



# BIOL316

## Invertebrates: Evolution, Behaviour and Diversity

S1 External 2015

*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

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

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

E8B224

Monday and Tuesday (am) - by appointment only

Lara Ainley

[lara.ainley@mq.edu.au](mailto:lara.ainley@mq.edu.au)

E8B205

Credit points

3

Prerequisites

39cp including BIOL208(P)

Corequisites

Co-badged status

Unit description

This unit explores the fascinating world of invertebrate animals. The unit starts by briefly outlining the features of the major groups of invertebrate animals (excluding unicellular organisms). Once this is established, we move away from a taxonomic focus to discuss major topics including: mating systems, communication, host-parasite relationships, predator-prey interactions, 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 <https://www.mq.edu.au/study/calendar-of-dates>

## Learning Outcomes

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

Assign key invertebrate species to their major taxonomic classifications

Apply various field methods for sampling invertebrates

Identify behavioral and life history strategies of invertebrates that have contributed to their success in adapting to diverse habitats

Identify and interpret invertebrate behaviours relevant to interactions at species and community levels

Generate hypotheses and design experiments to test hypotheses

Analyse data using basic statistical techniques

Prepare experimental findings for publication and/or communication to diverse audiences including the scientific community and the general public

## General Assessment Information

### Assignment submission

All assignments will be digitally submitted through the appropriate Turnitin submission link on iLearn. No hardcopy / paper submissions are needed.

### Extensions and penalties

10% of the mark allocated for the assignment will 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 an extension must be sought *before the due date* unless this is absolutely impossible. **All applications for extensions of deadlines must be submitted to the subject convenor.**

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.

## Assessment Tasks

Name	Weighting	Due
<u>Taxonomic Key</u>	15%	2/4/2015
<u>Mid Semester Test</u>	10%	2/5/2015
<u>Scientific Journal Article</u>	20%	21/5/2015
<u>Poster</u>	15%	25/5/2015

Name	Weighting	Due
<u>Final exam</u>	40%	TBA

## Taxonomic Key

Due: **2/4/2015**

Weighting: **15%**

Students will develop their own dichotomous / taxonomic key based on lab specimens. Accurate scientific drawings of four of the organisms along with short (100 words max) descriptions of each organisms natural history will be provided as references for the taxonomic key.

On successful completion you will be able to:

- Assign key invertebrate species to their major taxonomic classifications
- Identify behavioral and life history strategies of invertebrates that have contributed to their success in adapting to diverse habitats

## Mid Semester Test

Due: **2/5/2015**

Weighting: **10%**

A test on knowledge of course content up to and including wk 6.

On successful completion you will be able to:

- Assign key invertebrate species to their major taxonomic classifications
- Identify behavioral and life history strategies of invertebrates that have contributed to their success in adapting to diverse habitats
- Identify and interpret invertebrate behaviours relevant to interactions at species and community levels

## Scientific Journal Article

Due: **21/5/2015**

Weighting: **20%**

Students will complete a written scientific report (1300-1500 words, excluding references and short abstract) based on a field-based survey of invertebrates in benthic habitats. Benthic invertebrates will be collected from different habitats. Students will identify the invertebrates collected and report on the diversity and richness found between the sites. The report will follow the standard format for a scientific report article, i.e., it will have a short abstract, introduction, materials and methods, results and discussion sections and it will be appropriately referenced. Further details of the assignment requirements will be given in class or online.

On successful completion you will be able to:

- Assign key invertebrate species to their major taxonomic classifications
- Apply various field methods for sampling invertebrates
- Identify behavioral and life history strategies of invertebrates that have contributed to their success in adapting to diverse habitats
- Generate hypotheses and design experiments to test hypotheses
- Analyse data using basic statistical techniques
- Prepare experimental findings for publication and/or communication to diverse audiences including the scientific community and the general public

## Poster

Due: **25/5/2015**

Weighting: **15%**

Students will work in pairs to prepare and submit educational outreach posters. Posters will communicate the diversity, life history tactics and adaptations of a given group of invertebrate taxa to an audience of non-biologists. Effective posters will consider life history tactics, predator-prey interactions, habitat, adaptations to specific environments as well as shared and distinguishing features of the group. Details and expectations of the report will be provided in class and online.

On successful completion you will be able to:

- Assign key invertebrate species to their major taxonomic classifications
- Identify behavioral and life history strategies of invertebrates that have contributed to their success in adapting to diverse habitats
- Identify and interpret invertebrate behaviours relevant to interactions at species and community levels

## Final exam

Due: **TBA**

Weighting: **40%**

A test on knowledge of course content up to and including wk 13.

On successful completion you will be able to:

- Assign key invertebrate species to their major taxonomic classifications
- Apply various field methods for sampling invertebrates
- Identify behavioral and life history strategies of invertebrates that have contributed to their success in adapting to diverse habitats

- Identify and interpret invertebrate behaviours relevant to interactions at species and community levels
- Generate hypotheses and design experiments to test hypotheses
- Prepare experimental findings for publication and/or communication to diverse audiences including the scientific community 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 that you will use to 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:

- 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

Lecture graphics (slides as PDFs) and iLectures will be available on iLearn <http://ilearn@mq.edu.au> iLearn is a web-based computer mediated communication package and can be accessed by most web browsers from inside or outside the University. iLearn and email will be the principle method of communication in this subject. You will need stable access to the internet to access iLearn.

We expect you to use iLearn to:

- Regularly check subject announcements
- Download lecture materials
- Download laboratory materials
- Download reference materials
- Check your grades

How do you log in? The URL for the iLearn log in page is: <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. 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 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).

### Assignment submission

All assignments will be digitally submitted through Turnitin in iLearn.

## Unit Schedule

### Timetable

Lecture 1	Monday	1-2pm	E7B 100
Lecture 2	Thursday	12-1pm	E6A 102
On campus session 1	March 21-22 <sup>nd</sup>	9-5pm	E8A 160 & 120
On campus session 2	May 2-3 <sup>rd</sup>	9-5pm	E8A 160 & 120
(Internal prac classes	Thursday	2-5pm	E8A 160 & 120)

**Lecture topics\***

Week	Date	Lecture	Topic	Lecturer
1	23/2/2015	1	Introduction	Kath McClellan
	26/2/2015	2	Taxonomy and phylogenetics	Kath McClellan
2	2/3/2015	3	Invertebrate diversity I	Kath McClellan
	5/3/2015	4	Invertebrate diversity II	Kath McClellan
3	9/3/2015	5	Invertebrate diversity III	Kath McClellan
	12/3/2015	6	Invertebrate diversity IV	Kath McClellan
4	16/3/2015	7	Invertebrate interactions I - Herbivory	Sabine Nooten
	19/3/2015	8	Invertebrate interactions II - Parasitism	Matthew Lott
5	23/3/2015	9	Invertebrate interactions III - Predation	Lesley Hughes
	26/3/2015	10	Reproduction and mating I	Mariella Herberstein
6	30/3/2015	11	Reproduction and mating II	Mariella Herberstein
	1/4/2015	12	Sociality **	Marianne Peso
	3/4/2015-19/4/2015		<b>Mid-semester break</b>	
7	20/4/2015	13	Invertebrate immune responses **	David Raftos
	23/4/2015	14	Responses to environmental stress **	David Raftos
8	27/4/2015	15	No lecture - Public holiday	
	30/4/2015	16	Freshwater invertebrates	Kathryn Korbelt
9	4/5/2015	17	Invertebrates as environmental indicators	Kathryn Korbelt
	7/5/2015	18	Invertebrates & climate change **	Lesley Hughes
10	11/5/2015	19	Foraging	Patrick Schultheiss
	14/5/2015	20	Communication I **	Kath McClellan



11	18/5/2015	21	Communication II **	Kath McClellan
	21/5/2015	22	Biological control	Phil Taylor
12	25/5/2015	23	Conservation issues**	Lesley Hughes
	28/5/2015	24	Exam outline and revision	Kath McClellan
13	1/6/2015		No lecture – Exam revision	
	4/6/2015		No lecture – Exam revision	

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

### On-Campus practical sessions

Sessions held in E8A 120 and 160. \* The timing of the above schedule may be subject to change, depending on the weather. \*\* Please bring a packed lunch so that we can keep as much to the schedule as possible – not much if anything is open on campus on weekends.

Session	Class date	Activity	Time*
1 (week 4)	21/3/15	Welcome & Phylogenetics	9 – 11 am
		Invertebrate diversity I - garden collection	11 – 2 pm (lunch 12.30-1)**
		Invertebrate diversity II – Taxonomic key	2 – 5 pm
1	22/3/15	Invertebrate diversity III – Pitfall trapping	9 – 1 pm (lunch 12.30-1)**
		Invertebrate interactions – Herbivory diversity	1 – 5 pm

2 (week 8)	2/5/15	Mid Semester Test	9 – 10 am
		Spider behaviour	10 – 12 pm (lunch 12 – 12:30) **
		Ant foraging	12:30 – 2:30 pm
		Grasshopper dissection – eggs and altitude	3:30 – 4:30 pm
2	3/5/15	Poster session	9 – 10 am
		Diversity of benthic macroinvertebrates I & II	10 – 5 pm (lunch 12.30 – 1) **

## 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.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](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](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/](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](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](#)

## 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](http://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

### 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

- Apply various field methods for sampling invertebrates
- Generate hypotheses and design experiments to test hypotheses

## Assessment tasks

- 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

- Assign key invertebrate species to their major taxonomic classifications
- Apply various field methods for sampling invertebrates
- Identify and interpret invertebrate behaviours relevant to interactions at species and community levels
- Generate hypotheses and design experiments to test hypotheses

## Assessment tasks

- Taxonomic Key
- Mid Semester Test
- Scientific Journal Article
- Poster
- 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 outcomes

- Assign key invertebrate species to their major taxonomic classifications
- Apply various field methods for sampling invertebrates
- Identify and interpret invertebrate behaviours relevant to interactions at species and community levels

- Prepare experimental findings for publication and/or communication to diverse audiences including the scientific community and the general public

## **Assessment tasks**

- Taxonomic Key
- Mid Semester Test
- Scientific Journal Article
- Poster
- Final exam

## **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**

- Assign key invertebrate species to their major taxonomic classifications
- Apply various field methods for sampling invertebrates
- Identify behavioral and life history strategies of invertebrates that have contributed to their success in adapting to diverse habitats
- Identify and interpret invertebrate behaviours relevant to interactions at species and community levels
- Generate hypotheses and design experiments to test hypotheses
- Analyse data using basic statistical techniques

## **Assessment tasks**

- Taxonomic Key
- Mid Semester Test
- Scientific Journal Article
- Poster
- 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**

- Assign key invertebrate species to their major taxonomic classifications
- Apply various field methods for sampling invertebrates
- Identify behavioral and life history strategies of invertebrates that have contributed to their success in adapting to diverse habitats
- Identify and interpret invertebrate behaviours relevant to interactions at species and community levels
- Generate hypotheses and design experiments to test hypotheses
- Analyse data using basic statistical techniques
- Prepare experimental findings for publication and/or communication to diverse audiences including the scientific community and the general public

## **Assessment tasks**

- Taxonomic Key
- Mid Semester Test
- Scientific Journal Article
- Poster
- 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**

- Assign key invertebrate species to their major taxonomic classifications
- Apply various field methods for sampling invertebrates
- Identify and interpret invertebrate behaviours relevant to interactions at species and community levels
- Generate hypotheses and design experiments to test hypotheses

- Prepare experimental findings for publication and/or communication to diverse audiences including the scientific community and the general public

## **Assessment tasks**

- Taxonomic Key
- Mid Semester Test
- Scientific Journal Article
- Poster
- 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**

- Prepare experimental findings for publication and/or communication to diverse audiences including the scientific community and the general public

## **Assessment tasks**

- Scientific Journal Article
- Final exam

## **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**

- Prepare experimental findings for publication and/or communication to diverse audiences including the scientific community and the general public

## 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:

## Learning outcomes

- Apply various field methods for sampling invertebrates
- Generate hypotheses and design experiments to test hypotheses
- Prepare experimental findings for publication and/or communication to diverse audiences including the scientific community and the general public

## Assessment tasks

- Scientific Journal Article
- Final exam

## Changes from Previous Offering

Two new pracs (ant foraging & grasshopper dissection) have been developed and assessments have been altered (Taxonomic key and poster).

## Changes since First Published

Date	Description
22/02/2015	Lecture 2 and internal Prac times have changed
12/02/2015	Internal prac class info added