



# BIOL316

## Invertebrate Biology

S1 Day 2017

*Dept of Biological Sciences*

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#### **Disclaimer**

Macquarie University has taken all reasonable measures to ensure the information in this publication is accurate and up-to-date. However, the information may change or become out-dated as a result of change in University policies, procedures or rules. The University reserves the right to make changes to any information in this publication without notice. Users of this publication are advised to check the website version of this publication [or the relevant faculty or department] before acting on any information in this publication.

## General Information

Unit convenor and teaching staff

Unit Convenor

Katherine McClellan

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E8B224

Monday 9-11am & 2-4pm; Thursdays

Katherine McClellan

[katherine.mcclellan@mq.edu.au](mailto:katherine.mcclellan@mq.edu.au)

Credit points

3

Prerequisites

(39cp at 100 level or above) including (BIOL262 or BIOL208 or BIOL228 or BIOL229)

Corequisites

Co-badged status

Unit description

This unit explores the fascinating world of invertebrate animals. The unit starts by briefly outlining the diversity and key features of the major groups of invertebrate animals (excluding unicellular organisms), and using phylogenetic analysis to explore evolutionary relationships. Once this is established, we move away from a development and taxonomic focus to discuss major topics including: mating systems, communication, host-parasite relationships, predator-prey interactions, sociality, biological control, climate change, and conservation. These major topics draw on examples from research papers on various groups of invertebrates. This unit is suitable for students who are interested in whole animal biology or biological education, or for students who are interested in further research.

## Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at [http://students.mq.edu.au/student\\_admin/enrolmentguide/academicdates/](http://students.mq.edu.au/student_admin/enrolmentguide/academicdates/)

## Learning Outcomes

1. Classify invertebrates into major taxonomic groups on the basis of morphological traits

2. Identify morphological, behavioural, and physiological adaptations that allow invertebrates to survive in distinct habitats
3. Assess how adaptations of invertebrates influence species and community interactions, and ecosystem function
4. Create hypotheses and design experiments to test those hypothesis by collecting appropriate data
5. Critically evaluate scientific hypotheses by statistically analysing data, and accurately interpreting results of those analyses
6. Effectively communicate biological research findings and concepts to diverse audiences including scientists and the general public

## **General Assessment Information**

### **Assessment details**

Details of assessments will be provided on iLearn and in class.

### **Assignment submission**

All assignments will be digitally submitted through the appropriate Turnitin submission link on iLearn. No hardcopy / paper submissions are needed. All assessments need to be written in the students own words. For the taxonomic key you will need to submit four drawings. You will need to make a high quality scan of your scientific drawings (e.g. use the library photocopier / scanner and email yourself a copy) then "paste" the digital copy into your assignment before submission.

### **Academic honesty**

All assessments need to be written in the students own words. The penalties imposed by the University for plagiarism are serious and may include expulsion from the University. ANY evidence of plagiarism WILL be dealt with following University policy. Penalties for plagiarism range from a loss of marks to awarding of a zero depending on the level of plagiarism and reporting to Faculty disciplinary committee.

### **Extensions, penalties and Disruptions to Studies**

The deadlines for assignments are not negotiable. If an assignment is submitted late a penalty of -10% of the mark allocated for the assignment will be deducted per day that any work is submitted late (i.e. 5 days late = -50% of marks available).

If you experience a serious and unavoidable disruption to your studies and require an extension for an assessment please submit a Disruptions to Studies notification via [ask.mq.edu.au](http://ask.mq.edu.au) with supporting documentation, and a Professional Authority Form completed by your health care

professional. If you anticipate a potentially serious and unavoidable disruption (e.g. upcoming surgery) speak to the unit convenor early and apply for an extension before the due date.

If you apply for Disruption to Study for your final examination, you must make yourself available for the week of July 24 – 28, 2017 to sit a supplementary exam. If you are not available at that time, there is no guarantee an additional examination time will be offered. Specific examination dates and times will be determined at a later date.

### Unit completion

To pass this unit, students need to achieve an overall minimum grade of 50%.

## Assessment Tasks

Name	Weighting	Hurdle	Due
<a href="#"><u>Early assessment quiz</u></a>	5%	19/3/17	
<a href="#"><u>Taxonomic Key</u></a>	20%	Int:4/4/17, Ext:15/4/17	
<a href="#"><u>Mid Session Test</u></a>	10%	Int: 2/5/17, Ext: 29/4/17	
<a href="#"><u>Scientific Journal Article</u></a>	25%	23/5/17	
<a href="#"><u>Final exam</u></a>	40%	TBA	

### Early assessment quiz

Due: **19/3/17**

Weighting: **5%**

This is an early assessment quiz to help you know how you are doing early on in the unit. It will cover lectures 1-6 and will consist of 20 multiple choice answer questions.

This Assessment Task relates to the following Learning Outcomes:

- Classify invertebrates into major taxonomic groups on the basis of morphological traits

### Taxonomic Key

Due: **Int:4/4/17, Ext:15/4/17**

Weighting: **20%**

Students will develop their own dichotomous / taxonomic key based on all lab specimens provided; identify all specimen; create a short, informative natural-history table for all specimen with appropriate foot note referencing; and draw four accurate, scientific drawings, of four of the lab specimen. Further details will be provided on iLearn and in the prac classes.

This Assessment Task relates to the following Learning Outcomes:

- Classify invertebrates into major taxonomic groups on the basis of morphological traits
- Identify morphological, behavioural, and physiological adaptations that allow invertebrates to survive in distinct habitats
- Assess how adaptations of invertebrates influence species and community interactions, and ecosystem function
- Effectively communicate biological research findings and concepts to diverse audiences including scientists and the general public

## Mid Session Test

Due: **Int: 2/5/17, Ext: 29/4/17**

Weighting: **10%**

A multiple choice answer test on knowledge of course content up to and including week 6. This one hour test will take place in the prac, under closed-book exam conditions during the first prac after the mid-session break (internals) or during the mid-session break OCS (externals).

This Assessment Task relates to the following Learning Outcomes:

- Classify invertebrates into major taxonomic groups on the basis of morphological traits

## Scientific Journal Article

Due: **23/5/17**

Weighting: **25%**

Students will complete a scientific research report, written in their own words and based on a data collected in class. The report will follow the format of a Current Biology paper - details of which will be provided in class and online in iLearn.

This Assessment Task relates to the following Learning Outcomes:

- Create hypotheses and design experiments to test those hypothesis by collecting appropriate data
- Critically evaluate scientific hypotheses by statistically analysing data, and accurately interpreting results of those analyses
- Effectively communicate biological research findings and concepts to diverse audiences including scientists and the general public

## Final exam

Due: **TBA**

Weighting: **40%**

A test on knowledge of course content (lectures, pracs and readings) up to and including week 13.

This Assessment Task relates to the following Learning Outcomes:

- Classify invertebrates into major taxonomic groups on the basis of morphological traits
- Identify morphological, behavioural, and physiological adaptations that allow invertebrates to survive in distinct habitats
- Assess how adaptations of invertebrates influence species and community interactions, and ecosystem function
- Effectively communicate biological research findings and concepts to diverse audiences including scientists and the general public

## Delivery and Resources

### Required unit materials

The work carried out during practical classes is an important and integral part of the course. You must read, download and either print the prac notes to bring to each class, or bring them on a laptop or tablet.

You will also need a practical notebook with unlined pages that you will use to draw organisms, record data and observations from field and laboratory classes. We recommend you use an **A4 bound notebook with alternate unlined pages** for drawing (i.e. a botany notebook). Loose pages are not suitable. You may also bring your own dissecting kits to class, although some equipment will also be provided.

You will need enclosed shoes for every practical class in accordance with standard laboratory safety procedures. Without which you will not be allowed entry to the laboratory.

### Recommended readings

There are a number of books (also available in the library) that cover various aspects of BIOL316:

- Richard C. Brusca; Wendy Moore; Stephen M. Shuster (2016) Invertebrates. Sinauer Associates, Inc., Sunderland, Massachusetts U.S.A.
- Ruppert EE, Fox RS & RD Barnes (2004) Invertebrate zoology: a functional evolutionary approach. 7th ed. Sunders College Publishing (3 copies available in Special Reserve)
- Ponder W & D. Lunney (1999) The Other 99%: The Conservation and Biodiversity of Invertebrates. Transactions of the Royal Zoological Society of NSW. Surrey beattie & Sons, Chipping Norton
- Pechenik, J.A. Biology of the invertebrates. 6th ed. Boston, Mass.: McGraw-Hill, 2010.

- Anderson, D.T. (Ed). Invertebrate zoology. 2nd ed. South Melbourne, Vic.: Oxford University Press, 2001
- Moore, J. Introduction to the invertebrates. Cambridge: Cambridge University Press, 2001.
- Romoser, W.S. & Stoffolano, J.G. The science of entomology. 4th ed. Boston, Mass.: WCB McGraw-Hill, 1998.
- Choe, J.C. & Crespi, B.J. (Eds). The evolution of mating systems in insects and arachnids. Cambridge; New York: Cambridge University Press, 1997.
- Herrera, C.M. & Pellmyr, O. Plant-animal interactions: an evolutionary approach. Oxford: Blackwell Science, 2002.

## UNIT WEBPAGE, TECHNOLOGY USED AND REQUIRED

### Website

iLearn and email will be the principle method of communication in this subject. You will need stable access to the internet to access iLearn: <http://ilearn.mq.edu.au/>. You will need to log in to iLearn each time you use it. Your user name is your student number.

We expect you to use iLearn to:

- Regularly check subject announcements
- Access weekly reading and videos
- Download lecture materials
- Download laboratory materials
- Download reference materials
- Check your grades

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://students.mq.edu.au/support/health\\_and\\_wellbeing/disability\\_service/](http://students.mq.edu.au/support/health_and_wellbeing/disability_service/) for information on how to get assistance. 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 topics\*\*

Lecture 1 Monday 1pm in E7B100

Lecture 2 Tuesday 8am in E6A102

Week	Date	Lecture	Topic	Lecturer
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1	Mon 27 Feb	1	Introduction– why we should study inverts	Kath McClellan
	Tues 28 Feb	2	Taxonomy and phylogenetics	Kath McClellan
2	Mon 6 Mar	3	Invertebrate diversity I	Kath McClellan
	Tues 7 Mar	4	Invertebrate diversity II	Kath McClellan
3	Mon 13 Mar	5	Invertebrate diversity III	Kath McClellan
	Tues 14 Mar	6	Invertebrate diversity IV	Kath McClellan
4	Mon 20 Mar	7	Invertebrate interactions I - Predation	Kath McClellan
	Tues 21 Mar	8	Invertebrate interactions II - Herbivory	Kath McClellan
5	Mon 27 mar	9	Invertebrate interactions III - Parasitism	Kath McClellan
	Tues 28 Mar	10	Foraging	Kath McClellan
6	Mon 3 Apr	11	Aquatic invertebrates	Kath McClellan
	Tues 4 Apr	12	Biomonitoring & bioindicators	Lara Ainley
7	Mon 10 Apr	13	Eco Physiology	Ajay Narendra
	Tues 11Apr	14	Navigation	Ajay Narendra
	Friday 14 Apr – Sun 30 Apr		<b>Mid-session break</b>	
8	Mon 1 May	15	Communication I – Tactile & Audio	Ajay Narendra
	Tues 2 May	16	Communication II – Chemo	Ajay Narendra



9	Mon 8 May	17	Communication III – Vision	Ajay Narendra/Yuri
	Tues 9 May	18	Communication IV – Neurobiology	Ajay Narendra/ Franne
10	Mon 15 May	19	Insect immunology	Fleur Ponton
	Tues 16 May	20	Reproduction and mating I	Mariella Herberstein
11	Mon 22 May	21	Reproduction and mating II	Mariella Herberstein
	Tues 23 May	22	Sociality **	Kath McClellan
12	Mon 29 May	23	Invertebrates & climate change **	Lesley Hughes
	Tues 30 May	24	Conservation issues**	Lesley Hughes
13	Mon 5 June	25	Insects in managed systems	Phil Taylor
	Tues 6 June	26	Exam outline and revision	Kath McClellan

\*\* Lecture topics may change to accommodate guest lectures schedules

### Internal practical schedule

Tuesday (10am-1pm or 2pm-5pm) E8A 160

Week	Prac	Date	Topic
1		28/2/17	No prac
2	1	7/3/17	Phylogenetics
3	2	14/3/17	Invertebrate diversity 1 – Garden invertebrates
4	3	21/3/17	Invertebrate diversity 2 – Taxonomic key
5	4	28/3/17	Biodiversity sampling - Pitfall traps
6	5	4/4/17	Spider behaviour - territoriality
7	6	11/4/17	Navigation 1
			Mid-session Break
8	7	2/5/17	Mid semester test & Navigation 2
9	8	9/5/17	Navigation 3
10	9	16/5/17	Immunology – fruit flies
11	10	23/5/17	No prac – private study for assessment
12		30/5/17	No prac – private study for exam
13		6/6/17	No prac – private study for exam

**External practical schedule – (9am-5pm) E8A 120**

Session 1 (week 5): Saturday 1 April

Sessions 2-5 (mid-session break): Wednesday 26 to Saturday 29 April

Date	OCS		Time
1/4/17	1	Invertebrate diversity 1 – Garden invertebrates	9-12
		Invertebrate diversity 2 – Taxonomic key (assessment associated)	1-4
26/4/17	2	Phylogenetics	9-12
		Biodiversity sampling - Pitfall traps	1-4
27/4/17	3	Spider behaviour - territoriality	9-12
		Immunology – fruit flies	1-4
28/4/17	4	Navigation 1 (assessment associated)	9-12
		Navigation 2 (assessment associated)	1-4
29/4/17	5	Mid-session test – prac report instructions	9-12
		Navigation 3 - analysis (assessment associated)	1-4

## 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](http://mq.edu.au/policy/docs/academic_honesty/policy.html)

Assessment Policy [http://mq.edu.au/policy/docs/assessment/policy\\_2016.html](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](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](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/](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](http://ask.mq.edu.au).

### Special consideration / Disruptions to studies

If you have a serious and unavoidable disruption during your studies you can make an application for special consideration [Ask.mq.edu.au](http://ask.mq.edu.au) using the "Disruptions to Studies form." Disruptions need to be filed within 5 days of the disruption and have the correct supporting documentation. For more information on Disruptions to Studies notifications please refer to the university policy ([http://www.mq.edu.au/policy/docs/disruption\\_studies/policy.html](http://www.mq.edu.au/policy/docs/disruption_studies/policy.html)) and procedure ([http://www.mq.edu.au/policy/docs/disruption\\_studies/procedure.html](http://www.mq.edu.au/policy/docs/disruption_studies/procedure.html)).

## 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](http://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](#)

If you feel that you are not coping and could use some extra help or guidance, the Faculty of Science and Engineering has dedicated academic support officers to help you settle into studies

and reach your full potential. If you are struggling and don't know where to turn for help, contact Helene or Michele (available for appointments on Tuesday, Wednesday, Thursday 10-3pm). Please contact them on 9850-8348, or email [sci.studentsupport@mq.edu.au](mailto:sci.studentsupport@mq.edu.au) or drop in to the FSE Student Centre and make an appointment to be called back.

Some pearls of wisdom:

- Don't take on too much work
- Don't leave things to the last minute
- If anything is not making sense, get help

For **Counselling, Disability and Student Advocacy Services** please contact [Campus Wellbeing](#) 9850 7497, Email: [campuswellbeing@mq.edu.au](mailto:campuswellbeing@mq.edu.au)

## Student Enquiry Service

For all student enquiries, visit Student Connect at [ask.mq.edu.au](http://ask.mq.edu.au)

## Equity 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.

## IT Help

For help with University computer systems and technology, visit [http://www.mq.edu.au/about\\_us/offices\\_and\\_units/information\\_technology/help/](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

### 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

- Classify invertebrates into major taxonomic groups on the basis of morphological traits
- Identify morphological, behavioural, and physiological adaptations that allow invertebrates to survive in distinct habitats

- Assess how adaptations of invertebrates influence species and community interactions, and ecosystem function
- Create hypotheses and design experiments to test those hypothesis by collecting appropriate data
- Critically evaluate scientific hypotheses by statistically analysing data, and accurately interpreting results of those analyses

## **Assessment tasks**

- Early assessment quiz
- Taxonomic Key
- Mid Session Test
- Scientific Journal Article
- 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**

- Create hypotheses and design experiments to test those hypothesis by collecting appropriate data
- Critically evaluate scientific hypotheses by statistically analysing data, and accurately interpreting results of those analyses
- Effectively communicate biological research findings and concepts to diverse audiences including scientists and the general public

## **Assessment tasks**

- Taxonomic Key
- Scientific Journal Article
- 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**

- Effectively communicate biological research findings and concepts to diverse audiences including scientists and the general public

### **Assessment tasks**

- Taxonomic Key
- Scientific Journal Article
- Final exam

## **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**

- Assess how adaptations of invertebrates influence species and community interactions, and ecosystem function
- Create hypotheses and design experiments to test those hypothesis by collecting appropriate data
- Effectively communicate biological research findings and concepts to diverse audiences including scientists and the general public

### **Assessment tasks**

- Taxonomic Key
- Mid Session Test
- Scientific Journal Article
- 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**

- Identify morphological, behavioural, and physiological adaptations that allow invertebrates to survive in distinct habitats
- Assess how adaptations of invertebrates influence species and community interactions, and ecosystem function
- Create hypotheses and design experiments to test those hypothesis by collecting appropriate data
- Critically evaluate scientific hypotheses by statistically analysing data, and accurately interpreting results of those analyses
- Effectively communicate biological research findings and concepts to diverse audiences including scientists and the general public

## **Assessment tasks**

- Early assessment quiz
- Taxonomic Key
- Mid Session Test
- Scientific Journal Article
- 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**

- Create hypotheses and design experiments to test those hypothesis by collecting appropriate data

## **Assessment tasks**

- Scientific Journal Article
- Final exam



## 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:

### Assessment tasks

- Scientific Journal Article
- 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:

### Learning outcome

- Create hypotheses and design experiments to test those hypothesis by collecting appropriate data

### Assessment tasks

- Scientific Journal Article
- Final exam

## Changes from Previous Offering

New lectures have been added on Eco Physiology, Navigation, Immunology and the two Communication lectures have been unpacked into four lectures. New pracs are being developed on navigation with an associated prac report. Learning outcomes tweaked for new content and assessments.

## Changes since First Published

Date	Description
30/01/2017	Updated section "General Assessment Information" specifically information under heading "Extensions, penalties and Disruptions to Studies" regarding Faculty policy on disruptions to studies notifications involving exams.