



BIOL247

Systems Physiology

S2 External 2014

Dept of Biological Sciences

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General Information

Unit convenor and teaching staff

Other Staff

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Unit Convenor

Julia Raftos

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E8A 207

contact academic

Credit points

3

Prerequisites

6cp(P) from ((BBE101 and BIOL108 and BIOL114 and BIOL115 and (PSY104 or PSYC104) and (PSY105 or PSYC105) and HLTH108 and HLTH109))

Corequisites

Co-badged status

Unit description

This unit considers the maintenance of body homeostasis. We investigate the cardiovascular system including an examination of the electrical and mechanical functions of the heart, its interaction with the blood vessels, and the hormones and the autonomic nervous system that control heart function. Next we study the role of the renal system in the control of the chemical composition of the body, water balance and body fluid volume. An overview of the respiratory and gastrointestinal systems will follow. Practical classes involve measuring physiological parameters such as blood pressure and electrical conduction through the heart (the ECG) in humans.

Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at <https://www.mq.edu.au/study/calendar-of-dates>

Learning Outcomes

On successful completion of this unit, you will be able to:

Explain how the cardiovascular, renal and respiratory systems contribute to the maintenance of homeostasis

Identify specific structural features of organ systems and explain how they underlie essential functions

Use equations describing physical, chemical and electrical principles to predict and interpret important physiological processes

Identify situations in which the integrated function of several organ systems interact to produce a coordinated response

Prepare written presentations based on evaluation of current scientific literature on topical issues in physiology

Carry out experiments using human subjects safely following protocols sanctioned by the Macquarie University Human Ethics Committee

Collect experimental data accurately and analyse, graph and apply statistical methods to allow interpretation of the results

Assessment Tasks

| Name | Weighting | Due |
|------------------------------|-----------|-------------|
| <u>Essay</u> | 15% | TBA |
| <u>Mini-test</u> | 5% | TBA |
| <u>Mid-semester test</u> | 10% | TBA |
| <u>Practical Assessments</u> | 10% | TBA |
| <u>Final exam</u> | 60% | Exam Period |

Essay

Due: **TBA**

Weighting: **15%**

The essay must be written in your own words and marks will be deducted for any plagiarism. The essay must be submitted electronically through Turnitin which is available on iLearn. The essay will be of 1,000 words (excluding the references) and the topic will be chosen from the list below. For references, I suggest you start with a text book or review article (secondary literature) to give you an overview of the field then you can move to experimental papers (primary literature). For your essay I would expect you to cite about 6-10 recent articles from books or refereed scientific journals. Postings on Web sites may only be used if they come from a reputable source (e.g., Heart Foundation, National Health and Medical Research Council).

The essay is due before the mid-semester break so I suggest you start on it immediately. If you

are having any problems with the essay please talk to your tutors. They are always available in the practical classes.

Remember that in answering the questions posed in each topic you must concentrate on physiological concepts.

Writing the essay

The first step is to choose a topic that interests you. This may involve selecting a few possible topics from the list on pg 11 and doing some preliminary reading.

The next step is to interpret the essay topic so that you understand exactly the questions to answer. We will use an essay about the drug Vioxx as an example.

The drug Vioxx was a very widely used anti-inflammatory drug until it was removed from the market when it was shown to increase the risk of heart attack. Explain *why Vioxx was developed* and *the proposed mechanism of its deleterious effects on the cardiovascular system*.

To search the literature for information relevant to the topic I usually use the databases “pubmed” or Science Direct (or both) and in many instances you will be able to download relevant articles from these sites.

From the available journal articles select 10 or 12 that appear to be most relevant and read through them to develop an overview of the topic and then select around 6-10 articles that are most pertinent.

Some of these articles will be reviews (secondary literature) and some should be reports of experimental studies (primary literature). In the case of Vioxx, reports of clinical trials would be important primary literature.

Read these articles carefully and make notes in *your own words* of their content.

You should then set out a preliminary plan using section headings (subheadings). The plan should organise the information into a coherent, logical sequence (telling the story). For the Vioxx essay it may look like this

Introduction

- Purpose of anti-inflammatory drugs
- Vioxx usage around the world
- (don't need state the contents of your essay because you only have 1000 words)

Body

- COX1 and COX2 inhibitors
- gastrointestinal damage
- COX2 selective inhibitors designed to reduce gastrointestinal effect
- Clinical trial identifies cardiovascular risks
- Effect of Vioxx on the cardiovascular system

Conclusion

- Inherent risks with systemic drugs

Check over your subheadings to make sure that you are answering the questions posed in the title. Using your notes complete each of your sections. Your purpose here is to interpret the data and explain it in simple, clear English. When you have trouble expressing a concept it is often because you don't really understand it yourself.

If a diagram will help the reader's understanding include it.

Once you have completed your first draft, read it through carefully and be prepared to make major changes if necessary. I suggest you read it through to a friend to see if it makes sense to them.

Editing the draft is best done on a hard copy, not the screen and you should check the relevance of the material you have included and the coherence and logic of each paragraph and the essay as a whole. All the time you should be considering whether you have answered the questions posed in the topic. Check the spelling and grammar. Try and keep the sentences short, remove technical jargon where possible and choose familiar, simple words rather than long, complicated or unusual ones.

Citing and the reference list

The source of all statements and diagrams obtained from the literature must be cited. The reference list only contains the articles that you have actually cited in the essay. Citations and the reference list **must** be in Harvard Style. For more information go to

[www.bio.mq.edu.au/files/Harvard%20Referencing%20System%202012\(5\).pdf](http://www.bio.mq.edu.au/files/Harvard%20Referencing%20System%202012(5).pdf)

Layout

Please type the essay in 12pt, double spaced and with a 4-5 cm left hand margin and don't forget to keep a copy for yourself.

Submission

All students must submit their essays to **Turnitin**. There is a link to Turnitin under assessment in iLearn for BIOL247.

Requests for extensions should be made to Julia Raftos. Extensions will be considered on an individual basis.

Essay Topics

1. Barker's hypothesis states that low birth weight babies have an increased risk of developing diabetes mellitus, hypertension and heart disease in the future. What evidence led to the formulation of this hypothesis and through what mechanism(s) is it thought to occur.
1. The development of atherosclerosis is considered a critical risk factor in coronary heart

disease. Review the risk factors (such as hypertension, abnormal blood lipids, smoking) and proposed mechanisms of atheroma development.

1. ACE inhibitors and angiotensin II receptor blockers are two of the newer anti-hypertension drugs. Compare and contrast their mechanisms of action, their beneficial effects and their side effects.
1. Neonatal respiratory distress syndrome is due partially to the lack of surfactant in the lungs of preterm babies. Explain how surfactant works and current and future treatment of this syndrome.
1. The aquaporin water channel was only identified recently. Review how it was discovered, its structures and its role in the disease diabetes insipidus.
1. Statins are used to treat patients with coronary heart disease. How do statins work and why are they considered so beneficial for people with heart disease.
1. What are the proposed benefits of ensuring that most of the carbohydrates in the diet have a low glycemic index?

On successful completion you will be able to:

- Prepare written presentations based on evaluation of current scientific literature on topical issues in physiology

Mini-test

Due: **TBA**

Weighting: **5%**

Mini-test on first 6 lectures and the first two pracs. For this test there will be 20 multiple choice questions and the test will be held in your usual practical session.

On successful completion you will be able to:

- Explain how the cardiovascular, renal and respiratory systems contribute to the maintenance of homeostasis
- Identify specific structural features of organ systems and explain how they underlie essential functions
- Use equations describing physical, chemical and electrical principles to predict and interpret important physiological processes

Mid-semester test

Due: **TBA**

Weighting: **10%**

This test will include 30 multiple choice questions to be completed in 40 minutes. All the cardiovascular section (lectures 1-12) and the areas covered in the first two practical classes will be examined.

On successful completion you will be able to:

- Explain how the cardiovascular, renal and respiratory systems contribute to the maintenance of homeostasis
- Identify specific structural features of organ systems and explain how they underlie essential functions
- Use equations describing physical, chemical and electrical principles to predict and interpret important physiological processes
- Identify situations in which the integrated function of several organ systems interact to produce a coordinated response

Practical Assessments

Due: **TBA**

Weighting: **10%**

There are two assignments that are linked to the practical classes. The questions are included in your practical manual. These assignments should be completed and handed in to your tutor during your practical class.

No. Test Weight Due Date for external students 1 Questions on the effect of posture on BP and heart rate 5% TBA 2 Digestion questions 5% TBA

On successful completion you will be able to:

- Explain how the cardiovascular, renal and respiratory systems contribute to the maintenance of homeostasis
- Identify specific structural features of organ systems and explain how they underlie essential functions
- Use equations describing physical, chemical and electrical principles to predict and interpret important physiological processes
- Identify situations in which the integrated function of several organ systems interact to produce a coordinated response
- Carry out experiments using human subjects safely following protocols sanctioned by the Macquarie University Human Ethics Committee

- Collect experimental data accurately and analyse, graph and apply statistical methods to allow interpretation of the results

Final exam

Due: **Exam Period**

Weighting: **60%**

The exam is a three hour paper 33% of the marks will be for multiple choice questions, and the rest from short answer questions (a paragraph or dot points or a diagram). There will be some choice for the short answer questions.

On successful completion you will be able to:

- Explain how the cardiovascular, renal and respiratory systems contribute to the maintenance of homeostasis
- Identify specific structural features of organ systems and explain how they underlie essential functions
- Use equations describing physical, chemical and electrical principles to predict and interpret important physiological processes
- Identify situations in which the integrated function of several organ systems interact to produce a coordinated response

Delivery and Resources

CLASSES

There will be two lectures each week and one practical class or tutorial session. Lectures are at 12 pm on Mondays in the P.G.Price Theatre and 5 pm on Wednesdays in the Mason Theatre. Pracs are at 2pm on Tuesdays and 10 am and 2 pm on Wednesday in F7B 102, 105 and 110.

Practical sessions for external students will be held on Saturday 30 & Sunday 31 August and on Thursday and Friday the 25 & 26 of September.

REQUIRED AND RECOMMENDED TEXTS AND/OR MATERIALS

A practical manual and book of lecture graphics for Biol 247 are available in the Co-op Bookshop. The textbook for this unit is "Principals of Human Physiology" 4th edition by Cindy L Stanfield, published in 2011 by Pearson. Other physiological texts of a similar standard may also be suitable.

UNIT WEBPAGE AND TECHNOLOGY USED AND REQUIRED

Students are expected to have access to a computer with online facilities, an attached printer,

with software including Adobe reader, Microsoft Office Word, Powerpoint and Excel.

Your iLearn site will contain the Unit Outline, Lecture Graphics, the text of the lectures, a link to ECHO 360 (previously known as iLectures), practical notes, an announcements area, and other information to help you complete the unit. Later, practice tests and assignment marks will be added. Please check this site regularly.

Unit Schedule

Lecture Timetable 2014

| Week | Lecture |
|------|--|
| 1 | 1. Overview of the cardiovascular system |
| | 2. Electrical activity of the heart |
| 2 | 3. Generation of the heartbeat |
| | 4. Regulation of contraction of cardiac muscle |
| 3 | 5. Physics of the circulation |
| | 6. Components of the circulation and their specific functions |
| 4 | 7. Function of the microcirculation/Control of blood flow |
| | 8. Regulation of cardiac output |
| 5 | 9. Short term regulation of the arterial blood pressure |
| | 10. Structure and function of the renal system |
| 6 | 11. Production of urine by the nephron |
| | 12. Excretion as the outcome of filtration, reabsorption and secretion |
| 7 | 13. Water balance: The control of ECF osmolarity |
| | 14. Sodium balance : The control of the ECF volume and blood pressure |

Study break: 22/9/14 – 3/10/14

| | |
|---|--|
| 8 | Labour Day public holiday |
| | 15. Structure and function of the respiratory system |

| | |
|----|--|
| 9 | 16. The process of breathing |
| | 17. Alveolar ventilation and perfusion |
| 10 | 18. Gas exchange and the carriage of O ₂ and CO ₂ in the blood |
| | 19. Control of respiration |
| 11 | 20. Nutrition |
| | 21. Function and organisation of the gastrointestinal system |
| 12 | 22. Motility of the gastrointestinal system |
| | 23. Secretion in the gastrointestinal system |
| 13 | 24. Digestion and absorption of food |
| | no lecture |

External Students Practical Timetable 2014

External students will attend practical classes on 30 & 31 of August and the 25 & 26 of September. The classes start promptly at 9.00 am and will be held in F7B 105 and 110.

There will be a three hour “feedback, revision and review” sessions run in November if required. Alternatively, external students can come to any of the internal revision sessions in week 12.

| Saturday 30/8 | Thursday 25/9 |
|--|---|
| Introduction | Test on cardiovascular and renal systems (mcq) (L1-12) |
| Langendorff heart DVD | Body compartments tutorial questions |
| Cardiovascular system and the effect of posture on heart rate and blood pressure | PhysioEx interactive laboratory “Renal System Physiology” |
| Tutorial on the effect of posture on the cardiovascular system | Nutrition prac (food diaries) |
| Sunday 31/8 | Friday 26/9 |

| | |
|------------------------------|-----------------------------|
| The electrocardiogram (ECG) | Digestion prac |
| MCQ test on first 6 lectures | Review of mid-semester test |

Attendance and participation in practical sessions is **compulsory**.

Please note that in order to pass this unit, all assessment tasks must be completed and you must pass the final exam.

For external students, the mid-semester test on the cardiovascular and renal systems, which is worth 10% of the marks, is on Thursday, 25th September.

If you have any questions or difficulties during the semester please do not hesitate to contact Julia by email (preferred) or come and see me.

Assessment

Assignment due dates for internal and external students

| | | % total mark | Linked Learning Outcomes | Date for internal students | Date for external students |
|---|---|--------------|--------------------------|--------------------------------|----------------------------|
| 1 | Essay | 15 | 5 | 12/9/2014 | 12/9/2014 |
| 2 | Mini-test on first 6 lectures | 5 | 1,2,3 | Week 4 in your practical class | 30/8/2014 |
| 3 | Mid-semester test on cardiovascular and renal systems | 10 | 1,2,3,4 | Week 7 in your practical class | 25/9/2014 |
| 5 | Online quiz on The effect of posture on BP and heart rate practical | 5 | 1,2,4,7 | Week 6 | Week 6 |
| 7 | Online quiz on the Digestion practical | 5 | 6,7 | Week 11 | Week 11 |
| 8 | Final exam | 60 | 1,2,3,4 | Exam period | |

Attendance and participation in practical sessions is compulsory and assessable.

Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central](#).

Students should be aware of the following policies in particular with regard to Learning and Teaching:

Academic Honesty Policy http://mq.edu.au/policy/docs/academic_honesty/policy.html

Assessment Policy <http://mq.edu.au/policy/docs/assessment/policy.html>

Grading Policy <http://mq.edu.au/policy/docs/grading/policy.html>

Grade Appeal Policy <http://mq.edu.au/policy/docs/gradeappeal/policy.html>

Grievance Management Policy http://mq.edu.au/policy/docs/grievance_management/policy.html

Disruption to Studies Policy http://www.mq.edu.au/policy/docs/disruption_studies/policy.html *The Disruption to Studies Policy is effective from March 3 2014 and replaces the Special Consideration Policy.*

In addition, a number of other policies can be found in the [Learning and Teaching Category](#) of Policy Central.

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: https://students.mq.edu.au/support/student_conduct/

Student Support

Macquarie University provides a range of support services for students. For details, visit <http://students.mq.edu.au/support/>

Learning Skills

Learning Skills (mq.edu.au/learningskills) provides academic writing resources and study strategies to improve your marks and take control of your study.

- [Workshops](#)
- [StudyWise](#)
- [Academic Integrity Module for Students](#)
- [Ask a Learning Adviser](#)

Student Services and Support

Students with a disability are encouraged to contact the [Disability Service](#) who can provide appropriate help with any issues that arise during their studies.

Student Enquiries

For all student enquiries, visit Student Connect at ask.mq.edu.au

IT Help

For help with University computer systems and technology, visit <http://informatics.mq.edu.au/help/>.

When using the University's IT, you must adhere to the [Acceptable Use Policy](#). The policy applies to all who connect to the MQ network including students.

Graduate Capabilities

Capable of Professional and Personal Judgement and Initiative

We want our graduates to have emotional intelligence and sound interpersonal skills and to demonstrate discernment and common sense in their professional and personal judgement. They will exercise initiative as needed. They will be capable of risk assessment, and be able to handle ambiguity and complexity, enabling them to be adaptable in diverse and changing environments.

This graduate capability is supported by:

Learning outcomes

- Carry out experiments using human subjects safely following protocols sanctioned by the Macquarie University Human Ethics Committee
- Collect experimental data accurately and analyse, graph and apply statistical methods to allow interpretation of the results

Assessment tasks

- Essay
- Practical Assessments
- Final exam

Commitment to Continuous Learning

Our graduates will have enquiring minds and a literate curiosity which will lead them to pursue knowledge for its own sake. They will continue to pursue learning in their careers and as they participate in the world. They will be capable of reflecting on their experiences and relationships with others and the environment, learning from them, and growing - personally, professionally and socially.

This graduate capability is supported by:

Assessment task

- Essay

Discipline Specific Knowledge and Skills

Our graduates will take with them the intellectual development, depth and breadth of knowledge,

scholarly understanding, and specific subject content in their chosen fields to make them competent and confident in their subject or profession. They will be able to demonstrate, where relevant, professional technical competence and meet professional standards. They will be able to articulate the structure of knowledge of their discipline, be able to adapt discipline-specific knowledge to novel situations, and be able to contribute from their discipline to inter-disciplinary solutions to problems.

This graduate capability is supported by:

Learning outcomes

- Explain how the cardiovascular, renal and respiratory systems contribute to the maintenance of homeostasis
- Identify specific structural features of organ systems and explain how they underlie essential functions
- Use equations describing physical, chemical and electrical principles to predict and interpret important physiological processes
- Identify situations in which the integrated function of several organ systems interact to produce a coordinated response
- Carry out experiments using human subjects safely following protocols sanctioned by the Macquarie University Human Ethics Committee

Assessment tasks

- Essay
- Mini-test
- Mid-semester test
- Practical Assessments
- Final exam

Critical, Analytical and Integrative Thinking

We want our graduates to be capable of reasoning, questioning and analysing, and to integrate and synthesise learning and knowledge from a range of sources and environments; to be able to critique constraints, assumptions and limitations; to be able to think independently and systemically in relation to scholarly activity, in the workplace, and in the world. We want them to have a level of scientific and information technology literacy.

This graduate capability is supported by:

Learning outcomes

- Use equations describing physical, chemical and electrical principles to predict and interpret important physiological processes
- Identify situations in which the integrated function of several organ systems interact to

produce a coordinated response

- Prepare written presentations based on evaluation of current scientific literature on topical issues in physiology
- Collect experimental data accurately and analyse, graph and apply statistical methods to allow interpretation of the results

Assessment tasks

- Essay
- Mini-test
- Mid-semester test
- Practical Assessments
- Final exam

Problem Solving and Research Capability

Our graduates should be capable of researching; of analysing, and interpreting and assessing data and information in various forms; of drawing connections across fields of knowledge; and they should be able to relate their knowledge to complex situations at work or in the world, in order to diagnose and solve problems. We want them to have the confidence to take the initiative in doing so, within an awareness of their own limitations.

This graduate capability is supported by:

Learning outcomes

- Use equations describing physical, chemical and electrical principles to predict and interpret important physiological processes
- Identify situations in which the integrated function of several organ systems interact to produce a coordinated response
- Collect experimental data accurately and analyse, graph and apply statistical methods to allow interpretation of the results

Assessment tasks

- Essay
- Mini-test
- Mid-semester test
- Practical Assessments
- Final exam

Creative and Innovative

Our graduates will also be capable of creative thinking and of creating knowledge. They will be imaginative and open to experience and capable of innovation at work and in the community. We

want them to be engaged in applying their critical, creative thinking.

This graduate capability is supported by:

Learning outcome

- Prepare written presentations based on evaluation of current scientific literature on topical issues in physiology

Assessment tasks

- Essay
- Mid-semester test
- Practical Assessments
- Final exam

Effective Communication

We want to develop in our students the ability to communicate and convey their views in forms effective with different audiences. We want our graduates to take with them the capability to read, listen, question, gather and evaluate information resources in a variety of formats, assess, write clearly, speak effectively, and to use visual communication and communication technologies as appropriate.

This graduate capability is supported by:

Learning outcomes

- Prepare written presentations based on evaluation of current scientific literature on topical issues in physiology
- Carry out experiments using human subjects safely following protocols sanctioned by the Macquarie University Human Ethics Committee
- Collect experimental data accurately and analyse, graph and apply statistical methods to allow interpretation of the results

Assessment tasks

- Essay
- Practical Assessments
- Final exam

Changes since First Published

| Date | Description |
|------------|--|
| 01/08/2014 | Class times and external dates have been updated |