiz 2 (10/8) Group task: Using existing literature to develop and frame a valid cancer research question. Online Quiz 3 (24/8) Literature review (10/9)
5	L9. Stem cells & cancer L10. Inherited cancer risk	T5 *LGM #1	P5 - (G1) in ½ class (Radiation Oncology, POWH)	
6	L11. Biomarkers in diagnosis and therapy L12. Cancer cell metabolism	T6 (Groups 1-8 in pairs in four different rooms)	P6 - (F2) in ½ class (ACP, Lowy)	
7	L13. Clinical trials designs L14. Surgery	T7 Interview skills Mock interview	P7 - (A, B, C, D)	
8	L15. Radiotherapy L16. Chemotherapy	T8 (Groups 1-8 in pairs in four different rooms)	P8 - (Ht) in class (Lecture theatre, POWCS)	Group project: Development of a research plan to address a valid cancer research question. Online Quiz 4 (14/9)
9	L17. Advanced molecular techniques L18. Nano-oncology	T9 *LGM #2	P9 - (G2) in ½ class (Radiation Oncology, POWH)	

10	Presentation x 2	T10 (Groups 1-8 in pairs in four different rooms)	P10 - (A, B, C, D)	Online Quiz 5 (21/9) Specific Resume (28/9) Group presentations week 10-12 (Table 8 in details) (25/9 -3/10) 2nd Questionnaire (9/10) Group project design report submission 2 weeks after presentation (9/10-17/10) Within group peer assessment (10-18/10)
	Presentation x 2			
11	Presentation x 2			
	Presentation x 2			
12		Course wrap up		
SV1				
SV2				

*LGM=local group meeting, in which the group of students join their tutor's research group meeting.

Table 2. PATH3208 Course Title of Lectures, Tutorials and Practices

Name	Title
L01	Overview of Cancer Sciences (PATH3208), Questionnaires assessment 1
L02	Statistical thinking in project design, data measurement and evaluation
L03	Basic cancer biology
L04	Major unsolved issues in colorectal and lung cancer
L05	Experimental technologies in cancer research
L06	Breast and ovarian cancer
L07	Animal models in cancer research
L08	Epidemiology, risk factors and environmental carcinogenesis
L09	Stem cells and cancer
L10	Inherited cancer predisposition
L11	Personalised cancer therapy, predictive and prognostic markers
L12	Cancer cell metabolism
L13	Clinical study designs
L14	Principles of cancer surgery
L15	Radiotherapy and functional imaging
L16	Principles of chemotherapy
L17	Advanced molecular techniques for cancer research
L18	Nano-oncology
Prac A	Nanoparticles for biomedical application
Prac B	Advanced molecular technology
Prac C	Live cell imaging and confocal microscopy
Prac D	Animal Imaging
Prac E	Applied medical statistics
Prac F	Common techniques in basic cancer research
Prac G	Radiation practice
Prac H	Surgery for cancer
Tut 1	ePorfolio and software used
Tut 2	How to analyse a research article
Tut 3	How to prepare resume for job application
Tut 4	How to write and assess a project literature review
Tut 5	Attending tutor's research group meeting and Ethical & H&S policies
Tut 6	Project design, measurement and evaluation
Tut 7	How to prepare for and perform in a job interview
Tut 8	How to present and evaluate a research proposal
Tut 9	Attending tutor's research group meeting
Tut 10	How to write a project design report
Wrap up	Questionnaires assessment 2 and course feedback

Table 3. Location of course teaching venues

Venue	Location
Lectures	
CLB3	E19, Kensington Campus Map
Biomed E	E27, Kensington Campus Map
Tutorials	
Mat 102	F23, Kensington Campus Map
Mat 123	F23, Kensington Campus Map
Mat 125	F23, Kensington Campus Map
Mat 309	F23, Kensington Campus Map
Practical sessions	
V1: SMSE, Room 111	E8, Kensington Campus Map
V2: Ramaciotti Centre, Room 131 or 137	D26, Kensington Campus Map
V3: BMIF, LG12, LCRC	C25 Kensington Campus Map
V4: BRIL, Basement, LCRC	C25, Kensington Campus Map
V5: Computer lab G2/G4	C27, Kensington Campus Map
V6: ACP, Lowy Cancer Research Centre	C25, Kensington Campus Map
V7: Radiation Oncology, POWCS	3, Randwick Hospitals Map
V8: Lecture Theatre, POWCS	5, Randwick Hospitals Map

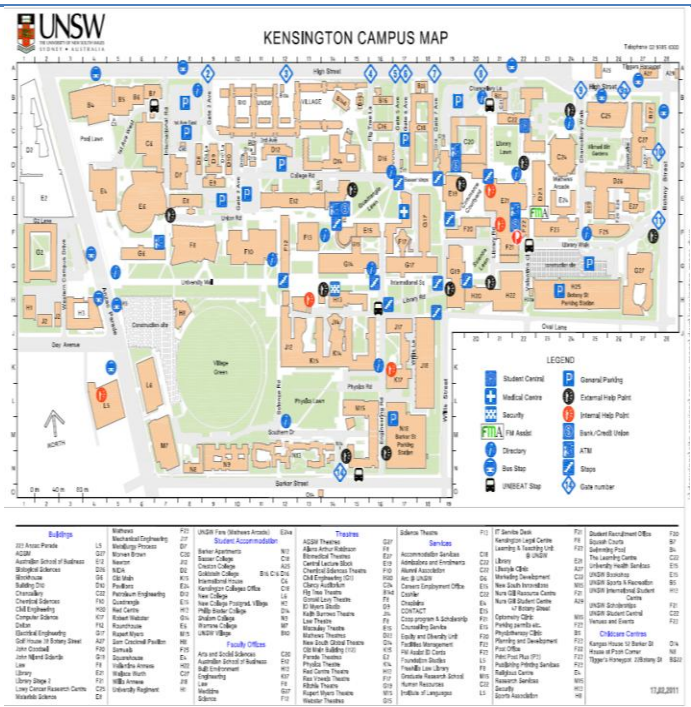

Table 4. PATH3208 Course Lecture Timetable

NOTE: Changes in the timetable will be announced on Blackboard.

Week	Date	Time	Venue	Lecturer	Title
1	Tue 17/7	9-10 am	CLB3	Nick Hawkins	Overview of PATH3208
	Wed 18/7	10-11 am	Biomed E	Jia-Lin Yang	Statistical thinking in project design, data measurement and evaluation
2	Tue 24/7	9-10 am	CLB3	Louise Lutze-Mann	Basic cancer biology
	Wed 25/7	10-11 am	Biomed E	Nick Hawkins	Unsolved issues in colorectal and lung cancer
3	Tue 31/7	9-10 am	CLB3	Luke Hesson	Common experimental technologies in cancer research
	Wed 1/8	10-11 am	Biomed E	Caroline Ford & Sheri Nixdorf	Breast & Ovarian cancer problems
4	Tue 7/8	9-10 am	CLB3	Carl Power	Animal models and cancer
	Wed 8/8	10-11 am	Biomed E	Claire Vajdic	Epidemiology, risk factors and environmental carcinogenesis
5	Tue 14/8	9-10 am	CLB3	John Pimanda	Stem cells and cancer
	Wed 15/8	10-11 am	Biomed E	Robyn Ward	Inherited cancer predisposition
6	Tue 21/8	9-10 am	CLB3	David Goldstein	Bio-molecular markers and cancer diagnosis, prognosis and individualised treatment
	Wed 22/8	10-11 am	Biomed E	Philip Hogg	Cancer drug development
7	Tue 28/8	9-10 am	CLB3	Barbara-Ann Adelstein	Clinical study designs
	Wed 29/8	10-11 am	Biomed E	Philip Crowe	Principles of cancer surgery
8	Tue 11/9	9-10 am	CLB3	Michael Jackson	Radiotherapy and functional imaging
	Wed 12/9	10-11 am	Biomed E	Melvin Chin	Principal of chemotherapy
9	Tue 18/9	9-10 am	CLB3	Marc Wilkins	Advanced Experimental techniques
	Wed 19/9	10-11 am	Biomed E	Jia-Lin Yang	Nano-oncology

Table 5. PATH3208 Tutorial Group Assignment and Student Course ID

Tutorial Group	Tutor	Student course ID	Student Name
TG1	Robert Rapkins	1	Araghi, Hamid Reza Arash
		2	Aylward, Alice Elizabeth
		3	Basuki, Monica
		4	Bui, Huyen Trang Jenny
TG2	Patsie Polly	5	Chin, Steven
		6	De Oliveira Muniz Lyra, Janaina
		7	Shirin, Nazia
		8	Riley, Thomas
		9	Yeo, Reichelle
TG3	Luke Hesson	10	Furze, Cailyn Sarah
		11	Higgins, Rupert
		12	Wilding, Melissa Anne
		13	Hong, Huiqi
TG4	Jason Wong	14	Duffy, Samuel
		15	Jaffer, Sara
		16	Kalla, Heyam
		17	Chan, Linda
TG5	Sheri Nixdorf	18	Lam, David
		29	Luu, Laurence Don Wai
		20	Nicolas, Miraye
		21	Robbins, Alissa Kathryn
TG6	Noel Whitaker	22	Rydstrand, Charlotte Brie
		23	Shanmugasundaram, Ramesh
		24	Faustino, Maria Joselle
		25	Sway Tin, Eindray Madi
		26	Kang, Young Chan
TG7	Anthony Don	27	Tonthat, Catherine
		28	Gabris, George
		29	Williams, Isabella Susannah
		30	Wong, Joanna Hoi-Kei
TG8	Kerrie McDonald	31	Flaherty, Monique Clare
		32	Kumaran, Sayanthan
		33	Siddiqi, Faraz Ahmad
		34	Wong, Peggy Pui Kwan
		35	Henry, Claire

Table 6. PATH3208 Tutorial Timetable

NB: Changes in the timetable will be announced on Blackboard.

Tute	Date	Time	Venue	Tutorial Groups	Tutor(s)
1	Tue 17/7	10-12	Mat 102	All	Fiona Thurn
2	Tue 24/7	10-11	Mat 102	TG1&2	Robert Rapkins, Patsie Polly
			Mat 309	TG3&4	Luke Hesson, Jason Wong
			Mat 123	TG5&6	Noel Whitaker, Sheri Nixdorf
			Mat 125	TG7&8	Kerrie McDonald, Anthony Don
3	Tue 31/7	10-12	Mat 102	All	Mita Das
4	Tue 7/8	10-11	Mat 102	TG1&2	Robert Rapkins, Patsie Polly
			Mat 309	TG3&4	Luke Hesson, Jason Wong
			Mat 123	TG5&6	Noel Whitaker, Sheri Nixdorf
			Mat 125	TG7&8	Kerrie McDonald, Anthony Don
5	Tue 14/8	10-11	Tutor's research group meeting	TG1	Robert Rapkins
				TG2	Patsie Polly
				TG3	Luke Hesson
				TG4	Jason Wong
				TG5	Sheri Nixdorf
				TG6	Noel Whitaker
				TG7	Anthony Don
				TG8	Kerrie McDonald
6	Tue 21/8	10-11	Mat 102	TG1&2	Robert Rapkins, Patsie Polly
			Mat 309	TG3&4	Luke Hesson, Jason Wong
			Mat 123	TG5&6	Noel Whitaker, Sheri Nixdorf
			Mat 125	TG7&8	Kerrie McDonald, Anthony Don
7	Tue 28/8	10-12	Mat 102	All	Mita Das
8	Tue 11/9	10-11	Mat 102	TG1&2	Robert Rapkins, Patsie Polly
			Mat 309	TG3&4	Luke Hesson, Jason Wong
			Mat 123	TG5&6	Noel Whitaker, Sheri Nixdorf
			Mat 125	TG7&8	Kerrie McDonald, Anthony Don
9	Tue 18/9	10-11	Tutor's research group meeting	TG1	Robert Rapkins
				TG2	Patsie Polly
				TG3	Luke Hesson
				TG4	Jason Wong
				TG5	Sheri Nixdorf
				TG6	Noel Whitaker
				TG7	Anthony Don
				TG8	Kerrie McDonald
10	Tue 25/9	10-11	Mat 102	TG1&2	Robert Rapkins, Patsie Polly
			Mat 309	TG3&4	Luke Hesson, Jason Wong
			Mat 123	TG5&6	Noel Whitaker, Sheri Nixdorf
			Mat 125	TG7&8	Kerrie McDonald, Anthony Don

Table 7. PATH3208 Practical Session Timetable and Group allocations

Week	Date	Time	Prac group	Venue	Site instructor	Practice session title
1	Fri 20/7	3-4.30	PGA	V1	Xuchuan Jiang	Nanoparticles for biomedicine
			PGB	V2	Helen Speirs	Advanced molecular technology
			PGC	V3	Renee Whan	Live cell imaging & confocal microscope
			PGD	V4	Carl Power	Animal imaging
2	Fri 27/7	3-4.30	PGA-D	V5	Sue Wilson	Applied medical statistics
3	Fri 3/8	3-4.30	PGB	V1	Xuchuan Jiang	Nanoparticles for biomedicine
			PGC	V2	Helen Speirs	Advanced molecular technology
			PGD	V3	Renee Whan	Live cell imaging & confocal microscope
			PGA	V4	Carl Power	Animal imaging
4	Fri 10/8	3-4.30	PGA&B	V6	Weini Samuel & Jia-Lin Yang	Basic cancer Research Laboratory
5	Fri 17/8	3-4.30	PGA&B	V7	Meg Schneider & Simon Downes	Radiation practices
6	Fri 24/8	3-4.30	PGC&D	V6	Weini Samuel & Jia-Lin Yang	Basic cancer Research Laboratory
7	Fri 31/8	3-4.30	PGC	V1	Xuchuan Jiang	Nanoparticles for biomedicine
			PGD	V2	Helen Speirs	Advanced molecular technology
			PGA	V3	Renee Whan	Live cell imaging & confocal microscope
			PGB	V4	Carl Power	Animal imaging
8	Fri 14/9	3-4.30	PGA-D	V8	Shing Wong	Surgery for cancer
9	Fri 21/9	3-4.30	PGC&D	V7	Meg Schneider & Simon Downes	Radiation practices
10	Fri 28/9	3-4.30	PGD	V1	Xuchuan Jiang	Nanoparticles for biomedicine
			PGA	V2	Helen Speirs	Advanced molecular technology
			PGB	V3	Renee Whan	Live cell imaging & confocal microscope
			PGC	V4	Carl Power	Animal imaging

Student practical groups (student course id)	**Practical Venues**
Prac Group A: 1, 5, 10, 14, 18, 22, 27, 31, 9	**V1:** Material Science & Engineering (Room 111, E8)
Prac Group B: 2, 6, 11, 15, 19, 23, 28, 32, 26	**V2:** Ramaciotti Centre (Room 131 or 137, D26)
Prac Group C: 3, 7, 12, 16, 20, 24, 29, 33, 35	**V3:** BMIF (LG 12, Lowy Centre, C25)
Prac Group D: 4, 8, 13, 17, 21, 25, 30, 34	**V4:** BRIL (Basement, Lowy Centre, C25)
	V5: Computer lab (G2/G4, WWB, C27)
	V6: ACP (L2 Lowy Centre, C25)
	V7: Radiation oncology (3, POWH)
	V8: Lecture Theatre (5, POWH)

Table 8. PATH3208 Presentation Schedule

Week	Date	Time	Venue	Presentation group	Assessment
10	Tue 25/9	9-10am	CLB3	1, 5	To be selected randomly
	Wed 26/9	10-11am	Biomed E	3, 7	To be selected randomly
11	Tue 2/10	10am-11pm	Mat 102	4, 8	To be selected randomly
	Wed 3/10	10-11am	Biomed E	2, 6	To be selected randomly
12	Tue 9/10	10am-11pm	Mat 102	course wrap up	
	Wed 10/10	10-11am	Biomed E	(back up)	

*Presentation (15 min), Question and answer (10 min), total 25 min.

PATH3208 Guide to Lectures

The aims and learning objectives for each lecture in the course are provided below, along with points for discussion and additional resources that may assist in understanding the material covered. Students are encouraged to read relevant information from their textbook or additional resources, and to think about the discussion issues, prior to attending the lecture.

Lecture 1: Overview of PATH3208

Students will be asked to complete questionnaire assessment 1 at the beginning of the lecture; no preparation is needed for this task.

Aim: This lecture will introduce the PATH3208 course, including its goals, teaching activities and assessment tasks.

Learning objectives: At the completion of this lecture, you should be able to:

1. State the broad goals of the course, and have an understanding of how these may be relevant to your future career.
2. Understand each of the teaching activities in the course (lectures, practical visits, tutorials) and be aware of the teaching staff you are likely to meet.
3. Understand the specific assignment tasks that you will be asked to complete in this course, including the timing and weighting of those tasks.

Points for discussion:

Does this course differ from those that you have undertaken previously. If it does, how might you need to alter your current study methods and strategies to make the most of the course? In relation to group tasks in this course, what strengths can you bring to the group, and what relevant experience, skills and knowledge would you like your colleagues to have?

Lecture 2: Statistical thinking in project design, data measurement and evaluation

Aim: This lecture is designed to introduce the important part that statistics plays in project design, data measurement and evaluation in cancer research.

Learning objectives:

1. Describe general procedure and content of a project design.
2. Understand basic statistical concepts associated with project design.
3. Describe data type, measurement and association with statistical method selection.
4. Select correct and relevant methods in evaluation of cancer research questions.

Point for discussion:

How do you plan your project properly after you have formulated a research question?

Lecture 3: Basic Cancer Biology

Aim: This lecture is designed to introduce the cell cycle and the changes that occur to induce the unrestrained growth that is cancer.

Learning objectives: At the completion of this lecture, you should be able to:

1. Describe the stages of the cell cycle and cell cycle check points.
2. Understand the role of proto-oncogenes and tumour suppressor genes in normal cells.
3. Describe the changes in cell cycle control, oncogenes and tumour suppressor genes that lead to cancer.
4. Understand the role of DNA repair pathways in preventing cancer-causing mutations.

Points for discussion: How many genetic changes are needed for a cell to become cancerous?

Additional resources: Page 91, 209, and 258, The Biology of Cancer.

Lecture 4: Major unsolved issues in Colorectal and Lung cancer

Aim: This lecture is designed to introduce the two leading causes of cancer death in Australia, and to briefly highlight some areas in which significant unanswered questions remain.

Learning objectives:

Regarding lung cancer, you should be able to:

1. Briefly describe what is known, and not known, about the relationship of smoking to cancer.
2. Describe the relevance of the terms small cell (SCLC) and non-small cell (NSCLC) lung cancer.

Regarding colorectal cancer, you should be able to:

3. Describe some of the common factors that predispose to colorectal cancer.
4. Recognise distinctive molecular pathways in colorectal cancer development.

For both cancers, you should

5. Understand the impact of cancer stage on outcome, and the significance and mechanisms for screening/early diagnosis.
6. Recognise the contribution of specific targeted therapies to the management of both cancer types.
7. Be aware of some specific areas where there are important gaps in our knowledge of how these tumours arise or can be managed.

Point for discussion:
What factors are most important in determining the “best” research questions to answer?

Lecture 5: Experimental Technologies in Cancer Research

Aim: This lecture will cover both fundamental and state-of-the-art molecular and biochemical techniques used in the study of cancer. The lecture will focus on how we use these techniques to learn more about the molecular and cellular basis of cancer, and how these have been useful in deciphering how cancer develops and progresses.

Learning objectives: By the end of the lecture the student should be able to;

1. Provide a framework for categorising the basic laboratory techniques used to answer research questions in the laboratory, including approaches based at the molecular, cellular, tissue level.
2. With regard to the fundamental molecular biology and biochemical techniques used in cancer research, list common approaches to the analysis of nucleic acids.
3. State common approaches to the analysis of proteins, including immunohistochemistry and immunoblotting.
4. Describe the principle of culturing cells "*in vitro*", and in the use of flow cytometry to analyse whole cells.
5. Discuss the important considerations when choosing a method or technology for a given research aim.

Points for discussion:

1. What are the factors to consider when choosing which method should be used for a research project?
2. Next-generation sequencing is emerging as a powerful technique for studying a wide range of pathologies including cancer. What are the different applications of this technique and how can we better understand cancer using next-generation sequencing?

Lecture 6: Breast & Ovarian cancer

Aim: To introduce students to clinicopathological findings, diagnosis, therapy and research concepts in both breast and ovarian cancer.

Learning objectives:

At the completion of this lecture, students will be able to

1. Describe the biological basis for different types and stages of breast and ovarian cancer.
2. Describe current approaches to the diagnosis and treatment of breast and ovarian cancer.
3. Explain how biological differences in cancers can lead to different strategies for detection, treatment and outcome.
4. Discuss current major obstacles for diagnosis, treatment and therefore patient outcome in breast and ovarian cancer.
5. Consider how knowledge of the biology of these cancers may lead to new ideas for effective diagnosis and treatment.

Points for discussion:

Both breast and ovarian cancer are important and common cancers in women. Their clinicopathological characteristics, histology, diagnosis, treatment, incidence and prognosis are markedly different. Yet both have a common genetic mutation which links them together. What are

these mutations and how might they be used in diagnosis or treatment. Which other pathways play a role in the individual disease entities and what can research add to improve the patient's overall prognosis in both breast and ovarian cancer?

Lecture 7: Animal Models of Cancer

Aim: This lecture will introduce the concept of using animal models for cancer research. The types of animal models available, their applications, advantages and limitations will be discussed.

Learning objectives: At the completion of this lecture, you should have a basic understanding of:

1. the types of animal models available for cancer research, their origins and research applications.
2. recent developments and advances in preclinical models of cancer.
3. the advantages and limitations of different animal models for particular applications.
4. the importance/relevance of preclinical studies to our current knowledge of cancer as a disease.

Points for discussion:

1. Preclinical animal studies continue to be a significant component of many fields of research, but are they really necessary?
2. What are the ethical implications of animal based research?

Lecture 8: Epidemiology, risk factors and environmental carcinogenesis

Aim: This lecture is designed to introduce descriptive and analytical cancer epidemiology and how they are used to understand the causes of cancer.

Learning objectives: At the completion of this lecture, you should be able to:

1. Understand the strengths and limitations of descriptive and analytical epidemiology.
2. Discuss the criteria for causality.
3. Describe the role of epidemiology in the discovery of behavioural and environmental carcinogens.
4. Give examples of important cancer-causing agents in the environment, such as tobacco or infectious diseases, and state their contribution to the burden of human cancer.
5. Describe the future role of epidemiology in cancer control.

Point for discussion: What are the major human carcinogens and what proportion of cancer deaths could be avoided by eliminating them?

Additional resources:

1. Goodman SN and Samet JM. Cause and cancer epidemiology. In, Schottenfeld D and Fraumeni JF Jr (Eds). Cancer Epidemiology and Prevention. Oxford University Press, New York, 2006, p3-9.
2. Cancer Epidemiology: Principles and Methods. Dos Santos Silva I (Ed). International Agency for Research on Cancer, Lyon, France. 1999. http://com.iarc.fr/en/publications/pdfs-online/epi/cancerepi/

3. Adami HO, Hunter D, Trichopoulos D (Eds). Text Book of Cancer Epidemiology. Oxford, University Press, 2008.

Lecture 9: Stem Cells and Cancer

Aim: This lecture is designed to introduce the concept of a cancer stem cell and its role in tumour initiation and persistence

Learning objectives: At the completion of this lecture, you should be able to:

1. Understand properties of normal tissue stem cells.
2. Understand properties of cancer stem cells.
3. Describe the evolution of tumour clones from a primary cancer, and the role of inherited or environmental factors (as discussed in previous lectures) in promoting this evolution.
4. Discuss the challenges posed by residual cancer stem cells to the eradication of a tumour.

Points for discussion: Many tissues have cells with stem cell properties that help regenerate and repair that tissue. What is their relationship to the development of cancer?

Additional resources: Chapter 12.1 to 12.3, The Biology of Cancer

Lecture 10: Inherited cancer predisposition

Aim: This lecture will examine the role of inherited factors (both genetic and epigenetic) that can predispose individuals to the development of cancer.

Learning objectives: At the completion of this lecture, you should be able to:

1. Recognise the role of inherited factors in the causation of human cancer.
2. Differentiate between high and low penetrance genetic risk (Mendelian vs. polygenetic).
3. Recognise the typical clinical manifestations of common hereditary cancer syndromes in the setting of breast and colorectal cancer.
4. Understand the importance of tumour suppressor genes as targets in common familial cancer syndromes.
5. Discuss mechanisms for recognising and reducing cancer risk in the setting of familial cancer.

Point for discussion: While hereditary cancers are rare and of little significance clinically, their importance is that they have allowed medical scientists to understand the molecular basis of the much more common sporadic cancers.

Additional resources: P412-413, p421-422, p236, p332-333, The Biology of Cancer, 2007.

Lecture 11: Personalising Cancer therapy, predictive and prognostic markers

The aim is for the student to appreciate the differences between predictive and prognostic biomarkers in cancer, and the information that each may provide about the clinical outcomes of a given cancer in a particular individual.

Learning objectives

1. Using examples, describe the nature and characteristics of biomarkers that are currently used in cancer management or that may be used in the near future.
2. Using examples, clearly distinguish between the terms prognostic and predictive in reference to biomarkers.
3. Describe what is meant by the terms "personalised cancer medicine" and "stratified cancer medicine".
4. Discuss in practical terms how a biomarker may be used to determine suitability for a targeted cancer therapy.

Points of discussion will include the varying types of such markers and how they are used in directing a targeted therapy. Targeted therapies are very expensive. Is it reasonable to use biomarkers to limit access to those drugs?

Additional resources

P727-732, The Biology of Cancer, 2007.

Lecture 12: Cancer cell metabolism

Aim: Cancer cells metabolise nutrients differently than healthy cells and this difference can be exploited to treat this disease.

Learning objectives: At the completion of this lecture, you should be able to:

1. Understand the differences between healthy and cancer cell metabolism of nutrients.
2. Understand how these differences may be exploited to treat this disease.
3. Have an appreciation of this field of cancer drug development - its promise and challenges.

Points for discussion: What are the three key differences between healthy and cancer cell metabolism and how can these difference be exploited to treat this disease?

Additional resources: Ramsay EE, Hogg PJ, Dilda PJ (2011) Mitochondrial metabolism inhibitors for cancer therapy. Pharmaceutical Res, in press (the PDF will be provided).

Lecture 13: Clinical Study Designs

Aim:

This lecture is designed to introduce the types of study designs used in research, and their appropriateness for different research questions.

Learning objectives:

At the completion of this lecture, you should be able to

1. Describe and evaluate common study designs.
2. Explain the association between research objectives and study design.
3. Compare the relative merits of different study designs.
4. Select the appropriate study design for any given research question.

Points for discussion:

1. How may bias arise in different study designs, and how can these be minimised?
2. What level of evidence is provided by different study designs?

Additional resources:

1. Grimes DA, Schulz KF. An overview of clinical research: The lay of the land. Lancet, 2002: 359:57-61.
2. Chapter 5: JA Muir Gray. Evidence-based Healthcare, 2001, Second Edition
3. P751-755, The Biology of Cancer, 2007.

Lecture 14: Principles of Cancer Surgery

Aim: Provide a board overview of place of surgery in managing a patient with cancer.

Learning objectives:

At the end of the lecture the student will have an understanding of;

1. The surgeon's role in the prevention of cancer.
2. How cancer is diagnosed.
3. What surgery can be performed to treat cancer?
4. When it is appropriate to perform surgery for palliation.
5. Oncologic emergencies that may require surgery.

Points for discussion:

1. Can surgery alone cure cancer?
2. What is the limitation of surgical cancer therapy?

Lecture 15: Radiation Therapy and Functional Imaging

Aim: This lecture is designed to cover the fundamental principles and clinical application of radiotherapy and functional imaging.

Learning objectives: At the completion of this lecture, you should be able to:

1. Understand the physical and biological mechanisms of radiotherapy.
2. Understand the interaction of radiation with cells, tumours and normal tissues.
3. Appreciate the role of radiotherapy in multidisciplinary cancer management.
4. Have a general understanding of the role of functional imaging (PET) in tumour diagnosis and in assessing the response to treatment.

Points for discussion:

1. Radiation damages all cells - how do we maximise the therapeutic ratio to cure cancer without unacceptable toxicity?
2. How will the assessment of early treatment response help us modify therapy in individual patients?

Lecture 16: Principles of Chemotherapy

Aim: To provide an overview of the use of cytotoxic chemotherapy and similar agents in the treatment of cancer.

Objectives:

1. Understand how knowledge of the Cell cycle is used as a target for chemotherapy.
2. Describe the classification of chemotherapy agents.
3. Know how chemotherapy works as single agents and in combination with other agents or modalities.
4. Understand the rationale of chemotherapy based on the intent of treatment.
5. Describe common and important side effects of chemotherapy.

Points for discussion:

1. How do you decide what chemotherapy to give to someone who has advanced cancer?
2. What factors do you take into consideration?

Lecture 17: Advanced Molecular Techniques in Cancer Research

Aim: This lecture will introduce a number of advanced analytical techniques that are commonly used for the study of cancer tissues.

Learning Objectives:

At the completion of this lecture, you should be able to:

1. Understand the fundamentals of nucleic acid microarrays.
2. Understand the fundamentals of next-generation genome and transcriptome sequencing.
3. Understand the fundamentals of protein arrays.
4. Discuss how these techniques can be applied to the study of cancer, especially for the comparison of normal to diseased tissues.

Points for discussion:

These approaches generate a lot of information. How do you think it can all be analysed and put into context?

Additional resources:

http://www.ncbi.nlm.nih.gov/About/primer/microarrays.html - a simple primer on microarrays. http://www.nature.com/nmeth/journal/v5/n1/pdf/nmeth1156.pdf - a comment on next-generation sequencing. http://www.nature.com/nrm/journal/v7/n8/pdf/nrm1941.pdf - a commentary on the use of protein arrays.

Lecture 18: Nano-oncology

Aim: This lecture will introduce how nanotechnology has been and will be applied in cancer.

Learning Objectives:

At the completion of this lecture, you should be able to:

1. Understand basic concepts in nano-oncology.
2. Describe current progress in nano-oncology in cancer prevention, early diagnosis, treatment and theranostics.
3. Describe how nanotechnology can be used to improve and individualise therapeutic strategies in cancer medicine.

Points for discussion:

1. How do you balance risk and benefit in applying nano-oncology in the clinic?
2. Can you think of a way in which you could incorporate the principles and/or practice of nanotechnology into your project design?

Additional resources:

Jain KK. Advances in the field of nanooncology. BMC Medicine 2010, 8:83 (http://www.biomedcentral.com/1741-7015/8/83)

PATH3208 Guide to the tutorials

Tutorials in Cancer Sciences are different from lectures and practicals. They cover four broad themes within the course. Some tutorials (2, 4, 6, 8, 10) cover material relevant to the assessment tasks of the course. Students can use this opportunity to ask questions and to clarify their approaches to the assessment tasks. Other tutorials (5, 9) allow students to participate in their tutor's research group meetings, so they can experience the activities that occur as part of a researcher's daily activities. The third theme (tutorials 3, 7) relates to developing an awareness of career options and employability, while the remaining tutorial (1) is an introduction to the ePortfolio software that will be used in the course to support your current and future learning.

Tutorial 1 – Introduction of ePortfolio Softwares

Aim: To provide an introduction and overview of the ePortfolio software, Mahara and its integration with Moodle.

Learning objectives:

At the end of this session students will be able to

1. login to Mahara through Moodle;
2. edit the settings of their ePortfolio;
3. add content to their ePortfolio;
4. organise their content into pages;
5. submit pages for assessment through the Mahara assessment type in Moodle.

Points for discussion: In what ways could an ePortfolio be of use over the course of a degree? In what ways is an ePortfolio better than other social media tools available on the web?

Additional Resources: https://wiki.mahara.org/index.php/User_Guide

https://wiki.mahara.org/index.php/User_Guide/Tutorials_about_Mahara

Tutorial 2 – Cancer Research Article Analysis

Aim: This tutorial aims to provide you with skills and experience in the critical analysis of a cancer research article.

Learning objectives:

At the completion of this tutorial you should be able to:

1. Use assessment guidelines set out in the Cancer Sciences Course Manual to critically analyse a cancer research article, or elements of that article.
2. Be aware of the professional background and cancer research interests of your tutor.
3. Describe common cancer terminology, including terms listed in the glossary of the course materials.

Points for discussion:

What particular knowledge or skills are needed in order to effectively analyse a cancer research article?

Additional Resources:

1. http://valwriting.net/blog/research-papers/critically-analyse-research-paper
2. http://www.ehow.com/how_5529487_analyze-journal-articles.html
3. Appendix 1.

Tutorial 3 – Resume and Cover Letter

Aim: This tutorial will teach you how to make your resume and cover letter stand out from your competitors. Find out what will give you the edge and get you to the interview stage.

Learning objectives: At the completion of this tutorial you should be able to:

1. Learn the basics of writing a successful cover letter & resume,
2. Make your cover letter & resume stand out from your competitors,
3. Tailor your resume to what an employer wants,
4. Market your skills & experience to get you to the interview stage.

Points for discussion

1. How do you provide evidence to an employer of your achievements and demonstrate your suitability for the job?
2. How do you write a specific resume ("review" in Mahara) against a real relevant advertisement found from current job market (internal or external, newspaper or website)?

Additional Resources:

www.careers.unsw.edu.au

Tutorial 4 – Writing and Assessing of a Project Literature Review

Aims:

This tutorial will provide you with an opportunity identify and define a relevant cancer research problem. You will also be provided with information on how to write and evaluate a project review, specifically using existing literature to develop and frame a valid cancer research question.

Learning objectives:

At the completion of this tutorial you should be able to:

1. Describe at least one current cancer problem which may be used to develop a valid cancer research question.
2. Understand the steps needed to write and evaluate a project literature review.
3. Understand the criteria to evaluate a project literature review.

Points for discussion

What is the difference between a project literature review and a publishable literature review?

Additional Resources:

Appendix 6.

Tutorial 5 – Experience a Real Research Group Meeting and Ethical and H&S Policies

Aims:

This tutorial aims to let you experience a real research lab meeting under the leadership of your supervisor as well as develop your knowledge of importance of Ethical and H&S policies in cancer studies.

Learning objectives:

At the completion of this tutorial you should be able to:

1. Be familiar with the picture of a real research group meeting.
2. Understand the focus and strength of the research group.
3. Understand that it is important and compulsory for any researchers to work in the laboratory to follow relevant ethical and H&S policies.
4. Understand induction, SWP/RA, chemical register/MSDS/chemical bottle labelling, after hour working policy and equipment safety issues.

Points for discussion

What have you learnt from the meeting?

Additional Resources:

http://www.ohs.unsw.edu.au/

Tutorial 6 – Project Design, Data Measurement and Evaluation

Aim: This tutorial aims to provide a template for general project design, data measurement and evaluation.

Learning objectives:

At the completion of this tutorial you should be able to:

1. Describe simple experimental design strategies for basic and clinical research projects, as well as simple clinical trials.
2. Compare and contrast the different phases of clinical trial designs.
3. Describe the roles of statistics in cancer project design, data measurement and evaluation.
4. Describe in general terms the method and applications of common laboratory techniques, and recognise the benefits and disadvantages of specific approaches in the context of your research question.

Points for discussion

What are bias and confounding? What are type 1 and type 2 errors?

Additional Resources:

Appendix 2.

Tutorial 7 – Job Interview/Mock Interview

Aim: Job interviews can be stressful for inexperienced students. Find out how to prepare for and tackle different interview styles and questions.

Learning objectives:

At the completion of this tutorial you should be able to:

1. Prepare for job interviews.
2. Make a positive first impression.
3. Understand different interview styles and questions types.
4. Practice answering some common interview questions.

Points for discussion

What are employers really looking for in an interview?

Additional Resources:

www.careers.unsw.edu.au

Tutorial 8 – Project Presentation and Evaluation

Aims: This tutorial aims to introduce you to the effective presentation of a research proposal, approaches to answering questions arising from your presentation and peer evaluation of performance.

Learning objectives:

At the completion of this tutorial you should be able to:

1. Present your group project and answer questions effectively.
2. Develop ability in assessing peer presentations and performance, and in evaluating contributions of group members.

Points for discussion

When answering questions after a presentation, what are the features of an answer that make it effective?

Additional Resources:

Appendices 2-5 and 7.

Tutorial 9 – Local Research Laboratory Meeting

Aim: This tutorial aims to provide an opportunity for students to attend the real research lab meeting again. If you want to continue your research career, you can negotiate on potential postgraduate studies with your supervisor.

Learning objectives:

At the completion of this tutorial you should be able to:

1. Further understand what a research life is generally looked like.
2. Prepare for your potential postgraduate study.

Points for discussion:

What are potential projects that you can do for a postgraduate study?

Tutorial 10 – Project Design Report

Aims: This tutorial aims to introduce how to write and evaluate project report.

Learning objectives:

At the completion of this tutorial you should be able to:

1. Understanding how to write a project report.
2. Understanding how to evaluate a project report.

Points for discussion:

What is the key part of a project report after project presentation?

Additional Resources:

Appendix 8.

PATH3208 Guide to the practical sessions

In large practical groups (total or half class), students will visit 4 different cancer research or treatment sites. Furthermore, as part of small groups (9 students per group) you will visit 4 different practical sites in turn at different times. The sites will include basic or clinical research laboratories, or cancer treatment facilities at Prince of Wales hospital. A practical session includes site instruction and observation. The teaching and learning results will be assessed in MCQ tests and included in final marks.

Practical Class A: Nanoparticles for Biomedicine

Aim: This practical class aims to provide insights into the common laboratory synthesis and characterisation of nanoparticles used in biomedicine.

Learning objectives:

At the completion of this practical class you should be able to:

1. Outline the use of nanoparticles in the diagnosis of cancer.
2. Discuss the effect of nanoparticle shape, size, size distribution and surface modifications on the diagnosis of cancer or other diseases.
3. Discuss the surface modification(s) of nanoparticles by different biomolecules (DNA, protein, and others) for diagnosis and then deliver antibodies, gene or drug for anti-cancer.
4. Describe the principles of nanoparticle surface modifications, interaction with cells, transfer into cells, and how they are used in the diagnosis of cancer.

Practical Class B: Advanced Molecular Techniques in Cancer Research - a visit to the Ramaciotti Centre for Gene Function Analysis

Aim: This practical class aims to introduce students to molecular biology techniques and instrumentation used in cancer research.

Learning Objectives:

On the completion of the tour of the Ramaciotti Centre, you should be able to:

1. Understand the fundamentals of microarrays and their applications in cancer research.
2. Understand the fundamentals of next-generation sequencing (NGS) and its application in cancer research.
3. Discuss how these techniques can be applied to the study and diagnosis of cancer.

Points for discussion:

Next-generation sequencing technology is replacing microarrays as the tool of choice for genome analysis. What are the advantages of NGS over microarrays and what are the disadvantages?

Practical class C: Live Cell Imaging and Confocal Microscopy

Aim: This practical class aims to provide insight into imaging live and fixed cells via microscopy to visualise cancer events

Learning objectives:

At the completion of this practical class you should be able to:

1. Outline the conditions for maintaining live cancer cells under a microscope.
2. Know the difference between transmitted light, fluorescence and confocal imaging.
3. Be able to choose the right imaging conditions for a given fluorophore e.g. what laser and detection wavelength.
4. Describe the various ways that you can label items of interest in cancer processes e.g. autofluorescence, probes, antibody labelling, genetic encoding.
5. Be able to calculate the resolution of an image.

Practical Class D: Imaging of Animals for Research

Aim: This practical class will cover technologies used to image cancer and other diseases in animal models, including techniques such as ultrasound, magnetic resonance imaging, positron emission tomography and optical imaging technologies.

Learning objectives:

At the completion of this practical class you should be able to:

1. List some of the technologies available for in vivo imaging of research animals and identify whether the resulting data from each instrument is predominantly structural or functional (or both).
2. Describe some research applications for these imaging techniques and how multimodal imaging can maximise research outputs.
3. Describe the resources and expertise required for use of each imaging systems.
4. Understand the similarities and differences between preclinical and clinical imaging.

Practical Class E: Applied Medical Statistics

Aim: To review the main phases of applied statistical work

Learning Objectives:

At the completion of this practical class you should be able to:

1. Formulate objectives in a statistical sense.
2. Discuss the design of a study.
3. Discuss data collection methods and data entry.
4. Discuss broad analysis guidelines with a demonstration of Rcmdr.
5. Discuss interpretation of statistical output.

Practical Class F: Basic Cancer Research Laboratory

Aim: This practical class aims to introduce a basic cancer research laboratory.

Learning objectives:

At the completion of this practical class you should be able to:

1. Outline the functions of the basic cancer research laboratory.
2. Understand the setting, H&S, OGTR, Ethics and EEO/AA and SWPs including taking experimental records.
3. Be familiar with common laboratory instruments and their functions.
4. Understand basic procedures and techniques for doing daily experiments.

Practical class G: Radiation Practical session

Aim: The main aim of this practical class is to provide students with an overview of the role of radiotherapy in the treatment of cancer and some understanding of the equipment and techniques used.

Learning objectives:

Upon completion of this practical class, you should be able to:

1. Discuss the role of radiotherapy in the treatment of cancer.
2. Understand the principles of the physics and biology of radiotherapy.
3. Understand the roles of the multidisciplinary team in a radiation oncology department.
4. Appreciate the patient's experience of radiotherapy treatment.
5. Develop an understanding of the use of radiotherapy for curative and palliative treatment.

Practical class H: Surgery for Cancer

Aim: The main aim of this practical class is to provide students an insight into the role of surgery in the treatment of cancer.

Learning objectives:

Upon completion of this practical class, you should be able to:

1. Discuss the role and principles of surgery in the diagnosis of cancer.
2. Outline the role of surgery in cancer treatment.
3. Develop an understanding of the principles of curative cancer surgery.
4. Analyse the basis and outcomes of palliative surgery for cancer.
5. Understand the role of multidisciplinary cancer teams.

Course wrap up

Aim: Assess your career awareness and employability as a result of this series of learning activities. In addition, we want to receive your feedback to the Cancer Sciences Course for evaluation and improvement.

Activities:

1. Complete questionnaire assessment 2.
2. Complete course feedback documents.

Approaches to teaching and learning

Learning and Teaching Rationale

The intended learning outcomes are achieved through pre-active and active participation as well as drawing on knowledge of students in a range of areas, including normal anatomy, pathology, histology, biochemistry, molecular and cellular biology and statistics.

This course has strong self-directed learning approaches, but also emphasises a collaborative, team-based approach to learning and assessment. Students will be encouraged to utilise their allocated teams as study groups. These strategies are designed to assist students in developing the skills that they will need as future members of a multidisciplinary research team, particularly in the setting of translational cancer research institutes, hospital-based cancer diagnostic laboratory and clinical trials organisations.

Teaching Strategies

The course employs a variety of teaching modes in order to facilitate student learning. These include:

1. A series of lectures (18 hours in total) that introduce key concepts and research techniques, as well as research project design, measurement and evaluation.
2. Whole class tutorials (6 hours in total) will introduce Moodle and Mahara pilot program used in the course assessment, e-portfolio, resume, career options and employability development. Small group tutorials (5 hours in total) and specialist facilitating that extend and amplify students' understanding of concepts and material presented in lectures. Small group tutorials will also provide opportunities for progress assessment, with students completing individual and team assessment tasks.
3. Practical classes (10 hours in total) provide an opportunity for students to experience and apply modern research techniques relevant to human cancer. They also provide an opportunity for students to amplify and extend their understanding of material and concepts covered in lectures and prescribed readings.
4. Individual and group study. Students will undertake individual and group study to complete key assignment tasks throughout the course (see Assessment).

Learning is supported via an eLearning Blackboard and an e-portfolio module that includes the Moodle/Mahara website accessible via student number and zPass at:
http://lms-blackboard.telt.unsw.edu.au/ for blackboard and,
https://moodle.telt.unsw.edu.au/login/index.php for Moodle/Mahara.

Announcements, timetables, lecture slides and other resources will be made available during the course.

Attendance requirements

Attendance at tutorials and practical sessions is compulsory. An 80% attendance is required for you to be eligible to be assessed for the final performance?

Assessment methods

The course covers a significant amount of new material and will require diligence and application to succeed. The learning objectives for each activity provide a focus for study, and should be previewed and reviewed for all activities. Students will take part in (self and peer) assessment together with academic staff.

The breakdown of assessments in the course is as follows:

Group work		***60%***
Literature review	*(18%)*	
Presentation and answer questions	*(18%)*	
Project design report	*(18%)*	
Individual performance in group (assessed by peer)	*(6%)*	
Individual assignments		***40%***
Questionnaires 1 &2 (at beginning and end of the course)	*(5%)*	
Online "review" (selective resume)	*(5%)*	
Quizzes (1-5)	*(15%)*	
Cancer research article analysis	*(15%)*	

1. Group assessment tasks: (60%)

Developing an experimental approach to a valid cancer research question

Students will undertake this project in a group of four to five students. The groups will be determined considering gender balance and pathology study experience (such as PATH2201, PATH3205/6 learning experience). As a group, students will complete three tasks. Firstly, they will develop and frame a valid research question, which they describe formally in a written literature review (20%, week 8). Secondly, they will present to their colleagues and tutors an experimental approach that may address this question (20%, week 10-11). Finally, they will provide a written report that details this experimental approach (20%, week 12). Each of these is described in more detail below.

Group project Part 1: Develop and frame the question (18%)

Working as a group, students will identify a valid cancer research question for a particular cancer and a research type (a tutor will help with this).

- Cancer research types will be broadly in the area of laboratory-based research, clinical research or clinical trials.
- Cancer types that may form the basis for the study include carcinoma of the breast, large bowel, lung prostate or ovary, or other malignancies including melanoma, lymphoma/leukaemia or sarcoma

These parameters need to be set by each group by the end of week 2, and no group can address a question from the same research ***and*** tumour type domains as any other group.

The group must produce a written literature review (which should be similar in form to a literature review at the start of an Honours thesis) that further describes this research question, and that ends

with a clear statement of the hypothesis and aim (hypotheses and aims) of the proposed research project. The literature review should be of no more than 3000 words in length (excluding tables, figures and references), and must be submitted online to Moodle system by the due date (refer to Table 1).

The title of the literature review should indicate the tumour type and research area and may cover the valid research question. The title page should include a word count. The introduction should identify the limitations of the literature and/or areas controversy and assess them critically. It should be adequately referenced with recent and appropriate studies and have clear and logical flow. The aims and hypotheses should be clearly stated and relate to the areas of controversy outlined (refer to Appendix 6 for literature review assessment criteria).

Group project Part 2: Oral presentation of experimental approaches (18%)

This involves a 15 minute oral presentation to the class, followed by a further 10 minutes of questions and discussion (20%). The presentation is about experimental approaches that may be used to better understand a research project identified from literature review. It will take place in a lecture theatre format in weeks 10-12 (see Table 8 for details), and will count for 20% of the total course marks. The presentation should cover background, hypothesis and aim, as well as experimental design, measurement and evaluation methodologies (Appendix 2. Project design template). The presentation should have clear and logical flow, good pace and preferably use appropriate audiovisual slides (refer to Table 7 for presentation assessment criteria).

Questions will be addressed to the group as a whole, or to individual group members. Each of the students in a group presentation should demonstrate an understanding of the questions raised during question time by giving appropriate answers. The presentation and responses to questions will be assessed by both peers and academic using specific forms (see Appendices 3a-b and 4). Peer assessment will account for 5% of the final mark, while academic assessment will count for 15% of the final mark.

Group project Part 3: Final written report of experimental approaches (18%)

The group will produce a separate written report which outlines the experimental approaches and methods that could be used to address the questions posed within the research project, as well as measurement and evaluation approaches to be used in the research project.

The written report will be based on the presentation given to the class, and should be modified to reflect feedback provided orally or in written form during or after the presentation. The written report should be no more than 3000 words in length, and must be submitted online within two weeks from the date of your oral presentation (see Table 8 for project report assessment criteria).

Formatting requirements for written group reports

For all written group reports (literature review and experimental approaches), the general (tables and figures) and referencing style should be based on a current paper written for Cancer Research (the official journal of American Academy for Cancer Research). References should be numbered in the order of their first mention in the text; cite only the number assigned to the reference. The reference list should be limited to only those citations essential to the presentation. The reference style follows that of the *Uniform Requirements for Manuscripts Submitted to Biomedical Journals*.

Note that the *Uniform Requirements* specify that for articles with more than six authors, the names of the first six authors must be listed, followed by "et al." For articles with six or fewer authors, all authors should be listed. Please note that this represents a recent change from earlier Instructions for Authors.

Referencing examples

Journal article
Warrell RP Jr, Frankel SR, Miller WH Jr, Scheinberg DA, Itri LM, Hittelman WN, et al. Differentiation therapy of acute promyelocytic 584 leukemia with tretinoin (all-trans-retinoic acid). N Engl J Med 1991;324:1385–93.

Book chapter
Yuspa SH, Hennings H, Roop D, Strickland J, Greenhalgh DA. Genes and mechanisms involved in malignant conversion. In: Harris CC, Liotta LA, editors. Genetic mechanisms in carcinogenesis and tumour progression. New York: Wiley-Liss; 1990. p.115–26.

Group project Part 4: Individual performance in group (assessed by peer) (6%)

Students will be required to submit online peer assessment of the work of each of your own group members except you. This must be done one day after you submit your final report (Table 1) using the online Form (as shown in Appendix 3).

2. Individual assessment tasks: (40%)

a. Critical review of a research paper (15%)

Students will be provided with a research paper in week 1 of the course, and will be required to critically review that paper in terms of specific criteria as shown in Appendix 1. Each student must submit online an individual written report of this appraisal, of approximately 500-1000 words in length, by the end of week 3 of the course (Table 1 for due date).

b. Quiz assessments (15%)

Five online (Moodle system) quizzes of 10 MCQ questions each will be assigned one week before the deadline (refer to Table 1), covering all materials within preceding lectures, practicals and tutorials. Each assessment will contribute 3% toward the course marks, to a total of 15%. Multiple (maximum three) attempts are allowed. The final result is the average result for all attempts.

c. Resume assessment and questionnaires (10%)

At both the beginning and end of the course, students will be required to submit a completed questionnaire that identifies their relevant career goals as well as evidence of achievement during the course (5%). They will also submit an online resume that records evidence of achievement in terms of developing capacities relevant to a career in cancer research (5%) (see Table 1 for deadline).

Failure to attend assessment tasks

If for any reason you miss a scheduled assessment task, you must inform the Registrar and also contact the relevant Course Office immediately. Normally, if you miss a formal assessment task (without medical reason) you will be given an absent fail. If you arrive late for an assessment, no time extension will be granted. It is your responsibility to check the timetable and ensure that you arrive with sufficient time.

If you miss any assessment task because of sickness, misadventure, or other circumstance beyond your control, then you may apply for special consideration with **three (3) working days** of the assessment in question. Full details of the application process are available at https://my.unsw.edu.au/student/atoz/SpecialConsideration.html.

Supplementary examination

A supplementary examination may be awarded at the discretion of the School of Medical Science to students who have provided evidence for special consideration according to the UNSW guidelines. It is intended that supplementary exams for this course will be held in the week commencing Monday 26th November, 2012. The deferred exam may include a significant oral element. Students who believe that they are eligible for further assessment via supplementary examination must contact A/Prof Jia-Lin Yang to seek further information.

Academic honesty and plagiarism

The University of NSW 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 penalised by the award of a score of zero for the assessable work. Significant plagiarism will be directly referred to the Division of the Registrar for disciplinary action under UNSW rules. The attention of students is drawn to the notes on plagiarism from the A-Z student guide on MyUNSW (https://my.unsw.edu.au/student/atoz/Plagiarism.html).

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 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.†

For the purposes of this policy, submitting an assessment item that has already been submitted for academic credit elsewhere may be considered plagiarism.

Knowingly permitting your work to be copied by another student may also be considered to be plagiarism.

Note that an assessment item produced in oral, not written, form, or involving live presentation, may similarly contain plagiarised material.

The inclusion of the thoughts or work of another with attribution appropriate to the academic discipline does *not* amount to plagiarism.

The Learning Centre website is main repository for resources for staff and students on plagiarism and academic honesty. These resources can be located via:
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, summarising, 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, and 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 format with an alphabetically arranged reference list at the end of the assignment. Note that merely citing textbooks or website URLs is unlikely to yield a reference list 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.

Research opportunities

Opportunities exist for all students wishing to undertake undergraduate and postgraduate cancer research program within the Faculty of Medicine. Information on the research interests of different staff members involved in the course is available through the UNSW Research Gateway (http://research.unsw.edu.au/). Details of the different research units in the Lowy Cancer Research Centre is available on the Centres website (http://www.lowycancerresearchcentre.unsw.edu.au/), while information on staff and research groups within the School of Medical Sciences can be found at http://medicalsciences.med.unsw.edu.au/somsweb.nsf/page/Research. Students are also

encouraged to communicate with invited guest lecturers that are active in research and clinical practice.

Resources for students

Textbooks

Students are expected to acquire the following text:

The Biology of Cancer. Robert A Weinberg, ©2007, Garland Science, Taylor & Francis Group LLC. ISBN 0-8153-4076-1 (soft cover) or ISBN 0-8153-4078-8 (hard cover).

PATH 3208 Web site

Students enrolled in the PATH 3208 course will be able to access the timetable, lecture notes and related information via Blackboard at http://lms-blackboard.telt.unsw.edu.au/, using their student number as the user name (e.g. z1234567) and their zPass as the password. Students are expected to visit this site regularly during the course.

Moodle/Mahara Websites

ePorfolio will be applied in the Cancer Sciences Course for the purpose of management and assessment. The website is at https://moodle.telt.unsw.edu.au/login/index.php. Its functions and user help/service will be described in the first tutorial.

Course evaluation and development

Student evaluative feedback on the course is gathered, using UNSW's Course and Teaching Evaluation and Improvement (CATEI) Process and in-house course evaluation questionnaires. These questionnaires are available online where students are requested to provide feedback on the course. Student feedback is taken seriously, and continual improvements are made to the course based in part on such feedback.

Student support services

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 convener prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equity and Diversity Unit at http://www.studentequity.unsw.edu.au. Issues to be discussed may include access to materials, note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made. Student Equity Officers (Disability) in the Student and Diversity Unit can be contacted on ph 9385 4734, or email seadu@unsw.edu.au.

Acknowledgement

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Dr. Patsie Polly (School of Medical Sciences)

Mrs. Trichelle Massy-Greene (Manager, Office of Faculty of Science)

Ms. Carmen Robinson (School of Medical Sciences)

Glossary

(References: (1) http://en.wikipedia.org/wiki/; (2) Weinberg RA. The Biology of Cancer. Garland Science, Taylor & Francis Group LLC. 2007)

Adenocarcinoma - Tumour derived from secretory epithelial cells.

Adenoma – Any of a series of pre-malignant, noninvasive growths in various epithelial tissues, many of which have the potential to progress further to carcinomas.

Agonist – Activating agent; opposite of antagonist.

Akt (Protein Kinase B) - A serine/threonine-specific protein kinase that plays a key role in multiple cellular processes such as glucose metabolism, apoptosis, cell proliferation, transcription and cell migration.

Allele – One alternative among different versions of a gene that may be defined by the phenotype that it creates, by the protein that it specifies, or by its nucleotide sequence.

Alternative splicing – Process whereby a pre-mRNA may be spliced in several alternative ways, resulting in mRNAs composed of different combinations of exons.

Alu repeat – Sequence block of about 300bp that is found in 500,000 to 1 million copies scattered throughout the human genome.

Anchorage independence – Ability of a cell to proliferate without attachment to a solid substrate.

Aneuploid – (1) Describing a karyotype that deviates from diploid because of increases or decreases in the numbers of certain chromosomes. (2) Less commonly describing a karyptype that carries structurally abnormal chromosomes.

Angiogenesis – process by which new blood vessels are formed.

Animal model - A living, non-human animal used during the research and investigation of human disease, for the purpose of better understanding the disease without the added risk of causing harm to an actual human being during the process.

Anoikis – Form of apoptosis that is triggered by the failure of a cell to establish anchorage to a solid substrate, such as the extracellular matrix, or by loss of such anchorage.

Antibody – A soluble protein produced by plasma cells of the immune system that is capable of recognizing and binding particular antigens with high specificity.

Antigen – A molecule or portion of a molecule, often an oligopeptide, that can be specifically recognized and bound by an antibody or a T-cell receptor or that provokes the production of an antibody.

Aptamers - chemical antibodies, which are single-stranded oligonucleotides generated from an in vitro process known as SELEX (Systematic Evolution of Ligands by Exponential Enrichment).

Apoptosis – Complex program of cellular self-destruction, triggered by a variety of stimuli and involving the activation of caspase enzymes, that results in quick fragmentation and phagocytosis of a cell.

Autophagy – Program of cellular responses to nutrient deprivation involving the digestion of a cell's organelles within its own lysosomes.

Autophophorylation – Phosphorylation of a protein molecule by its own associated kinase activity.

Autoradiography – Procedure for detecting radiolabeled molecules by placing them adjacent to a radiographic emulsion, which responds to radioactive decay by producing silver granules.

Autosome – A chromosome that is not a sex chromosome.

Benign – (1) Describing a growth that is confined to a specific site within a tissue and gives no evidence of invading adjacent tissue. (2) Referring to an epithelial growth that has not penetrated through the basement membrane.

Biomarkers - Indicating a change in expression or state of a protein that correlates with the risk or progression of a disease, or with the susceptibility of the disease to a given treatment.

Bias – An inclination to present or hold a partial perspective at the expense of (possibly equally valid) alternatives. Anything biased generally is one-sided, and therefore lacks a neutral point of view.

BRAF - a human gene that makes a protein called B-Raf, which is more formally known as serine/threonine-protein kinase B-Raf. The B-Raf protein is involved in sending signals inside cells, which are involved in directing cell growth. In 2002, it was shown to be faulty (mutated) in human cancers. [

Cachexia – Physiologic state, often seen late in cancer development, in which the patient loses appetite and suffers wasting of tissues throughout the body.

Cancer - Cancer refers to any uncontrolled or abnormal growth of cells that are able to spread locally (invasion) or from the site of origin to distant sites (metastasis). Cancer represents a diverse group of over 100 diseases.

Cancer stem cell – Cancer cells (found within tumours or haematological cancers) that possess characteristics associated with normal stem cells, specifically the ability to give rise to all cell types found in a particular cancer sample.

Cancer vaccine - Referring to a vaccine that either prevents infections with cancer-causing viruses, treats existing cancer or prevents the development of cancer in certain high risk individuals.

Carcinoma – A cancer arising from epithelial cells, also called epithelial cancer.

Cell cycle – being the series of events that take place in a cell leading to its division and duplication (replication). In cells without a nucleus (prokaryotic), the cell cycle occurs via a process termed binary fission. In cells with a nucleus (eukaryotes), the cell cycle can be divided in two periods: interphase—during which the cell grows, accumulating nutrients needed for mitosis and duplicating its DNA—and the mitosis (M) phase, during which the cell splits itself into two distinct cells, often called "daughter cells" and the final phase, cytokinesis, where the new cell is completely divided. The cell cycle consists of four distinct phases: G_1 phase, S phase (synthesis), G_2 phase (collectively known as interphase) and M phase (mitosis). M phase is itself composed of two tightly coupled processes: mitosis and cytokinesis. Cells that have temporarily or reversibly stopped dividing are said to have entered a state of quiescence called G_0 phase.

Computerized tomography (CT) - A medical imaging procedure, which utilizes computer-processed X-rays to produce tomographic images or 'slices' of specific areas of the body.

Confocal microscopy - An optical imaging technique used to increase optical resolution and contrast of a micrograph by using point illumination and a spatial pinhole to eliminate out-of-focus light in specimens that are thicker than the focal plane. It enables the reconstruction of three-dimensional structures from the obtained images.

Confounding - An extraneous variable in a statistical model that correlates (positively or negatively) with both the dependent variable and the independent variable.

Data measurement - The process or the result of determining the presentation from a biological quantity or quality, such as a concentration, survival time, colour change or alive or dead etc., to a unit of measurement, such as the nM, year, intensity grade or digital coding.

DNA repair - A collection of processes by which a cell identifies and corrects damage to the DNA molecules that encode its genome.

Enhanced permeability and retention (EPR) – A mechanism describing how nanoparticles/nanocarriers can be delivered via intravenous or intraperitoneal paths into circulation and reach sites of cancer. In highly vascular tumours, gaps are present in the endothelial cells of tumour blood vessels to allow nanoparticles to extravasate efficiently, while the absence of lymphatic drainage from tumour tissues contributes to retention of the nanocarriers ultimately leading to accumulation of high concentrations of drug.

Epigenetics – the study of heritable changes in gene expression or cellular phenotype caused by mechanisms other than changes in the underlying DNA sequence. It refers to functionally relevant modifications to the genome that do not involve a change in the nucleotide sequence. Examples of such changes are DNA methylation and histone modification, both of which serve to regulate gene expression without altering the underlying DNA sequence.

Epithelial-mesenchymal transition – Acquisition by epithelial cells of the phenotype of mesenchymal cells.

Exosomes - Small (30 to 100 nm) membrane-bound particles that are released from normal, diseased, and neoplastic cells and are present in blood and other bodily fluids.

Familial cancer – Referring to a trait that cancer is heritable and therefore found in clusters in certain families.

Flow cytometry - A laser based, biophysical technology employed in Cell counting, sorting, biomarker detection and protein engineering, by suspending them in a stream of fluid and passing them by an electronic detection apparatus. It allows simultaneous multiparametric analysis of the physical and/or chemical characteristics of up to thousands of particles per second.

Immunoblotting (Western blot) - A widely used analytical technique used to detect specific proteins in the given sample of tissue homogenate or extract. It uses gel electrophoresis to separate native proteins by 3-D structure or denatured proteins by the length of the polypeptide. The proteins are then transferred to a membrane (nitrocellulose), where they are stained with antibodies specific to the target protein.

Immunohistochemistry/Immunocytochemistry - The process of detecting antigens (e.g., proteins) in cell lines or cells of a tissue section by exploiting the principle of antibodies binding specifically to antigens in biological tissues.

KRAS (GTPase KRas or V-Ki-ras2 Kirsten rat sarcoma viral oncogene homolog) - A protein that in humans is encoded by the *KRAS* gene. The protein product of the normal KRAS gene performs an essential function in normal tissue signalling, and the mutation of a KRAS gene is an essential step in the development of many cancers.

Leukaemia - a type of cancer of the blood or bone marrow characterized by an abnormal increase of immature white blood cells called "blasts". Leukemia is a broad term covering a spectrum of diseases. In turn, it is part of

the even broader group of diseases affecting the blood, bone marrow, and lymphoid system, which are all known as hematological neoplasms.

Lymphoma - a cancer of the lymphocytes, a type of cell that forms part of the immune system. Typically, lymphoma is present as a solid tumor of lymphoid cells. Treatment might involve chemotherapy and in some cases radiotherapy and/or bone marrow transplantation, and can be curable depending on the histology, type, and stage of the disease.

Magnetic resonance imaging (**MRI**), **nuclear magnetic resonance imaging** (**NMRI**), or **magnetic resonance tomography** (**MRT**) - A medical imaging technique used in radiology to visualize internal structures of the body in detail. MRI makes use of the property of nuclear magnetic resonance (NMR) to image nuclei of atoms inside the body. MRI provides good contrast between the different soft tissues of the body, which makes it especially useful in imaging the brain, muscles, the heart, and cancers compared with other medical imaging techniques such as computed tomography (CT) or X-rays. Unlike CT scans or traditional X-rays, MRI does not use ionizing radiation.

Mendelian inheritance - A scientific theory of how hereditary characteristics are passed from parent organisms to their offspring; it underlies much of genetics.

Metastasis - The process in which cancer spread to distant parts of the body through the lymphatic system or bloodstream.

Microarray - A multiplex lab-on-a-chip. It is a 2D array on a solid substrate (usually a glass slide or silicon thin-film cell) that assays large amounts of biological material using high-throughput screening methods.

MicroRNA – A microRNA molecule has very few nucleotides (an average of 22) compared with other RNAs. miRNAs are post-transcriptional regulators that bind to complementary sequences on target messenger RNA transcripts (mRNAs), usually resulting in translational repression or target degradation and gene silencing. The human genome may encode over 1000 miRNAs, which may target about 60% of mammalian genes and are abundant in many human cell types.

Mutation – A change or changes in a genomic sequence: the DNA sequence of a cell's genome.

Nano-oncology - Application of nanobiotechnology in cancer has resulted in the creation of a new field, nano-oncology

Nanopartcles - molecules featuring one or more dimensions in the order of 100 nm or less.

NGS (next-generation sequencing or high-throughput sequencing) - The high demand for low-cost sequencing has driven the development of NGS technologies that parallelize the sequencing process, producing thousands or millions of sequences at once (as many as 500,000 sequencing-by-synthesis operations may be run in parallel).

Oncogene - A gene that has the potential to cause cancer.

Oncomir - A microRNA (miRNA) that is associated with cancer. For example, an oncomir may be more or less abundant in primary tumours or in tumour cell lines than in healthy cells.

P53 - A tumour suppressor protein that in humans is encoded by the *TP53* gene. p53 is crucial in multicellular organisms, where it regulates the cell cycle and, thus, functions as a tumour suppressor that is involved in preventing cancer. As such, p53 has been described as "the guardian of the genome" because of its role in

conserving stability by preventing genome mutation.

PCR (**polymerase chain reaction**) - A scientific technique in molecular biology to amplify a single or a few copies of a piece of DNA across several orders of magnitude, generating thousands to millions of copies of a particular DNA sequence.

Palliative care - an area of healthcare that focuses on relieving and preventing the suffering of patients.

Personalised cancer medicine – An approach envisioning risk stratification and therapeutic selection based on an individual's genetic makeup and physiologic state, which are assessed through cellular or molecular phenotypes.

PI3Ks (Phosphatidylinositol 3-kinases) - A family of enzymes involved in cellular functions such as cell growth, proliferation, differentiation, motility, survival and intracellular trafficking, which in turn are involved in cancer. In response to lipopolysaccharide, PI3K phosphorylates p65, inducing anandamide synthesis to inhibit NF-κB activation.

Positron emission tomography (PET) - A nuclear medicine imaging technique that produces a three-dimensional image or picture of functional processes in the body. The system detects pairs of gamma rays emitted indirectly by a positron-emitting radionuclide (tracer), which is introduced into the body on a biologically active molecule. Three-dimensional images of tracer concentration within the body are then constructed by computer analysis. In modern scanners, three dimensional imaging is often accomplished with the aid of a CT X-ray scan performed on the patient during the same session, in the same machine.

Power - The probability that the test will reject the null hypothesis when the null hypothesis is false. The power is in general a function of the possible distributions, often determined by a parameter, under the alternative hypothesis. The probability of a Type II error occurring is referred to as the false negative rate (β). Therefore power is equal to 1 − β, which is also known as the sensitivity. Power analysis can be used to calculate the minimum sample size required so that one can be reasonably likely to detect an effect of a given size. Power analysis can also be used to calculate the minimum effect size that is likely to be detected in a study using a given sample size. In addition, the concept of power is used to make comparisons between different statistical testing procedures: for example, between a parametric and a nonparametric test of the same hypothesis.

Prediction - A statement about the way things will happen in the future, often but not always based on experience or knowledge.

Prognosis - A medical term for predicting the likely outcome of an illness.

PTEN (**Phosphatase and tensin homolog**) - A protein that, in humans, is encoded by the *PTEN* gene. Mutations of this gene are a step in the development of many cancers. *PTEN* acts as a tumour suppressor gene through the action of its phosphatase protein product. This phosphatase is involved in the regulation of the cell cycle, preventing cells from growing and dividing too rapidly. It is one of the targets of an oncomiR, MIRN21.

Sample size determination - The act of choosing the number of observations or replicates to include in a statistical sample. The sample size is an important feature of any empirical study in which the goal is to make inferences about a population from a sample. In practice, the sample size used in a study is determined based on the expense of data collection, and the need to have sufficient statistical power. In complicated studies

there may be several different sample sizes involved in the study: for example, in as survey sampling involving stratified sampling there would be different sample sizes for each population. In a census, data are collected on the entire population; hence the sample size is equal to the population size. In experimental design, where a study may be divided into different treatment groups, there may be different sample sizes for each group. Sample sizes may be chosen in several different ways: (1) expedience - For example, include those items readily available or convenient to collect. A choice of small sample sizes, though sometimes necessary, can result in wide confidence intervals or risks of errors in statistical hypothesis testing. (2) using a target variance for an estimate to be derived from the sample eventually obtained and (3) using a target for the power of a statistical test to be applied once the sample is collected.

Sarcoma – Tumour derived from mesenchymal cells, usually those constituting various connective tissue cell types, including fibroblasts, osteoblasts, endothelial cell precursors, and condrocytes.

Senescence or **biological aging** - The change in the biology of an organism as it ages after its maturity. Such changes range from those affecting its cells and their function to those affecting the whole organism. There are a number of hypotheses as to why senescence occurs; for example, some posit it is programmed by gene expression changes, others that it is the cumulative damage caused by biological processes. Senescence is not the inevitable fate of all organisms. A variety of organisms, including some cold-blooded animals, have negligible senescence. Whether senescence as a biological process can be slowed down, halted or even reversed, is a subject of current scientific speculation and research.

ShRNA (**small hairpin RNA or short hairpin RNA**) - A sequence of RNA that makes a tight hairpin turn that can be used to silence target gene expression via RNA interference (RNAi). Expression of shRNA in cells is typically accomplished by delivery of plasmids or through viral or bacterial vectors. The promoter choice is essential to achieve robust shRNA expression. At first, polymerase III promoters such as U6 and H1 were used; however, these promoters lack spatial and temporal control. As such, there has been a shift to using polymerase II promoters to regulate expression of shRNA. shRNA is an advantageous mediator of RNAi in that it has a relatively low rate of degradation and turnover. However, shRNA is disadvantageous in that it requires use of an expression vector which can pose safety concerns.

SiRNA (**small interfering RNA, short interfering RNA or silencing RNA)** - A class of double-stranded RNA molecules, 20-25 nucleotides in length. siRNA plays many roles, but its most notable is in the RNA interference (RNAi) pathway, where it interferes with the expression of specific genes with complementary nucleotide sequence. siRNA also acts in RNAi-related pathways, e.g., as an antiviral mechanism or in shaping the chromatin structure of a genome. The complexity of these pathways is only now being elucidated.

Synthetic lethality – Arising when a combination of mutations in two or more genes leads to cell death, whereas a mutation in only one of these genes does not, and by itself is said to be viable In a synthetic lethal genetic screen, it is necessary to begin with a mutation that does not kill the cell, although may confer a phenotype (for example, slow growth), and then systematically test other mutations at additional loci to determine which confer lethality.

Targeted cancer therapy - A type of medication that blocks the growth of cancer cells by interfering with specific targeted molecules needed for carcinogenesis and tumour growth, rather than by simply interfering

with rapidly dividing cells (e.g. with traditional chemotherapy). Targeted cancer therapies may be more effective than current treatments and less harmful to normal cells.

Theranostics - The term used to describe the proposed process of diagnostic therapy for individual patients - to test them for possible reaction to taking a new medication and to tailor a treatment for them based on the test results.

Tissue microarray (**TMA**) - Consisting of paraffin blocks in which up to 1000 separate tissue cores are assembled in array fashion to allow multiplex histological analysis.

Tumour suppressor gene – A gene that protects a cell from one step on the path to cancer. When this gene is mutated to cause a loss or reduction in its function, the cell can progress to cancer, usually in combination with other genetic changes.

Tumour grade - A measure of cell anaplasia (lack of differentiation) in the sampled tumor and is based on the resemblance of the tumor to the tissue of origin.

Tumour stage - A measure of the extent to which the cancer has spread.

Tumour type – A measure of the property of the microscopic anatomy of cells and tissues of a tumour.

Type 1 error - occurs when the null hypothesis (H_0) is true, but is rejected. It is asserting something that is absent, a false hit. A type I error may be compared with a so called *false positive* (a result that indicates that a given condition is present when it actually is not present) in tests where a single condition is tested for. Type I errors are philosophically a focus of skepticism and Occam's razor. A Type I error occurs when we believe a falsehood. In terms of folk tales, an investigator may be "crying wolf" without a wolf in sight (raising a false alarm) (H_0: no wolf). The rate of the type I error is called the *size* of the test and denoted by the Greek letter α. It usually equals the significance level of a test. In the case of a simple null hypothesis α is the probability of a type I error. If the null hypothesis is composite, α is the maximum (supremum) of the possible probabilities of a type I error.

Type 2 error - an error of the second kind, occurs when the null hypothesis is false, but it is erroneously accepted as true. It is missing to see what is present, a miss. A type II error may be compared with a so-called *false negative* (where an actual 'hit' was disregarded by the test and seen as a 'miss') in a test checking for a single condition with a definitive result of true or false. A Type II error is committed when we fail to believe a truth. In terms of folk tales, an investigator may fail to see the wolf ("failing to raise an alarm"; see Aesop's story of The Boy Who Cried Wolf). Again, H_0: no wolf. The rate of the type II error is denoted by the Greek letter β and related to the power of a test (which equals 1- β).

Wnt signalling - A network of proteins best known for their roles in embryogenesis and cancer, but also involved in normal physiological processes in adult animals.

Appendix 1. Assessing guideline of a research article:

1. Is the hypothesis important? Is it clearly stated? Is the work reported original? Is it novel or does is replicate other work? Is that replication deserved?

2. Have any of the data been published before?

3. Is the title accurate and informative? Is it too long? If so, suggest an alternative.

4. Is the abstract clear and succinct, covering all important points (effectively summarise the paper)? Is it too brief for clarity or unnecessary long? Does it contain hard data?

5. Does the introduction state the scientific problem clearly?

6. Is the design of the experiment suitable? Are there appropriate controls? Are the materials and methods (are the methods specific enough?) used adequate for the problem under investigation and sufficiently well documented (assessing degree of competency with which the work has been performed)? Would you be able to replicate the work from the information given?

7. Have animals or human subjects or tissue been used? Have ethical guidelines been followed and/or permission granted from the appropriate body?

8. Are the experimental results sufficient to justify the conclusions? (outlining major omissions and irrelevance).

9. Is the statistical analysis robust, thorough, and suitable to the data? Are there enough data to make a significant analysis?

10. Are all tables or figures necessary? Is their quality adequate? Do the captions contain sufficient information? Are any of data displayed repeated and/or redundant?

11. Is the discussion successful in placing the results in the context of related work? Is it too long or too speculative? Does the discussion address properly possible sources of error (random, systemic, inter-observer, etc)?

12. Are the conclusions justified by the data?

13. Are all references necessary? Are the most important previous studies cited? Are the references balanced and adequate in number? Do they conform to the format of the journal? Is the literature cited up to date?

14. Is the length of the paper appropriate to its content?

15. How does the paper read? Does the English need improving?

Appendix 2. Project design template (for reference only):

Developing a concept outline for a proposed research project

Title
Background and rationale
Hypotheses
Aim
Objectives (specific aims)
Samples and setting
OH&S and Ethics consideration
Intervention
Project design
Methods
Measures
Study procedures
Statistical considerations
Special analysis considerations
Feasibility
Expected outcome
Competing studies
Funding and support
Investigators and groups

Appendix 3. Peer assessment form one (for use by group members)

Group ID		Leave a blank (zero) or place a cross in the appropriate mark box for each of the five criteria listed.	
Name and ID of student to be assessed			
Assessor's name and student ID (optional)		0.5	1.0
Participation in the planning of the presentation			
Execution of allocated tasks effectively and on time			
Attendance to meetings called on by Group members			
Contribution to Group discussion			
Scientific quality of contribution			
Total			

Total marks will be distributed as follows:

0	Did not address any objectives
1	Attempted to address the objectives but did not achieve satisfactory standard
2	Satisfactorily addressed the objective
3-5	Addressed the objectives well

Appendix 4. Peer assessment form two (for assessing other groups)

Group ID: Assessor name & student ID	Leave a blank (zero) or place a cross in the appropriate mark box for each of the five criteria listed.				
	1	2	3	4	5
Clear explanation of a valid research question					
Structure of content – introduction, hypotheses and aims, research design, methods, measurement and evaluation, logical flow					
Effective use of PowerPoint to deliver presentation					
Ability to answer questions					
Overall impression					
Member name:					
Group ID					
1					
2					
3					
4					
5					
6					
7					
8					
Overall impression					
Total mark					

Comments	
Strengths	
Improvement	
Points for clarification (if necessary)	

Assessor: …… (sign). **Date:** ……

Appendix 5. Academic assessment form

Group ID: Academic name & staff number	Leave a blank (zero) or place a cross in the appropriate mark box for each of the five criteria listed.				
	1	2	3	4	5
Clear explanation of a valid research question					
Structure of content – brief background, hypotheses and aims, research design, methods, measurement and evaluation, logical flow					
Effective use of PowerPoint to deliver presentation					
Ability to answer questions					
Member name:					
Group ID					
1					
2					
3					
4					
5					
6					
7					
8					
Overall impression					
Total mark					

Comments	
Strengths	
Improvement	
Points for clarification (if necessary)	

Assessor: …… (sign). **Date:** ……

Criteria	Appendix 6: Literature Review Assessment Criteria (Mark out of 10 for each marking criteria)						
	10-9.0	9.0-8.5	8.4-.8.0	7.9-7.5	7.4-6.5	6.4-5.0	5-0
Background **_____/10 x 2.5**	Very comprehensive, detailed and focused introduction.	Highly detailed and focused introduction.	Detailed and focused introduction	Detailed introduction.	Some key basic information missing in introduction.	Major lack of key basic information in introduction.	Lack of significant detail in introduction.
Critical Analysis **_____/10 x 2.5**	Comprehensive critical analysis of strengths and limitations of the literature	Critical analysis of strengths and limitations of the literature	Some critical analysis of strengths and limitations of the literature.	Some critical analysis of strengths and limitations of the literature but mostly descriptive	Limited critical analysis of strengths and limitations of the literature, mostly descriptive	Very limited critical analysis of strengths and limitations of the literature.	No critical analysis of strengths and limitations of the literature presented
Hypotheses & Aims **_____/10 x 1**	Hypotheses and aims clearly outlined and comprehensively justified.	Hypotheses and aims clearly outlined and justified.	Hypotheses and aims outlined and justified.	No clear hypotheses. Aims outlined and justified.	No clear hypotheses. Aims outlined.	No clear hypotheses. Aims not clearly outlined.	No hypotheses or aims apparent.
Methods **_____/10 x 0.5**	Clear and detailed description of proposed experiments. Comprehensively planned and accurately outlined experiments.	Clear and detailed description of proposed experiments. Accurately outlined experiments.	Clear description of experiments, but minor detail lacking. Accurately outlined experiments.	Descriptions of experiments mostly clear, but some detail lacking. Minor inconsistencies in experimental design.	Description of experiments lacked some major detail. Minor inconsistencies in experimental design.	Description of experiments lacks major details. Major inconsistencies in experimental design.	Experiments not described.
	Well developed and very clear links between hypotheses, aims and methods and literature.	Very clear links between hypotheses, aims and methods and literature.	Clear links between hypotheses, aims and methods and literature.	Some links between hypotheses, aims and methods and literature.	Poor links between hypotheses, aims and methods and literature.	No links between hypotheses, aims and methods and literature.	No hypotheses, aims or methods

_____/10 x 0.5							
References _____/10 x 1	Predominant and comprehensive use of primary articles. All articles presented from recent or seminal publications.	Predominant use of primary articles. All articles presented from recent or seminal publications.	Predominant use of primary articles. Most articles presented from recent or seminal publications.	Some over reliance on reviews. Most articles presented from recent or seminal publications	Some over reliance on reviews. Many articles not from recent or seminal publications.	Significant over reliance on reviews. Limited number of recent or seminal articles used.	Use of literature limited to a few articles and reviews. Poor attempt to explore literature.
_____/10 x 1	Citation style correct and consistent throughout. Reference list completely accurate with no errors.	Citation style correct and consistent. Reference list complete, but a few minor errors.	Citation style consistent. Reference list complete, but many minor errors.	Some references inconsistent between text and list with many minor errors. Citation style mostly consistent.	Many references inconsistent between text and list with many minor errors. Citation style incorrect / inconsistent.	Many inconsistencies between text and list. Some major errors. Inappropriate citation style used.	Many references inconsistent between text and list. Many major errors.
Presentation _____/10 x 1	No grammatical or spelling errors. Professional expression and style used consistently. All figures accurate and informative.	No grammatical or spelling errors. Professional expression and style used. All figures accurate and informative.	No grammatical errors and minor spelling errors. Professional expression and style used. All figures accurate and informative	Minor grammatical errors and minor spelling errors. Professional expression and style used. Most figures accurate and informative.	Minor grammatical errors and minor spelling errors. Professional expression used. Most figures accurate.	Major grammatical and spelling errors. Professional expression used Numerous errors in figures.	Major grammatical and spelling errors. Language used not professional. Numerous errors in figures.

COMPONENTS	Appendix 7: Group Presentation Assessment Criteria (Mark out of 10 for each marking criteria)						
	10 - 9	9 - 8.5	8.4 - 8	7.9 - 7.5	7.4 - 6.5	6.4 - 5	5 - 0
Background **/10 x 2**	• Very focused introduction with sufficient detail and all concepts and terminology described to allow for understanding by a non-expert audience.	• Focused introduction with sufficient detail and most concepts and terminology described to allow for understanding by a non-expert audience	• Somewhat focused introduction with satisfactory detail and most concepts and terminology described to allow for understanding by a non-expert audience	• Introduction lacks some focus, has adequate detail and most concepts and terminology described to allow for understanding by a non-expert audience	• Introduction lacks focus and detail. Many concepts and terminology not described to allow for understanding by a non-expert audience	• Introduction lacks focus and has inadequate detail. Most concepts and terminology not described to allow for understanding by a non-expert audience	• Introduction lacks focus and has inadequate detail. Cannot be understood by a non-expert audience
Hypotheses & Aims **/10 x 0.5**	• Very clear and well developed links between hypotheses, aims and methods and literature.	• Very clear links between hypotheses, aims and methods and literature.	• Clear links between hypotheses, aims and methods and literature.	• Links between hypotheses, aims and methods and literature.	• Some links between hypotheses, aims and methods and literature.	• No clear links between hypotheses, aims and methods and literature.	• No hypotheses, aims or methods
Methods **/10 x 1.5**	• Clear and detailed description of proposed experiments.	• Clear description of proposed experiments.	• Clear description of experiments, but minor detail lacking.	• Descriptions of experiments mostly clear, but minor detail lacking. Minor inconsistencies in experimental design.	• Description of experiments lacked some major detail. Minor inconsistencies in experimental design.	• Description of experiments lacked some major detail. Major inconsistencies in experimental design.	• Experiments not described.
Presentation	• The font, colour, graphics and slide layout used greatly enhances the presentation. Figures used and clearly labelled. No errors. Clear and logical structure throughout • Delivery clear, well paced, articulate and professional	• The font, colour, graphics and slide layout used enhances the presentation. Figures used and clearly labelled. Minor errors. Clear and logical structure throughout • Delivery clear, well paced, articulate and professional.	• The font, colour, graphics and slide layout used enhances the presentation. Figures used and labelled. Minor errors. Mostly clear and logical structure throughout • Delivery clear, well paced and articulate. Mostly confident	• The font, colour, graphics and slide layout used sometimes distracts from the presentation. Figures used and labelled with some errors. Mostly clear and logical structure throughout • Delivery clear and well paced. Mostly	• The font, colour, graphics and slide layout used sometimes distracts from the presentation. Not all figures used are labelled or have errors. Lacking clear and logical structure • Delivery mostly clear. Some major lapses in body language	• The font, colour, graphics and slide layout used distracts from the presentation. Poor use of figures those used are labelled or have errors. Lacking clear and logical structure • Delivery unclear / inaudible. Some major lapses in body	• The font, colour, graphics and slide layout used distracts from the presentation. • Figures used not labelled. No logical structure to presentation • Delivery unclear / inaudible. Not confident with poor body language

/10 x 3	throughout. Confident stance and body language. Enthusiastic and interesting.	Confident stance and body language. Enthusiastic.	stance and body language. Enthusiastic.	confident stance and body language.	observed	language observed.	
Questions **/10 x 3**	• All responses demonstrated clear understanding of complex technical and contextual issues. • Consistently strongly argued and accurate answers to questions drawing from related literature.	• Responses demonstrated clear understanding of complex technical and contextual issues. • Strongly argued and accurate answers to questions drawing from related literature.	• Responses demonstrated understanding of technical and contextual issues. • Accurate answers to questions drawing from related literature	• Responses demonstrated some understanding of technical and contextual issues. • Mostly accurate answers to questions drawing from literature.	• Responses demonstrated some understanding of technical or contextual issues but not both. • A number of minor errors made in responses to questions	• Responses demonstrated little understanding of technical and contextual issues. • A number of major errors made in responses to questions.	• Responses did not demonstrate any understanding of the project. • Significant errors made in responses to questions.

CATEGORY	Appendix 8: Project Design Report Assessment Criteria						
	10-9.0	9.0-8.5	8.4-8.0	7.9-7.5	7.4-6.5	6.4-5	5-0
ABSTRACT, INTRODUCTION, HYPOTHESIS AND AIMS **_____/10 X 3**	• Concise and clear account of the scientific background and the rationale of the experiment. Very clear links between hypotheses / aims and literature.	• Concise and clear account of the scientific background and the rationale of the experiment. Clear links between hypotheses / aims and literature.	• Clear account of the scientific background and the rationale of the experiment. Clear links between hypotheses / aims and literature. Minor errors.	• Clear account of the scientific background and the rationale of the experiment. Minor omissions or errors. Links between hypotheses / aims and literature	• A good introduction of the scientific background and the rationale of the experiment. Some factual error or omissions. Some links between hypotheses / aims and literature	• Some introduction to the scientific background and the rationale of the experiment. More detail needed. Some links between hypotheses / aims and literature. Factual errors or omissions in text.	• Lacking detail of the rationale of the experiment and scientific background. No links between hypotheses / aims and literature. Factual errors or omissions in text.
PROJECT DESIGN, DATA MEASUREMENT AND EVALUATION **_____/10 X 4**	• Clear and detailed description of experiments and data measurement and analysis (including statistical analysis).	• Clear description of experiments and data analysis (including statistical analysis).	• Good description of experiments and data analysis (including statistical analysis), with minor errors.	• Description of experiments and data analysis (including statistical analysis) mostly clear but significant detail lacking. Minor errors present in methods.	• Description of experiments and data analysis (including statistical analysis) lacking major details. Minor errors present methods.	• Description of experiments and data analysis (including statistical analysis) lacking major details. Major errors in methods.	• Description of experiments and data analysis (including statistical analysis) absent or unclear.
REFERENCES	• Predominant and comprehensive use of primary articles. All articles presented from recent or seminal publications. • Citation style correct and consistent throughout. Reference list completely accurate with no errors.	• Predominant use of primary articles. All articles presented from recent or seminal publications. • Citation style correct and consistent. Reference list complete, but a few minor errors.	• Predominant use of primary articles. Most articles presented from recent or seminal publications. • Citation style consistent. Reference list complete, but many minor errors. Citation style consistent.	• Some over reliance on reviews. Most articles presented from recent or seminal publications • Some references inconsistent between text and list with many minor errors. Citation style mostly consistent.	• Some over reliance on reviews. Many articles not from recent or seminal publications. • Many references inconsistent between text and list with many minor errors. Citation style incorrect / inconsistent.	• Significant over reliance on reviews. Limited number of recent or seminal articles used. • Many inconsistencies between text and list. Some major errors. Inappropriate citation style used.	• Use of literature limited to a few articles and reviews. Poor attempt to explore literature. • Many references inconsistent between text and list. Many major errors.

_____/10 X 1.5							
PRESENTATION _____/10 X 1.5	• No grammatical or spelling errors. Professional expression and style used consistently. All figures accurate and informative. • Word count <3,000	• No grammatical or spelling errors. Professional expression and style used. All figures accurate and informative. • Word count <3,000	• No grammatical errors and minor spelling errors. Professional expression and style used. All figures accurate and informative • Word count <3,000	• Minor grammatical errors and minor spelling errors. Professional expression and style used. Most figures accurate and informative. • Word count <3,000	• Minor grammatical errors and minor spelling errors. Professional expression used. Most figures accurate. • Word count: <3,000	• Major grammatical and spelling errors. Professional expression used. Numerous errors in figures. • Word count: <3,000	• Major grammatical and spelling errors. Language used not professional. Numerous errors in figures. • Word count: <or>5000