BIOL206

Genetics

S1 Day 2019

Dept of Biological Sciences

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General Information

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Unit Convenor

Associate Professor
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Credit points
3

Prerequisites
BIOL115 and (BIOL114 or BIOL116 or BIOL108)

Corequisites
STAT170 or STAT171

Co-badged status
BIOL604

Unit description
Genetics occupies a central role in modern sciences, with profound implications for basic and applied research in biology, medicine and agriculture, as well as for a number of philosophical issues in human affairs. This unit offers a balanced approach to teach introductory principles of genetics. It combines sections on classical, molecular and population genetics presented in an integrative way. The practical sessions offer students the possibility of learning essential techniques and skills in modern molecular genetics.

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:

Describe how genetic processes apply to agriculture, human health, society, and the

environment

Apply numeracy and basic principles of genetics to solve problems and draw conclusions from genetic data

Describe routine techniques used to assay genetic variation in populations

Demonstrate proficiency in the use of genetic research tools (pipettes, gel electrophoresis, sequence analysis)

Analyse genetic data using some common population genetic software and bioinformatic tools

Source and critically evaluate appropriate primary scientific literature

Synthesise and present information from the literature in written and oral formats

General Assessment Information

General Assessment Information

To achieve a pass in BIOL206, you must obtain at least 45% on the final exam, and the total of your exam marks and in semester assignments must equal 50% or above. A **hurdle requirement** is an activity for which a minimum level of performance or participation is a condition of passing a unit. In BIOL206 the final exam is the hurdle assessment and the university has stipulated that if you have made a serious attempt, but failed to pass a hurdle requirement, you will be given a second chance to attain a passing grade. The pass mark for the final exam is 45%. Students who have a mark of 35 to 44% will be able to sit the exam again. The exam papers for the first and second attempts will be the same in style (i.e. multiple choice and short answer questions), but the actual questions will be different.

Assessment Tasks

Name	Weighting	Hurdle	Due
Problem Sets	5%	No	Weeks 3, 4, 6, 8 & 9
Test	10%	No	Week 11
Seminar Poster	10%	No	26 April
Practical Report	20%	No	26 April
Final Exam	55%	Yes	Exam Period

Problem Sets

Due: **Weeks 3, 4, 6, 8 & 9**
Weighting: **5%**

The problem sets are designed to assist you to understand topics covered in the course and to

provide you with feedback on your understanding of those topics. It is essential that you do complete the problem sets as the test and the final examination will cover similar topics to the problems. We will go through the problem sets during the practicals. Answers to the problem sets will be found on the unit's web page one week after the problem sets due date.

Problem sets are to be brought to your practical/tutorial classes.

Students doing their practicals externally should hand in problem sets according to the external assessment schedule. If a good attempt is made at each of the problem sets (that are to be handed in) then 1 mark will be awarded for each. This will make up 5% of the final assessment. We also recommend that you attempt the problems at the end of the relevant chapters in your textbook. It contains solved problems and answers to selected problems.

On successful completion you will be able to:

- Apply numeracy and basic principles of genetics to solve problems and draw conclusions from genetic data

Test

Due: **Week 11**
Weighting: **10%**

Your progress during the unit will also be assessed with a test in **week 11, in your practical session (23th or 24th May).** The test is worth 10% of the unit's assessment. The test will focus mostly on topics covered during the lectures and are based on 35 multiple choice questions and 7 short answers. Students have up to one hour and 20 minutes to finish the test. This test will require application of genetic principles to solve problems and an ability to describe genetic processes and techniques.

On successful completion you will be able to:

- Describe how genetic processes apply to agriculture, human health, society, and the environment
- Apply numeracy and basic principles of genetics to solve problems and draw conclusions from genetic data
- Describe routine techniques used to assay genetic variation in populations

Seminar Poster

Due: **26 April**

Weighting: **10%**

You are required to design and present a conference poster (design as a powerpoint slide) to your tutorial group on almost any aspect of genetics that you find exciting. Don't panic. Being able to talk is essential in almost any job and it is far better to learn the art in front of a group of friendly biologists than anywhere else. You will have 3 minutes to present your poster and 2 minutes for questions.

You must email your PowerPoint presentation as an attachment to the specified email address by **10am, Friday the 26th April (internal students).** The email address will be provided closer to the due date. Make sure the file name of your presentation contains your surname and practical session day and time, e.g. "Smith_MonAM" (IMPORTANT: also make this the subject line of the email). Please use PowerPoint (avoid tif. files for images) and also bring your presentation on a USB key as back up. It is your responsibility to ensure the presentation is emailed to correct email address by the due date – we will not be chasing you up for it!

Useful places to begin searching for information on your topic are the following.

1. **Trends in Ecology and Evolution**
2. **Science**
3. **Nature**
4. **New Scientist**
5. **Scientific American**

Content: Choose an interesting topic and try to convey as much enthusiasm to your audience as possible. State the main points of the topic in a clear and concise manner and attempt to construct your own tables and figures, rather than taking from internet or using unreadable photocopies from papers. Make sure that there is a simple take home message.

Presentation: Write clearly and don't put too much information, illustrations may be a more effective way to impart information and be as creative as you like with the design. You will need a heading and for text, write few lines with large print in point form rather than in sentences. Address your audience and stand back from the projector making sure that the audience has a clear view of the screen. Do not read from a transcript and use the poster as a reminder for the major points you wish to get across.

Assessment (10% of unit's assessment): The grade of your poster assessment will be based on content and presentation and involves peer evaluation. The overall mark is calculated as

follows: 30% is based on the mean of the students' marks in the class, 70% of the final mark is based on the tutors' mark.

We need two practical sessions to include everyone's posters and you are expected to attend, participate in discussions and mark both poster sessions.

On successful completion you will be able to:

- Describe how genetic processes apply to agriculture, human health, society, and the environment
- Describe routine techniques used to assay genetic variation in populations
- Source and critically evaluate appropriate primary scientific literature
- Synthesise and present information from the literature in written and oral formats

Practical Report

Due: **26 April**
Weighting: **20%**

A major component of *BIOL206 Genetics* is the preparation of a practical report. This practical report should be presented in the style of a scientific publication and describe the procedures and results of a series of three week practicals.

The report has a forensics type focus in that you will receive an unknown tissue sample and you need to identify the species from which it came. In the process of identifying your sample, you will learn essential skills, including: how to isolate DNA, visualize DNA using gel electrophoresis, perform PCR amplification, and sequence a mitochondrial gene. Students will then identify their unknown sample by comparing their sequences with those available in the DNA sequence databases. After this is done, we will align all the DNA sequences collected and build a phylogenetic tree as a complementary method for species identification.

It is highly recommended that you access the library and browse through relevant journals to familiarize yourself with setting out and general structure of scientific papers before you commence writing your report. We will also discuss the structure of your paper during class. Please do not underestimate the time requirement for this exercise. It is recommended that you start drafting your paper at the commencement of the '*from tissue to species identification*' DNA practical series.

Specific guidelines about preparing your practical report will be posted on iLearn.

The practical report is worth 20% of your total unit assessment and should be between 2,000 and 3,000 words (text only, do not include references and tables in your word count).

Submission of Report:

Assignments must be submitted electronically.

Practical Report: due at 10am via ONLINE SUBMISSION ONLY. The link for submission, via Turnitin, is called "Practical Report submission" and is under "Assessments at a Glance" on the iLearn page. Please save your assignment in one file as a .doc or .docx, and you can upload it there. Please remember the word limit is 2000-3000 words, and it must be referenced in Harvard style - look at a recent article from the journal *Molecular Ecology* for an idea of referencing style, although you should for this assignment list all paper authors in the reference list.

If you need assistance, please contact Student IT Help (02 9850 4357). If you have any questions about privacy, security or these procedures, please contact the Coordinator, Copyright and Digital Asset Management (02 9850 7578)

Please note:

MARKS (10% per day) WILL BE DEDUCTED FOR LATE ASSIGNMENTS

PLAGIARISM: THE REPORT MUST BE YOUR OWN WORK AND PLAGIARISM WILL NOT BE TOLERATED

Please follow this link for further information on plagiarism

Extensions and penalties

10% of the mark allocated for the assignment may be deducted per day that any work is submitted late.

The deadlines for assignments are not negotiable. Only a medical certificate or a letter with appropriate supporting documents outlining other serious, extenuating circumstances can be

used to submit an assignment after the due date without penalty. All applications for special consideration or extension must be sought *before the due date* unless this is absolutely impossible. **All applications for extensions of deadlines must be submitted to the unit convenor.**

On successful completion you will be able to:

- Describe routine techniques used to assay genetic variation in populations
- Demonstrate proficiency in the use of genetic research tools (pipettes, gel electrophoresis, sequence analysis)
- Analyse genetic data using some common population genetic software and bioinformatic tools
- Source and critically evaluate appropriate primary scientific literature
- Synthesise and present information from the literature in written and oral formats

Final Exam

Due: **Exam Period**
Weighting: **55%**
This is a hurdle assessment task (see assessment policy for more information on hurdle assessment tasks)

The final exam is comprised of multiple choice and short answer questions which will require problem solving and knowledge of genetic processes and techniques. Students will be tested on their knowledge of course content. The exam will include information from lectures, prac classes and assessment tasks up to and including week 13.

This is a hurdle assessment task (see General Assessment Information below, and assessment policy for more information on hurdle assessment tasks). Exam conditions will be as for the mid-semester test. The date for your final exam will be available later in the semester. The pass mark for the final exam is 45%.

On successful completion you will be able to:

- Describe how genetic processes apply to agriculture, human health, society, and the environment
- Apply numeracy and basic principles of genetics to solve problems and draw conclusions from genetic data
- Describe routine techniques used to assay genetic variation in populations

Delivery and Resources

REQUIRED AND RECOMMENDED TEXTS AND/OR MATERIALS

Text Book

- Peirce (2017). Genetics: A conceptual Approach (6th Edition). W.H. Freeman and Company, New York.

Other Major References

General Genetics

- Griffiths, A. J. F., Wessler, S. R., Lewontin R. C., Gelbart W. M., Suzuki, D. T., Miller, J.H. (2015). An Introduction to Genetic Analysis (11th Edition) W. H. Freeman, New York.

Population and Molecular Evolutionary Genetics

- Avise, J. C. (2004). Molecular Markers, Natural History and Evolution. Sinauer, New York.
- Frankham, R., Ballou, J. D. and Briscoe D. A. (2002) Introduction to Conservation Genetics. Cambridge University Press, Cambridge, UK.
- Hartl, D. L. and Clark, A. G. (1997) Principles of Population Genetics (3rd Edition) Sinauer Assoc. Massachusetts.

Problems

- Price H.J. (2000) Study Guide and Problems Workbook for Principles of Genetics (2nd Edition). John Wiley & Sons, New York.
- Thompson, J. N., Hellack, J. J., Braver, G. and Durica, D. S. (1997). Primer of genetic analysis. A problems approach. Cambridge University Press, Cambridge.

UNIT WEBPAGE AND TECHNOLOGY USED AND REQUIRED

BIOL 206 on iLearn

Access Web Address: https://ilearn.mq.edu.au/login/MQ/

More information on this system can be found at the following site: http://www.mq.edu.au/iLearn/student_info/

iLearn provides **essential** information on various aspects of the unit, including practical guides, various notes, material required for practical reports, and general information about the unit. Students should visit our web site on a weekly basis. Lecture notes and audio are available via Echo360.

If you are having trouble accessing your online unit due to a disability or health condition, please go to the Student Services Website at http://sss.mq.edu.au/equity/about for information on how to get assistance.

If you are having problems logging on, If you cannot log in after ensuring you have entered your username and password correctly, you should contact Student IT Help, Phone: (02) 9850 4357 (in Sydney) or 1 800 063 191 (outside Sydney).

Unit Schedule

Lecture Schedule – 2019

Two lectures per week

Wednesdays 9am-10am in Lotus Theatre (27 Wallys Walk) AND Thursdays 11am-12pm in Mason Theatre (14 Sir Christopher Ondaatje Ave)

Lecture	Date		Topic
1	Feb	27	Introduction
2	Feb	28	Basic Revision 1: Genetics and the Organism
3	March	6	Basic Revision 2: Sex and Reproduction
4	March	7	Mendelian Genetics
5	March	13	Sex determination and Patterns of Inheritance
6	March	14	Allelic variation and gene function
7	March	20	Linkage and Crossing Over
8	March	21	Chromosome Number and Structure
9	March	27	Central Dogma 1
10	March	28	Central Dogma 2
11	April	3	Mutation and DNA repair
12	April	4	Molecular Techniques 1
13	April	10	Molecular Techniques 2
14	April	11	**No lecture scheduled**
Mid-Semester Break			
15	May	1	Population Genetics
16	May	2	Genetics of Human Behavior
17	May	8	Inbreeding and Inbreeding Depression
18	May	9	Conservation Genetics
19	May	15	Evolutionary Genetics

20	May	16	Quantitative Genetics
21	May	22	Reflecting on a successful career in Science
22	May	23	Human Genetics
23	May	29	Technological Advances
24	May	30	Revision

Internal Students Practical Schedule - 2019

Week	Date	Practical/Tutorial
1	28 Feb & 1 March	**NO PRACTICAL/TUTORIAL**
2	7 & 8 March	DNA Extractions & PCR
3	14 & 15 March	DNA Sequence Alignment and Data Analysis
4	21 & 22 March	Hardy-Weinberg Equilibrium - single locus
5	28 & 29 March	Hardy-Weinberg Equilibrium - population level
6	4 & 5 April	Bioinformatics - SNPs
7	11 & 12 April	**NO PRACTICAL /TUTORIAL**
Mid Semester Break		
8	2 & 3 May	Poster session I
9	9 & 10 May	Poster session 2
10	16 & 17 May	Revision questions
11	23 & 24 May	Test
12	30 & 31 May	Test Revision
13	6 & 7 June	**NO PRACTICAL/TUTORIAL**

Internal Assessment Schedule (2019)

Week	Assessment
3	Problem Set 1 Due
4	Problem Set 2 Due
6	Problem Set 3 Due
Break	Poster power point file due
Break	Practical Report Due
8	Poster session I, Problem Set 4 Due

9	Poster session II, Problem Set 5 Due
11	Test
Exam Period	Final exam

EXTERNAL STUDENTS

External Students Practical Schedule - 2019

First On-Campus Session

Saturday March 16, 9.00 am (E8A150)

DNA Prac I - extraction

Review problem sets 1 - 2

DNA Prac II - PCR, Electrophoresis

Finish ~ 6:00pm

Sunday March 17, 9.00 am (E8A 150)

HWE pracs 1 and 2

DNA Prac III - Sequence alignment and data analysis, guidance on report writing

Finish ~ 6.00 pm

Second On-Campus Session

Saturday April 13, 9.00am (E8A 150)

Bioinformatics - SNPs

Review problem set 3, 4 & 5

Finish ~6:00pm

Third On-Campus Session

Saturday May 25, 9.00 am (E8A 150)

All student posters

Revision Questions

Finish ~6:00pm

Sunday May 26, 9.00 am (E8A 150)

Revision Questions

Test

Finish ~ 2:00 pm

External Assessment Schedule (2019)

Date	Assessment
Saturday 16 March	Problem Sets 1 & 2 Due
Saturday 13 April	Problem Sets 3 - 5 Due
Thursday 23 May	Poster power point file due
Saturday 25 May	Poster presentation (on campus session)
Friday 26 April	Practical Report Due
Sunday May 26	Test
Exam Period	Final exam

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- Academic Appeals Policy
- Academic Integrity Policy
- Academic Progression Policy
- Assessment Policy
- Fitness to Practice Procedure
- Grade Appeal Policy
- Complaint Management Procedure for Students and Members of the Public
- Special Consideration Policy *(**Note:** The Special Consideration Policy is effective from 4 December 2017 and replaces the Disruption to Studies Policy.)*

Undergraduate students seeking more policy resources can visit the Student Policy Gateway (https://students.mq.edu.au/support/study/student-policy-gateway). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

If you would like to see all the policies relevant to Learning and Teaching visit Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/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/study/getting-started/student-conduct

Results

Results published on platform other than eStudent, (eg. iLearn, Coursera etc.) or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in eStudent. For more information visit ask.mq.edu.au or if you are a Global MBA student contact globalmba.support@mq.edu.au

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

If you are a Global MBA student contact globalmba.support@mq.edu.au

IT Help

For help with University computer systems and technology, visit http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/.

When using the University's IT, you must adhere to the Acceptable Use of IT Resources Policy. The policy applies to all who connect to the MQ network including students.

Graduate Capabilities

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 outcomes

- Describe how genetic processes apply to agriculture, human health, society, and the environment
- Apply numeracy and basic principles of genetics to solve problems and draw conclusions from genetic data
- Analyse genetic data using some common population genetic software and bioinformatic tools
- Source and critically evaluate appropriate primary scientific literature
- Synthesise and present information from the literature in written and oral formats

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

- Describe routine techniques used to assay genetic variation in populations
- Demonstrate proficiency in the use of genetic research tools (pipettes, gel electrophoresis, sequence analysis)
- Source and critically evaluate appropriate primary scientific literature
- Synthesise and present information from the literature in written and oral formats

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:

Learning outcomes

- Describe routine techniques used to assay genetic variation in populations

- Demonstrate proficiency in the use of genetic research tools (pipettes, gel electrophoresis, sequence analysis)
- Analyse genetic data using some common population genetic software and bioinformatic tools

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

- Describe how genetic processes apply to agriculture, human health, society, and the environment
- Apply numeracy and basic principles of genetics to solve problems and draw conclusions from genetic data
- Describe routine techniques used to assay genetic variation in populations
- Demonstrate proficiency in the use of genetic research tools (pipettes, gel electrophoresis, sequence analysis)
- Analyse genetic data using some common population genetic software and bioinformatic tools
- Source and critically evaluate appropriate primary scientific literature
- Synthesise and present information from the literature in written and oral formats

Assessment tasks

- Problem Sets
- Test
- Seminar Poster
- Practical Report
- 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

- Describe how genetic processes apply to agriculture, human health, society, and the environment
- Apply numeracy and basic principles of genetics to solve problems and draw conclusions from genetic data
- Analyse genetic data using some common population genetic software and bioinformatic tools
- Source and critically evaluate appropriate primary scientific literature
- Synthesise and present information from the literature in written and oral formats

Assessment tasks

- Test
- Seminar Poster
- Practical Report
- 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

- Describe how genetic processes apply to agriculture, human health, society, and the environment
- Apply numeracy and basic principles of genetics to solve problems and draw conclusions from genetic data
- Describe routine techniques used to assay genetic variation in populations
- Demonstrate proficiency in the use of genetic research tools (pipettes, gel electrophoresis, sequence analysis)
- Analyse genetic data using some common population genetic software and bioinformatic tools

- Source and critically evaluate appropriate primary scientific literature
- Synthesise and present information from the literature in written and oral formats

Assessment tasks

- Problem Sets
- Test
- 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 outcome

- Synthesise and present information from the literature in written and oral formats

Assessment tasks

- Seminar Poster
- Practical Report

Engaged and Ethical Local and Global citizens

As local citizens our graduates will be aware of indigenous perspectives and of the nation's historical context. They will be engaged with the challenges of contemporary society and with knowledge and ideas. We want our graduates to have respect for diversity, to be open-minded, sensitive to others and inclusive, and to be open to other cultures and perspectives: they should have a level of cultural literacy. Our graduates should be aware of disadvantage and social justice, and be willing to participate to help create a wiser and better society.

This graduate capability is supported by:

Learning outcome

- Describe how genetic processes apply to agriculture, human health, society, and the environment

Assessment tasks

- Seminar Poster
- Practical Report

Socially and Environmentally Active and Responsible

We want our graduates to be aware of and have respect for self and others; to be able to work with others as a leader and a team player; to have a sense of connectedness with others and country; and to have a sense of mutual obligation. Our graduates should be informed and active participants in moving society towards sustainability.

This graduate capability is supported by:

Learning outcomes

- Describe how genetic processes apply to agriculture, human health, society, and the environment
- Source and critically evaluate appropriate primary scientific literature
- Synthesise and present information from the literature in written and oral formats

Changes from Previous Offering

In response to the recent teaching evaluation and development surveys for this unit we have increased feedback for the test by dedicating the practical session following the test to working through the solutions. Additional feedback will also now be provided for the practical report.

Changes since First Published

Date	Description
12/02/2019	Added details about exam as a hurdle assessment and supplementary exams to assessment table and general assessment information sections.