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# 1. PHSL 3211 CARDIOVASCULAR PHYSIOLOGY AND PATHOPHYSIOLOGY

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## COURSE OUTLINE

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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

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	55%
Mid-session Test	20%
Practical Exam	10%
Poster Presentation	10%
PBL	5%
Total	100%

*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.*

- **Final Examination**

The final examination will be composed of multiple-choice and short answer questions covering the entire course. In the case of failure, a post or supplementary exam will be made available only in exceptional circumstances .

- **Mid-Session Test**

The mid-session test on April 18<sup>th</sup> will be a brief test on the material covered to that point of the course

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only (not 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 M210 by 10AM on Thursday 24<sup>th</sup> May 2012.

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

**Possible Topics:**

1. Endothelium-mediated vasodilatation.
2. Conducted vasomotion.
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 cells.
7. Regulation of lymphatic (vaso) motion.
8. Physiology of “train high – perform low” training regimens.
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. Cellular adhesion in the cardiovascular system
15. Vascular remodelling.

Students will be assigned 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 and Exam**

There are four practical classes; Cardiac Muscle; Recording and Interpretation of the ECG; Exercise Physiology and the Autonomic Nervous System. Students will be examined on the findings of these practicals and the concepts explored in a 1-hour exam, which will consist of multiple-choice and short-answer questions.

- **Problem-Based Learning (PBL) Session**

Students will undertake self-directed learning using a case study or scenario 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, prior to each tutorial a work sheet will be provided. In addition, students are encouraged to collect and submit any questions relating to lecture material. Details of this process will be provided. Tutorials are expected to last between 60 and 90 minutes.

TIMETABLE 2012

	Wk	Date	Time	Activity (Lecture, Practical, Problem Based Learning)		Teacher	
Unit One	2	Tues 6 <sup>th</sup> Mar	2-4	L - Course Introduction / Endothelium	CLB4	TM/SS	
		Wed 7 <sup>th</sup> Mar	2-3	L- Gap Junctions	CLB3	SS	
		Thu 8 <sup>th</sup> Mar	10-12	PBL-1.1 'Joan Murray' A: Mat125, B: Mat312, C: Mat104		TM, GF, AC	
			2-4	PBL-1.1 'Joan Murray' D: MorvB G6, E: Mat104, F: Mat125		TM, GF, AC	
	3	Tues 13 <sup>th</sup> Mar	2-4	L - Cardiac Muscle	CLB4	TC	
		Wed 14 <sup>th</sup> Mar	2-3	L - Vascular Smooth Muscle: Electrophysiology	CLB3	TM	
		Thu 15 <sup>th</sup> Mar	10-1	P - Cardiac Muscle (A)	Bio329	TM, GF, Se	
			2-5	P - Cardiac Muscle (B)	Bio 329	TM, GF, Se	
	4	Tues 20 <sup>th</sup> Mar	2-4	L - Vascular Smooth Muscle: Mechanics and Signal Transduction	CLB4	TM	
Wed 21 <sup>st</sup> Mar		2-3	Tutorial - Unit One	CLB3	TM / on-line		
		Thu 22 <sup>nd</sup> Mar	10-12	PBL-1.2 'Joan Murray' A: Mat125, B: Mat312, C: Mat104		TM, GF, NM	
2-4			PBL-1.2 'Joan Murray' D: MorvB G6, E: Mat104, F: Mat125		TM, GF, FW		
Unit Two	5	Tues 27 <sup>th</sup> Mar	2-4	L - Haemodynamics	CLB4	MP	
		Wed 28 <sup>th</sup> Mar	2-3	L- Introduction to the ECG	CLB3	KG	
		Thur 29 <sup>th</sup> Mar	10-1	P- Recording and Interpretation of the ECG (A)	Bio329	KG, TM, Se	
			2-5	P- Recording and Interpretation of the ECG (B)	Bio329	KG, TM, Se	
	6	Tues 3 <sup>rd</sup> Apr	2-4	L- Microcirculation and Lymphatics	CLB4	TM	
		Wed 4 <sup>th</sup> Apr	2-3	L- Cardiovascular Regulation During Exercise	CLB3	SB	
		Thu 5 <sup>th</sup> Apr	10-1	P- Exercise Physiology (A)	Bio329	SB	
			2-5	P- Exercise Physiology (B)	Bio329	SB	
	6 <sup>th</sup> - 15 <sup>th</sup> April – MID-SESSION RECESS – MID-SESSION RECESS – MID-SESSION RECESS						
	7	Tues 17 <sup>th</sup> Apr	2-4	L - Control of Cardiac Output	CLB4	TM	
		Wed 18 <sup>th</sup> Apr	2-3	Mid-Session Test	CLB3	TM	
		Tues 24 <sup>th</sup> Apr	2-4	L - Control of Blood Pressure	CLB4	TM	
			Wed 25 <sup>th</sup> Apr	10-1	P - Computer Lab: Isolated Heart Muscle and Cardiovascular Exercises	Bio329	TM
	2-5	P - Computer Lab: Isolated Heart Muscle and Cardiovascular Exercises			Bio329	TM	
	9	Tues 1 <sup>st</sup> May	2-4	L - Autonomic Control of the Cardiovascular System	CLB4	LL	
		Thu 3 <sup>rd</sup> May	10-1	P - Autonomic Nervous System (A)	Bio329	TM, Se	
2-5			P - Autonomic Nervous System (B)	Bio329	TM, Se		
10	Tues 8 <sup>th</sup> May	2-4	L- Control of the Regional Circulations	CLB4	TM		
	Wed 9 <sup>th</sup> May	2-3	Practical Exam	CLB3	TM		
Unit Three	11	Tues 15 <sup>th</sup> May	2-4	L - Hypertension	CLB4	MM	
		Wed 16 <sup>th</sup> May	2-3	L- Gene Expression and Cardiovascular Disease	CLB3	LK	
		Thu 17 <sup>th</sup> May	10-12	Tutorial Unit Two (A)		TM / on-line	
			2-3	Tutorial Unit Two (B)		TM / on-line	
	12	Tues 22 <sup>nd</sup> May	2-4	L- Atherosclerosis	CLB4	MK	
		Wed 23 <sup>rd</sup> May	2-3	L - Circulatory Shock	CLB3	TM	
		Thu 24 <sup>th</sup> May	2-5	Poster Presentations (A & B)	Bio329	Staff	
13	Tues 29 <sup>th</sup> May	2-3	L- Heart Failure	CLB4	TC		
	Wed 30 <sup>th</sup> May	3-4	L- Oxygen Radicals and Reperfusion Injury	CLB4	NJ		
		2-3	Tutorial Unit Three	CLB3	TM / on-line		

**Lecturers and Teaching Staff**

GF Mr. George Fatseas  
 KG A/Prof. Karen Gibson  
 LK Prof. Levon Khachigian  
 MM Prof. Margaret Morris  
 MK Dr. Maaik Kockx  
 MP A/Prof. Michael Perry

MRB Mr. Matthew Rikard-Bell  
 NJ Dr. Nicole Jones  
 NM Dr. Nicole Marden  
 SB A/Prof. Steve Boutcher  
 SS Dr. Shaun Sandow  
 TC Prof. Terry Campbell  
 TM Dr. Tim Murphy

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