



# MACQUARIE UNIVERSITY

Department of Biological Sciences  
Brain, Behaviour & Evolution  
Faculty of Science  
Macquarie University

## BBE306 Neuroethology

### Unit Guide

Semester 2, 2011 D2 – Day  
3 credit points

<http://learn.mq.edu.au>

## Unit Staff

### Convenor:

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### Guest Lecturers:

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### Demonstrators:

Eirik Søvik ([Eirik.Sovik@students.mq.edu.au](mailto:Eirik.Sovik@students.mq.edu.au))

Lecture location: W6B 338

Practical location: F7B 102

## Pre-requisites

BBE200	Animal Behaviour	<b>or</b>
BIOL208	Animal Structure & Function	<b>or</b>
BIOL246	Human Physiology	<b>or</b>
PSY236	Biopsychology & Learning	

## Unit description

BBE 306 is a higher-level course in which you will engage directly with research and primary scientific papers to explore the latest findings about the biological basis of behaviour. Topics covered will include how genes and genomes control behaviour, the neural basis of behaviour, mechanisms of learning and memory, instinct, the biology of sexual behaviour, and the extent to which our behaviour is defined by genes.

## Unit Objectives

1. Explain the levels of complexity in the nervous system.
2. Describe the principles behind the operation of neural circuits.
3. Detail the operation of the major sensory systems, and how sensory information is processed to extract a sense of space and the environment.
4. Describe the mechanisms animals use to navigate their environment.
5. Discuss what is known of how genes can control behaviour, and how genetic variation can contribute to variation in behaviour.
6. Discuss the biological basis of instinct and motivation.
7. Explain how hormonal and neural systems interact to produce behavioural 'drives' and motivations.
8. Investigate how complex patterns of behaviour develop and can evolve.
9. Discuss the roles of 'nature' and 'nurture' in the development of behaviour, including human behaviour.

## Learning outcomes

This course is about moving beyond memorizing facts, to engaging with a deeper and critical consideration of the topics covered. Students are expected to be accessing the primary scientific literature to enhance their comprehension of the lecture material, and thinking critically about the topics, questions and new research in Neuroethology. Specific learning outcomes are:

1. Explain patterns of nervous system evolution
2. Explain the complexities when relating behavioural phenotypes to the genome
3. Source primary scientific literature to research an essay on a topic related to the lecture material.
4. Generate hypotheses, and design new experiments to test hypotheses.
5. Execute a small independent scientific project.
6. Present experimental findings as a paper written in the style of a recognised scientific journal.
7. Present a research project orally.
8. Critique, review and discuss primary scientific papers.

## Graduate capabilities

An aim of this unit is to develop the skill sets needed to equip students for successful completion of the honours year, and higher degrees in behavioural science. Specific capabilities are as follows.

### 1. *Discipline Specific Knowledge and Skills*

Graduates should 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 should be able to demonstrate, where relevant, professional technical competence and meet professional standards. They should 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.

### *2. Critical, Analytical and Integrative Thinking*

On successful completion of this course graduates should be capable of reasoning, questioning and analyzing, 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. Successful graduates will have a high level of scientific and information technology literacy.

### *3. Problem Solving and Research Capability*

Graduates should be capable of researching; of analyzing, 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. Graduates should have the confidence to take the initiative in doing so, within an awareness of their own limitations.

### *4. Effective Communication*

After successfully completing this course graduates will have the ability to communicate and convey their views in forms effective with different audiences. Graduates should 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.

### *5. 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.

### *6. Capable of Professional and Personal Judgment 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 judgment. 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.

## **Unit Review**

This unit is subject to annual review. In response to student feedback from 2010:

- More directed readings have been given for each lecture
- The essay assignment has been more closely linked to lecture content so that students can improve and demonstrate understanding of core course material.
- The spacing of assignments has been improved to prevent clumping of assignments later in the semester: specifically the paper critique has been moved to the first half of the semester.

## **UNIT SCHEDULE**

### **Website**

Lecture graphics and iLectures will be available on Blackboard <http://learn.mq.edu.au>

Blackboard™ is a web-based computer mediated communication package and can be accessed by most web browsers from inside or outside the University. Blackboard and email will be the principle method of communication in this subject.

You must use Blackboard for:

- Regularly checking subject announcements.
- Downloading lecture materials.
- Downloading laboratory materials.
- Downloading reference materials.
- Checking your grades.

The URL for the Blackboard log-in page is: <http://learn.mq.edu.au/>. You will need to log in to Blackboard 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 are having problems logging on you should contact Student IT Help, Phone: (02) 9850 4357 (in Sydney) or 1 800 063 191 (outside Sydney).

### Timetable

Lecture	Tuesdays	13:00 – 15:00	W6B 338
Practical 1	Fridays	10:00 – 13:00	F7B 102
Practical 2	Fridays	14:00 – 17:00	F7B 102

### Lecture topics. All lectures are 2 h

Week	Date	Topic	Lecturer
1	02/08/11	An introduction to neuroethology	Andrew Barron
2	09/08/11	Neurons and nervous systems	Andrew Barron
3	17/08/11	Motivation, reinforcement and addiction	Jennifer Cornish
4	23/08/11	Learning and cognitive ecology	Ken Cheng & Eirik Søvik
5	30/08/11	Memory & Introduction to practical projects	Andrew Barron
6	06/09/11	Current papers in neuroethology	Student presentations
7	13/09/11	Sound and hearing	Andrew Barron
Mid Semester Break			
8	04/10/11	Vision & Navigation	Jochen Zeil
9	11/10/11	Genes and behaviour	Andrew Barron & Darren Burke

10	18/10/11	Genes, Genomics and behaviour	Andrew Barron
11	25/10/11	Sex	Andrew Barron
12	01/11/11	Social behaviour	Andrew Barron
13	08/11/11	Revision and review	Andrew Barron

**Practical sessions**

Week	Dates	Activity
1	05/08/11	No practical
2	12/08/11	Brains
3	19/08/11	Immunohistochemistry 1
4	26/08/11	Immunohistochemistry 2
5	02/09/11	Confocal microscopy
6	09/09/11	Visual ecology
7	16/09/11	Projects planning
8	07/10/11	Projects
9	14/10/11	Projects
10	21/10/11	Projects
11	28/10/11	Projects
12	04/11/11	Presentations
13	11/11/11	No practical

**ASSESSMENT IN THIS UNIT****Assessment at a glance –**

Task	Proportional contribution	Submission deadline	Brief Description
Short answer questions	0 %	1 pm 16/8/11	Short answer questions linked to the lecture content. Relevant to learning outcomes 1,2
Essay outline	5 %	3 pm 2/9/11	A one-page outline of your chosen essay topic. Relevant to learning outcome 3
Essay	15 %	3 pm 3/10/11	An essay addressing one of the questions set in week 3. Relevant to learning outcome 3
Paper critique	10 %	3 pm 16/9/11	A written critical assessment of a scientific paper. Relevant to learning outcome 8
Project report	30 %	3 pm 11/11/11	A written report of the practical project in the form of a scientific paper. Relevant to learning outcomes 4-7
Final exam	40 %	TBA	A test on knowledge of course content up to and including wk 13. Relevant to learning outcomes 1,2

## Unit completion requirements

To pass this subject you must achieve all of the following.

- Receive a final overall mark of >50%.
- Submit an essay
- Submit a paper critique
- Submit a project report
- Take the final examination

## Assignment submission

All assignments must be handed in according to the Faculty of Science procedures. Assignments should have a cover sheet attached and be placed in collection boxes in the reception area of the Science Centre, E7A level 1. Outside of normal hours, a collection box will be available in the entrance of E7A. Assignment cover sheets can be down loaded from:

[http://web.science.mq.edu.au/new\\_and\\_current\\_students/undergrad/assignments\\_and\\_coversheets/](http://web.science.mq.edu.au/new_and_current_students/undergrad/assignments_and_coversheets/)

**All assignments must also be submitted through Turnitin by the submission deadline.**

Go to <http://turnitin.com> Go to NEW USER, select STUDENT

Class ID: 3948315

Enrollment Password: neurosci

follow the prompts to set up your user profile.

## Assignment description

### Short answer questions (ungraded)

This is a self-assessed exercise. Following the lectures in week 2 students will be given 2 short answer questions of the style you can expect in your final exam. You should prepare answers to these, and model answers and a marking guide will be posted on Blackboard in week 3. The intention is to give students early feedback on their comprehension of the lecture material. Students are encouraged to discuss their answers or any problems with the unit convenor. This assessment does not count to your final grade.

### Essay outline (5 % of final mark)

Addresses graduate capabilities 1, 2 and 4

Chose one essay topic from the list distributed via Blackboard in week 3. Produce a **brief** outline of your essay detailing main headings, essay structure, principle conclusions and

key source materials. Maximum one page of A4 paper. I don't want to see big blocks of text or a half-written essay. I want to be able to give feedback on your structure, intended content and the nature of the argument you will develop in your essay. The intention of this assessment task is to give early feedback to students on their essay.

### **Essay (15 % of final mark)**

Addresses graduate capabilities 1, 2 and 4

Developing the same essay topic chosen for the essay outline into a fully referenced essay of **maximum 2000 words**. There is no lower word limit. The essay must be fully referenced according to the style of the journal *Animal Behaviour*. The reference list does not count towards the word limit.

*Guide to assessment levels.* To pass this assignment you must produce a competent, coherent scientific argument that fully references primary literature. To achieve a distinction in this assignment you should show evidence of critical thinking, a capacity to structure an argument, comprehensive review of relevant literature, initiative in identifying relevant and current source material and a novel synthesis of information from multiple sources.

### **Paper critique (10 % of final mark)**

Addresses graduate capabilities 1, 2 and 4

Working in small groups students will be assigned a scientific paper to analyse and critique. Each group will lead a discussion of their paper in the lecture period in week 6. Working individually, each student will write a critique of their assigned paper. Maximum 1500 words, there is no lower word limit. The critique must be fully referenced according to the style of the journal *Animal Behaviour*. **Both the written critique and contribution to class discussion will contribute to the assessment of this assignment.**

A critique is not the same as an essay. In a critique you are reflecting on the content, value and validity of the paper you have chosen. You should be discussing whether the experiments are well designed for the focal question, whether the data are convincing, whether the discussion is comprehensive and balanced and whether the paper makes an important contribution. Critique does not mean criticise. You should speak to the paper's strengths as well as discuss any possible problems.

*Guide to assessment levels:* To pass this assignment you must participate in the class discussion and produce an intelligent and considered critique of the paper that considers whether the presented experimental data support the authors' interpretation of their findings. This must be fully referenced. To achieve a distinction in this assignment you must contribute intelligently and constructively to class discussion, and produce a critique the assigned paper that places the chosen paper within the context of the literature.

### **Project and project report (30 %)**

Addresses graduate capabilities 1 - 6

Working in small groups students will perform a focussed novel scientific study from weeks 7 to 11. The subject of the study will be chosen from the list of projects presented in the lectures in week 5, and agreed with the unit convenor. Each group will give a 10 minute presentation of their project during the practical class of week 12.

Working individually, each student will write a project report in the style of a manuscript to be submitted to *Animal Behaviour*. Style guidelines for this journal can be found here

[http://www.elsevier.com/wps/find/journaldescription.cws\\_home/622782/authorinstructions#20000](http://www.elsevier.com/wps/find/journaldescription.cws_home/622782/authorinstructions#20000)

You will also find it helpful to read some articles from *Animal Behaviour* to help you model your project report.

Maximum 2000 words, there is no lower word limit. The project report must be fully referenced according to the style of *Animal Behaviour*. Figure legends and references do not count towards to the word limit.

**Both the written report and project presentation will contribute to the assessment of this assignment.**

*Guide to assessment levels:* To pass this assignment you must contribute constructively to your group's practical work, participate in a mature and considered oral presentation of your project by your group and produce a report that appropriately presents, analyses your findings, and discusses these with reference to existing literature. Performance at distinction level in this assignment will involve excelling in the oral presentation, contributing strongly and creatively to your groups' practical work and producing a report that demonstrates a complete understanding of the rationale for your topic, the state of the current relevant literature and how your project generates new information.

Sometimes experiments fail. Your project does not need to 'work' for you to score a high grade in this assignment. If your project 'failed', discuss why it did not work as planned and what could be done differently in future.

### **Final exam (40%)**

Addresses graduate capabilities 1 - 4

Held in the end-of-year exam period. Students will be tested on their knowledge of course content. The exam may include material from all lectures and practical classes up to and including week 13. No written material, programmable calculators or mobile phones may be brought into the exam room. Non-programmable calculators may be used.

### **Guide to assessment levels:**

As a guide to approximate grade boundaries, in all assessment tasks a pass is 50-64 %, a credit is 65-74 %, distinction is 75-84 % and an HD is > 85 %.

Academic senate has a set of guidelines on the distribution of grades across the range from fail to high distinction. Your final result will include a grade plus a standardised numerical grade (SNG) that involves a process of scaling and normalising grades to ensure fair and standard grading across the university. Because of this normalising process it is possible that your raw mark for this unit calculated from your assessments will not be identical to your SNG.

## Extensions and penalties

10% of the mark allocated for the assignment will be deducted for every 24 h period (or part thereof) that any work is submitted past the nominated deadline.

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. **Applications for special consideration or extension should be made in writing to the unit convenor.** All applications for special consideration or extension must be sought *before the due date*, unless this is absolutely impossible.

## Returning assessment tasks

Assessment tasks will be returned via the science centre. Students will be notified via Blackboard when assessments are available for collection.

## Required unit materials

The work carried out during practical classes is an important and integral part of the course. You must have a lab coat for practicals in weeks 4 and 5, and **enclosed shoes for every practical class** in accordance with standard laboratory safety procedures. Enclosed shoes are defined as flat shoes that cover at least the front half of the foot. Without these you will not be allowed entry to the laboratory.

You will require a bound note book for the practical classes for your own notes and reference.

## Recommended readings

This course covers a very wide scope meaning there is no single book that covers all the course content. The course also presents and discusses the latest scientific findings, which have not percolated into the text books yet. For these reasons there is no nominated textbook for this course, rather each lecture provides a list of references and source materials. For a higher-level unit such as this it is expected that you are accessing and exploring the primary scientific literature. However, a number of books do have excellent sections that are relevant the topics covered in this unit. These are listed below. These selected readings do not encapsulate the lecture material, they are not complete readings for a given topic, and are definitely not a substitute for the lectures or for broader reading. They are, however, the best introductory text for each topic, and will help you understand and revise the lecture material, and launch your exploration of the primary literature.

Week	Topic	Text
1	An introduction to neuroethology – basics of neuron function.	Biology the Dynamic Science Russell et al 2008 Ch 37 QH308.2 .B562 2008
2	Neurons and nervous systems – how circuits work.	An introduction to Nervous Systems Greenspan 2007 Ch 2 & 3 QP361 .G67 2007
3	Motivation, reinforcement and addiction	Fundamental Neuroscience 3 <sup>rd</sup> Ed.Squire et al 2008 Ch 43 QP355.2 .F862 2008
4	Learning and cognitive ecology – mechanisms of learning	Foundations of Neurobiology Delcomyn 1998 Ch 24 QP355.2 .D45 1997 Behavioral Neurobiology Carew 2000 Ch 10 QP360 .C347 2000
5	Memory	Foundations of Neurobiology Delcomyn 1998 Ch 24 QP355.2 .D45 1997 Behavioral Neurobiology Carew 2000 Ch 10, 11 QP360 .C347 2000
7	Sound and hearing	Foundations of Neurobiology Delcomyn 1998 Ch 12 Nerve cells and animal behaviour Simmons and Young 1999 Ch 6 QP356 .Y68/1999
8	Vision and navigation	Readings provided on blackboard
9	Genes and behaviour	An introduction to behavior genetics Bazzett 2008 Ch 6, 9 QH457 B37 2008
10	Genes, genomics and behaviour	How genes influence behaviour Flint et al 2010 Ch 9, 11
11	Sex	Biological Psychology (10 <sup>th</sup> ed) Kalat 2009 Ch 11 QP360 K33 2007
12	Social behaviour	How genes influence behaviour Flint et al 2010 Ch 8

### Other recommended books

#### 7-Day loan

Animal behavior : an evolutionary approach / John Alcock. QL751 .A58/2001

Cognitive ecology : the evolutionary ecology of information processing and decision making / edited by Reuven Dukas QL785 .C5/1998

Nerve cells and animal behaviour / Peter J. Simmons and David Young QP356 .Y68/1999

The naked ape / Desmond Morris QH368 .M88

Fundamental neuroscience / edited by Larry Squire ... [et al.] QP355.2 .F862 2008

Nature via nurture : genes, experience, and what makes us human / Matt Ridley QH438.5 .R535 2003

The selfish gene / Richard Dawkins QH437 .D38

Hormones and social behavior / D. Pfaff ... [et al.] (eds.). QP356.45 .H432 2008

Biology, evolution and human nature / Timothy H. Goldsmith and William F. Zimmerman QH308.2 .G665 2001

#### Reserve

An introduction to nervous systems / Ralph J. Greenspan QP361 .G67 2007  
Neuroethology : nerve cells and the natural behavior of animals / Jeffrey M. Camhi QP360 .C33/1984  
Biology : the dynamic science / Peter J. Russell ... [et al.]. QH308.2 .B562 2008  
Behavioral neurobiology : the cellular organization of natural behavior / Thomas J. Carew. QP360 .C347 2000

### **Main Collection.**

Motivation a Biobehavioural approach / Roderick Wong BF503 .W665 2000  
Learning and Memory from Brain to Behaviour / Mark A. Gluck, Eduardo Mercado & Catherine E. Myers QP408 .G58 2008  
The Naked Man a Study of the Male Body / Desmond Morris HQ1090. M669 2009  
Foundations of Neurobiology / Fred Delcomyn QP355.2 .D45 1997  
Hardwired Behaviour what Neuroscience Reveals about Morality / Lawrence Tancredi BJ45.5 .T36 2005  
An introduction to Behaviour Genetics / Terence J. Bazzett QH457 B37 2008  
An introduction to Brain and Behaviour / Bryan Kolb & Ian Q Whishaw QP376 .K635 2006  
Biological Psychology / James W. Kalat QP360 K33 2007

References to supplemental readings relevant to each lecture and practical topic will be provided for each lecture. Some of these will be posted via Blackboard as PDF files.

### **POLICIES**

Macquarie has a number of policies in the area of learning and teaching. Approved policies and associated guidelines and procedures can be found at Policy Central:

<http://www.mq.edu.au/policy/>

In particular you should be familiar with Macquarie's policy for academic honesty

[http://www.mq.edu.au/policy/docs/assessment/policy\\_code\\_of\\_practice.html](http://www.mq.edu.au/policy/docs/assessment/policy_code_of_practice.html)

and special consideration.

[http://www.mq.edu.au/policy/docs/special\\_consideration/procedure.html](http://www.mq.edu.au/policy/docs/special_consideration/procedure.html)

Specific policies developed for the Faculty of Science are available

[http://www.science.mq.edu.au/for/new\\_and\\_current\\_students/undergraduate](http://www.science.mq.edu.au/for/new_and_current_students/undergraduate)

There you will find the Faculty's policy and associated procedures on:

- Appeals
- Transcripts
- Waivers
- Special consideration

You should be familiar with the Faculty and University policies in these areas.

## **Plagiarism**

The University defines plagiarism in its rules: “Plagiarism involves using the work of another person and presenting it as one’s own.” This includes copying from your own previous work. Plagiarism is a serious breach of the University’s rules and carries significant penalties. Read the University’s practices and procedures on plagiarism. <http://www.student.mq.edu.au/plagiarism/> The policies and procedures explain what plagiarism is, how to avoid it, the procedures that will be taken in cases of suspected plagiarism, and the penalties if you are found guilty.

**For BBE306, the penalty for plagiarism is failure of the unit.**