

# PHSL3211

## Cardiovascular Physiology and Pathophysiology

### COURSE OUTLINE

TERM 2, 2019

Please read this outline in conjunction with the following pages on the [School of Medical Sciences website](#):

- [Advice for Students](#)
- [Learning Resources](#)

(or see "STUDENTS" tab at [medalsciences.med.unsw.edu.au](http://medalsciences.med.unsw.edu.au))

## **COURSE COORDINATORS**

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## **COURSE OUTLINE AND STRUCTURE**

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The cardiovascular system is vital to normal functioning of the human body. Diseases afflicting the cardiovascular system result in high rates of illness and mortality throughout the world. This course aims to educate the student in important aspects of cardiovascular physiology and pathophysiology, and to present the latest research strategies used to investigate this complex system.

The course is divided into three units, over which the student will be taken from the physiology of cardiac and vascular cells, examine the function and regulation of these cells within vascular tissues and organs, and finally learn about the latest theories and techniques leading research into cardiovascular pathophysiology and disease. As the course progresses, material builds on information presented in earlier classes. Course material is delivered by staff actively engaged in cardiovascular research, able to illustrate theory with examples from their own laboratories.

### **Unit 1: Cellular Aspects**

The aim of this unit is to become familiar with the cellular characteristics of the blood vessels wall. Further emphasis will be placed on interactions that occur between vascular cells and the extracellular environment.

- Endothelial cells
- Cardiac Muscle
- Smooth Muscle: Signal transduction, contractile activity, mechanics.
- Electrophysiology: Ion channels relevant to the cardiovascular system.
- Cellular Junctions: Gap junctions, adherens junctions, integrins

### **Unit 2: Integration and Control of the Cardiovascular System**

This unit aims to expand the knowledge obtained in Unit 1 into circulatory systems and control situations.

- Haemodynamics
- Microcirculation
- Lymphatics: fluid exchange, oedema, cellular basis of lymphatic function
- Control of blood pressure
- Control of cardiac output
- Interaction with Neurohumoral Control: autonomic, hormonal, paracrine
- Control of the Regional Circulations
- Cardiovascular Regulation During Exercise

### **Unit 3: Molecular Approaches in the Study of the Cardiovascular System**

Using modern state-of-the-art experimental approaches this unit aims to use pathophysiological situations to highlight function of the cardiovascular system.

- Circulatory Shock
- Cardiac Arrhythmia and Heart Failure
- Atherosclerosis – alterations in lipid handling leading to disturbed endothelial function and vasoreactivity.
- Reactive Oxygen Species / Ischemia Reperfusion / Adhesion
- Hypertension – use of animal models, including transgenic animals, for the study of disturbances in blood pressure control.

## ASSESSMENT AND TEACHING ACTIVITIES

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Final Examination	40%	In order to achieve a satisfactory performance in this course it is anticipated that students will achieve a pass mark, or higher, in each assessment task.
Mid-session Test	30%	
Poster Presentation	15%	
PBLs	15%	
<b>Total</b>	<b>100%</b>	

### Final Examination

The final examination will be composed of multiple-choice and short answer questions covering the entire course including practical material. Post or supplementary exams will be made available only in exceptional circumstances.

### Mid-Session Test

The mid-session test on July 3<sup>rd</sup> will be a brief test on the material covered to that point of the course only including practical material, consisting of multiple-choice and short-answer questions.

### Poster Presentation

Work will be undertaken in groups of 3-4, to which students will be assigned. Each group will have a topic area assigned to them, and a published paper to report upon. The final product will be a Poster and should include: an Introduction; Methods; Data drawn from the article; Summary.

This poster must be completed for display in room WW116 by 10 AM or 2 PM (group depending) on Friday 9<sup>th</sup> August 2019.

Each group is expected to provide a brief (5 mins) oral presentation of poster.

Possible Topics:

1. Endothelium-mediated vasodilatation.
2. Conducted responses in the vasculature.
3. Ca<sup>2+</sup>-dependency of smooth muscle contraction.
4. Ion channels in regulation of vascular tone.
5. Ion channels in regulation of cardiac function.
6. Mechanotransduction in vascular / cardiac cells.
7. Regulation of lymphatic (vaso) motion.
8. Exercise and cardiovascular remodelling.
9. Impact of altitude on cardiovascular physiology.
10. Transgenic models in the study of the cardiovascular system.
11. Cellular mechanisms underlying hypertension.
12. Cellular mechanisms underlying atherosclerosis.
13. Circulatory shock
14. Mechanisms underlying cardiac arrhythmia / heart failure.
15. Vascular remodelling.

Students may select a topic from the above list, plus a journal article upon which to base their final presentation. Students may use the literature to find extra journal articles to complement their poster presentation. Students may consult with Dr. Murphy or other staff members regarding their assigned topic prior to completing the poster project. Assessment will be based on both the poster presentation and its oral defence.

### Practical Classes

There are four 'wet' practical classes; Cardiac Muscle; Recording and Interpretation of the ECG; Exercise Physiology and the Autonomic Nervous System. Attendance at practical classes is compulsory. Students will be examined on the findings of these practicals and the concepts explored as part of the mid-session and final examinations.

### Problem-Based Learning (PBL) Session

Students will undertake self-directed learning using case studies or scenarios relevant to cardiovascular physiology. In an introductory session students will be given an outline of the problem and "clues" towards what information is required. Students will then research the material and present their findings at a subsequent session. Facilitators will be available to provide direction.

### Tutorials

Each unit is followed by a tutorial, with practice multi-choice and short-answer questions on-line. These questions do not constitute a 'bank' of questions and will not appear on any exam. In addition, students are encouraged to collect and submit any questions relating to lecture material, either directly via e-mail or through the discussion boards on Moodle.

## TIMETABLE 2019

	Wk	Date / Hrs	Time	Activity (Lecture, Practical, Problem Based Learning)	Teacher	
Unit One	1	Tue 4 <sup>th</sup> Jun	9-10	L - Course Introduction / Vascular Smooth Muscle: Electrophysiology	Mat D Mat D	TM
		Wed 5 <sup>th</sup> Jun	9-11	L - Cardiac Muscle		MaP
		Fri 7 <sup>th</sup> Jun	10-1	P - Cardiac Muscle (A)	WW116	TM, ML, GI
			2-5	P - Cardiac Muscle (B)	WW116	TM, ML, GI
Unit One	2	Tue 11 <sup>th</sup> Jun	9-10	L - Vascular Smooth Muscle: Mechanics I	Mat D	TM
		Wed 12 <sup>th</sup> Jun	9-11	L - Vascular Endothelium/Gap Juncs	Mat D	SS
		Fri 14 <sup>th</sup> Jun	11-12	L - Vascular Smooth Muscle: Mechanics II	Mat D	TM
			10-1	PBL-1.1 'Joan Murray' A: Lib176A; B: Lib176B; C: Mat 313		TM, ML, TBC
		2-5	PBL-1.1 'Joan Murray' A: Lib176A; B: Lib176B; C: Mat 313		TM, ML, TBC	
Unit Two	3	Tue 18 <sup>th</sup> Jun	9-10	T - Review Unit One	Mat D	TM
		Wed 19 <sup>th</sup> Jun	9-11	L - Control of Cardiac Output	Mat D	TM
			11-12	L - Introduction to the ECG	Mat D	KG
		Fri 21 <sup>st</sup> Jun	10-1	P - Recording and Interpretation of the ECG (A)	WW116	KG, ML, GI
			2-5	P - Recording and Interpretation of the ECG (B)	WW116	KG, ML, GI
	4	Tue 25 <sup>th</sup> Jun	9-10	Free time?	Mat D	MiP
		Wed 26 <sup>th</sup> Jun	9-11	L - Haemodynamics	Mat D	TM, ML, TBC
		Fri 28 <sup>th</sup> Jun	10-1	PBL-1.2 'Joan Murray' A: Lib176A B: Lib176B, C: Mat313		
			2-5	PBL-1.2 'Joan Murray' D: Lib176A E: Lib176B, F: Mat313		TM, ML, TBC
	5	Tue 2 <sup>nd</sup> Jul	9-10	L - Cardiovascular Regulation During Exercise	Mat D	YB
	Wed 3 <sup>rd</sup> Jul	9-11	L - Microcirculation & Lymphatics	Mat D	TM	
		11-12	Mid-Session Exam; Prac Grp A MatD; Grp B TBD	Mat D	TM, ML	
	Fri 5 <sup>th</sup> Jul	10-1	P - Exercise Physiology (A)	WW116	YB + staff	
		2-5	P - Exercise Physiology (B)	WW116	YB + staff	
6	Tue 9 <sup>th</sup> Jul	9-10	L - Autonomic Control of the Cardiovascular System	Mat D	LL	
	Wed 10 <sup>th</sup> Jul	9-11	L - Control of Blood Pressure	Mat D	TM	
	Fri 12 <sup>th</sup> July	10-1	P - Autonomic Control of the CVS	WW116	TM, ML, NL	
		2-5	P - Autonomic Control of the CVS	WW116	TM, ML, NL	
7	Tue 16 <sup>th</sup> Jul	9-10	L - Control of the Regional Circulations I	Mat D	TM	
	Wed 17 <sup>th</sup> Jul	9-10	L - Control of the Regional Circulations II	Mat D	TM	
		10-11	T - Review Unit Two	Mat D	TM	
	Fri 19 <sup>th</sup> Jul	10-1	PBL-2.1 'Michael Koval' A: Lib176A B: Lib176B, C: Mat313		TM, ML, TBC	
		2-5	PBL-2.1 'Michael Koval' D: Lib176A E: Lib176B, F: Mat313		TM, ML, TBC	
Unit Three	8	Tue 23 <sup>rd</sup> Jul	9-10	L - Heart Failure	Mat D	SYO
		Wed 24 <sup>th</sup> Jul	9-11	L - Hypertension	MatD	MM
		Fri 26 <sup>th</sup> Jul	10-1	P - Computer Lab: Isolated Heart Muscle and Cardiovascular Exercises	WW116	TM, ML, NL
			2-5	P - Computer Lab: Isolated Heart Muscle and Cardiovascular Exercises	WW116	TM, ML, NL
	9	Tue 30 <sup>th</sup> Jul	9-10	L - Cardiac Arrhythmia	MatD	JV
		Wed 31 <sup>st</sup> Jul	9-11	L - Atherosclerosis	MatD	BC
			11-12	L - Oxygen Radicals and Reperfusion Injury	MatD	NJ
		Fri 2 <sup>nd</sup> Aug	10-12	PBL-2.2 'Michael Koval' A: Lib176A B: Lib176B, C: Mat313		TM, ML, TBC
			2-4	PBL-2.2 'Michael Koval' D: Lib176A E: Lib176B, F: Mat313		TM, ML, TBC
	10	Tue 6 <sup>th</sup> Aug	9-10	L - Circulatory Shock	Mat D	TM
	Wed 7 <sup>th</sup> Aug	9-11	T - Review Unit Three	Mat D	TM	
	Fri 9 <sup>th</sup> Aug	10-1	Poster Presentations 'A'	WW116	Staff	
		2-5	Poster Presentations 'B'	WW116	Staff	

## LECTURERS AND TEACHING STAFF

BC	Dr Blake Cochran	ML	Dr Martin Le Nebelec	NL	Mr Nathan Luque
GI	Mr George Ivanov	MM	Prof. Margaret Morris	SS	Dr Shaun Sandow
JV	Prof Jamie Vandenberg	MaP	Dr Matt Perry	S-YO	Dr Sze-Yuan Ooi
KG	Dr Karen Gibson	MiP	A/Prof Michael Perry	TM	Dr Tim Murphy
LL	A/Prof Lu Liu	NJ	Dr Nicole Jones	YB	A/Prof Yati Boutcher