BIOL206

Genetics

S1 Day 2017

Dept of Biological Sciences

Contents

General Information

Unit convenor and teaching staff
Unit Convenor
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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

To pass this unit students must attempt each assessment task and achieve 45% or more in the final exam. The final exam is comprised of multiple choice and short answer questions which will require problem solving and knowledge of genetic processes and techniques.

Assessment Tasks

Name	Weighting	Hurdle	Due
Problem Sets	5%	No	Weeks 3, 4, 6, 8 & 9
Test	10%	No	Week 11

Name	Weighting	Hurdle	Due
Seminar Poster	10%	No	28 April
Practical Report	20%	No	28 April
Final Exam	55%	No	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 (22nd or 23rd 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: **28 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 Monika by **10am, Friday the 28th April (internal students) or Thursday 11th May (external students).** Make sure your presentation is saved with your surname and practical session day and time, e.g. "Smith_MonAM" (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 Monika 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: **28 April**
Weighting: **20%**

A major component of *BIOL206 Genetics* is the preparation of a practical report. This practical report, titled *"From tissue to Species Identification"*, 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 Friday 28th April at 10am 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%**

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. Exam conditions will be as for the mid-semester test. The date for your final exam will be available later in the semester.

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 (2008). Genetics: A conceptual Approach (4th 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. (2008). An Introduction to Genetic Analysis (9th 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 – 2017

(Wednesday 17:00-18:00, Y3A & Friday 13:00-14:00pm, Y3A)

Lecture	Date		Topic
1	March	1	Introduction
2	March	3	Basic Revision 1: Genetics and the Organism
3	March	8	Basic Revision 2: Sex and Reproduction
4	March	10	Mendelian Genetics
5	March	15	Sex determination and Patterns of Inheritance
6	March	17	Allelic variation and gene function (Dr Rachael Dudaneic)
7	March	22	Chromosome Number and Structure
8	March	24	Linkage and Crossing Over
9	March	29	Central Dogma 1
10	March	31	Central Dogma 2
11	April	5	Mutation and DNA repair (Dr Rachael Dudaneic)
12	April	7	Molecular Techniques 1 (Dr Rachael Dudaneic)
13	April	12	Molecular Techniques 2 (Dr Rachael Dudaneic)
14	April	14	*Good Friday* - **No lecture**
Mid-Semester Break			
15	May	3	Population Genetics
16	May	5	Genetics of Human Behavior
17	May	10	Inbreeding and Inbreeding Depression
18	May	12	Conservation Genetics

19	May	17	Evolutionary Genetics
20	May	19	Quantitative Genetics (Guest Lecturer Dr Kemp)
21	May	24	Reflecting on a successful career in Science (Prof. Frankham)
22	May	26	Human Genetics (A.Prof Jenny Donald)
23	May	31	Technological Advances (Dr Rachael Dudaneic)
24	June	2	Revision

Internal Practical Schedule - 2017

Week	Date	Practical/Tutorial
1	27 & 28 Feb	**NO PRACTICAL**
2	6 & 7 March	DNA – Extraction of DNA
3	13 & 14 March	PCR
4	20 & 21 March	DNA – Sequence Alignment and Data Analysis
5	27 & 28 March	Hardy-Weinberg Equilibrium - single locus
6	3 & 4 April	Hardy-Weinberg Equilibrium - population level
7	10 & 11 April	**NO PRACTICAL**
Mid Semester Break		
8	1 & 2 May	Poster session I
9	8 & 9 May	Poster session 2
10	15 & 16 May	Revision questions
11	22 & 23 May	Test
12	29 & 30 May	Test Revison
13	5 & 6 June	**NO PRACTICAL**

External Practical Schedule - 2017

<u>First On-Campus Session</u>

Saturday March 18, 9.00 am (E8A150)

DNA Prac I - extraction

Review problem sets 1 - 2

DNA Prac II - PCR, Electrophoresis

Finish ~ 6:00pm

Sunday March 19, 9.00 am (E8A 150)

HWE pracs 1 and 2

Finish ~ 2.00 pm

Second On-Campus Session

Wednesday April 19, 9.00am (E8A 150)

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

Review problem set 3, 4 & 5

Finish ~6:00pm

Third On-Campus Session

Saturday May 13, 9.00 am (E8A 150)

All student posters (**email to Monika by Thursday 11th May**)

Finish ~6:00pm

Sunday May 14, 9.00 am (E8A 150)

Revision Questions

Test

Finish ~ 2:00 pm

Internal Assessment Schedule (2017)

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

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_2016.html

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

Complaint Management Procedure for Students and Members of the Public http://www.mq.edu.au/policy/docs/complaint_management/procedure.html

Disruption to Studies Policy (in effect until Dec 4th, 2017): http://www.mq.edu.au/policy/docs/disruption_studies/policy.html

Special Consideration Policy (in effect from Dec 4th, 2017): https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policies/special-consideration

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/

Results

Results shown in *iLearn*, 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.

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://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
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- 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 and the seminars series changed to a poster session.

Changes since First Published

Date	Description
04/08/2017	Removal of non-teaching staff
21/02/2017	Altered lecture schedule due to public holiday on April 14 (Good Friday).