BBE 306

Behavioural Genomics

S2 Day 2015

Dept of Biological Sciences

Contents

General Information

Unit convenor and teaching staff
Unit Convenor
Matthew Bulbert
matthew.bulbert@mq.edu.au
Contact via matthew.bulbert@mq.edu.au

Co-conspirator
Peggy Even
naila.even@mq.edu.au

Credit points
3

Prerequisites
39cp including (BBE200 or BIOL208 or BIOL246 or BIOL257 or PSY236)

Corequisites

Co-badged status

Unit description
In this unit students engage directly with research and primary scientific papers to explore the latest findings about the complex interactions between the genome and behaviour. Topics include: the extent to which our behaviour is determined by our heritable biology, how genes and genomes control behaviour; the mechanisms of learning and memory; the evolution and biological basis of instinct; and how our behaviour can influence our genome.

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:

- Explain patterns of nervous system evolution
- Explain the complexities when relating behavioual phenotypes to the genome
- Source primary scientific literature to research an essay on
- Generate hypotheses, and design new experiments to test hypotheses
- Execute a small independent scientific project.

Present experimental findings as a paper written in the style of a recognised scientific journal

Present a research project orally

Critique, review and discuss primary scientific papers

General Assessment Information

Selling your neurotransmitter (10%)

You are currently working as a researcher for an institute known as the National Enterprise for Research by Vikings and Eskimos otherwise known as the N.E.R.V.E centre. You have a great idea for a research topic involving a neurotransmitter but you need funding. Your task is to pitch your research to an eccentric entrepreneur Sir Cecil Offelburger who owns the wildlife park – 'Offelburger's paradise' – a reserve free of boring model species. Offelburger has no time for waffle and has an exceedingly little attention span and so only listens to briefs that follow certain guidelines. The guidelines include:

1. **Create three Powerpoint slides with annotated notes outlining your presentation.**
2. **The slides must deal with the following:**

Slide 1: What is a neurotransmitter and how do they work?

Slide 2: A general slide on your allotted neurotransmitter?

Slide 3: How will understanding this neurotransmitter potentially benefit an animal in Sir Offelburgers wildlife park? (note this is a neuro-behavioural course and evidence for these claims will be required)

1. **Sir Offelburger is a busy man as you would expect and hence has hired a team of assessors to go through the proposals (That is, you will peer assess ie rate other students brief's using a simple rubric).**

Note: Neurotransmitters will be made available for selection

Topic for Essay and Essay Outline:

Discuss the role of neurotransmitters in predator-prey interactions

Recommended paper to begin your reading: Chivers, Douglas P., et al. "Impaired learning of predators and lower prey survival under elevated CO2: a consequence of neurotransmitter interference." *Global change biology* 20.2 (2014): 515-522.

Essay outline (0 % of final mark) but compulsory.

For this topic produce a brief outline of your essay detailing main headings, essay structure, principle conclusions and key source materials. Maximum one page of A4 paper. Do not provide big blocks of text as this is an outline but key points under each

topic would seem reasonable. 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 (20 % of final mark).

For the assigned topic develop 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.**

Project report (30 %)

During weeks 8 – 11 during the practical sessions you will participate in a study of the variation in lateralisation in humans. Working individually student will write up the project in the form of a research article to be submitted to the Journal of Experimental Biology. For the style guidelines for research articles look here: http://jeb.biologists.org/ under 'author info'

You will also find it helpful to read some articles from Journal of Experimental Biology to help you model your writing. Maximum 3000 words, there is no lower word limit. Figure legends, abstract and references do not count towards to the word limit. The project report must be fully referenced according to the journal style

***Guide to assessment levels*: To pass this assignment you must produce a report that appropriately presents, and analyses your findings, and discuss these with reference to existing literature. Performance at distinction level in this assignment will involve contributing strongly and creatively to the practical work and producing a report that demonstrates a complete understanding of the rational for your topic, the state of the current relevant literature, competent and appropriate analyses, and demonstration of independent thought in analysis and interpretation of the data.**

Final exam (40%)

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 unit 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 fare 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 must be lodged through *Tracker*. All applications for special consideration or extension must be sought before the due date,** unless this is absolutely impossible. Details on special consideration are provided here:

http://www.student.mq.edu.au/ses/Special%20Consideration.html

Assessment Tasks

Name	Weighting	Due
Selling your neurotransmitter	10%	10th and 17th of August
Essay outline	0%	7 September
Essay	20%	5 October
Project report	30%	30 October
Final exam	40%	TBA

Selling your neurotransmitter

Due: **10th and 17th of August**
Weighting: **10%**

Selling your neurotransmitter

On successful completion you will be able to:

- Explain patterns of nervous system evolution
- Explain the complexities when relating behavioual phenotypes to the genome
- Critique, review and discuss primary scientific papers

Essay outline

Due: **7 September**
Weighting: **0%**

A one-page outline of your chosen essay topic.

On successful completion you will be able to:

- Source primary scientific literature to research an essay on

Essay

Due: **5 October**
Weighting: **20%**

An essay addressing one of the questions set in week 3

On successful completion you will be able to:

- Source primary scientific literature to research an essay on

Project report

Due: **30 October**
Weighting: **30%**

A written report of the practical project in the form of a scientific paper

On successful completion you will be able to:

- Generate hypotheses, and design new experiments to test hypotheses
- Execute a small independent scientific project.
- Present experimental findings as a paper written in the style of a recognised scientific journal
- Present a research project orally
- Critique, review and discuss primary scientific papers

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:

- Explain patterns of nervous system evolution

- Explain the complexities when relating behavioual phenotypes to the genome

Delivery and Resources

How BBE306 2015 will work

Website

The course homepage containing lecture handouts, course materials and lecture recordings is available on iLearn

http://mq.edu.au/iLearn/

You must use iLearn for:

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

If you are having trouble accessing the 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).

Lectures:

There will be no face-to-face lectures in this unit. All lectures will be pre-recorded and will be made available 9am Thursday each week.

Practicals:

This course will have regular practicals during the semester and an on campus session run during the semester break. However note the practicals are not every week and some of these practicals are more like tutorials, discussions and/or technical practice. The practicals during semester will be in 1-4pm Thursday according to the schedule below in E8A 120 & E8A 160. The on campus session will be in the E8C Labs 1 and 2 – these are the brand spanking new labs just off the biology courtyard. These days will be from 9-4pm.

Communication:

Given the delivery mode it will be important that we establish a good working relationship via ilearn forum. If you have questions about lecture material please post them via ilearn. We can then work on the answers as a group. I want to make sure that everyone is comfortable with the delivery mode and is confident enough to post questions and answers. This is a 3rd year unit so it is important you practice engaging in the course material. I will be as active as I can on ilearn to address concerns and if there are questions I am unable to answer we can research them as well as pass them onto the researchers delivering the material.

UNIT COMPLETION REQUIREMENTS

Minimum requirements include:

1. The completion and submission of all assessment tasks (taking into account special considerations)

2. Must achieve a final overall mark of >50%

3. Must attend all practicals - if you miss a practical then follow the instructions below.

Overall grades

The current university grading is: fail (F <50%), pass (P 50%-64%), credit (CR 65%-74%), distinction (D 75%-84%) and high distinction (HD 85%-100%).

What to do if you miss an assignment task or practical session through:

Illness or misfortune

· **Submit special consideration via** ask.mq.edu.au **(Do not give doctors certificates to convener or tutor)**

- You will need to provide documentation for illness. For other situations you must provide a supporting letter explaining the circumstances that has led to you missing the practicals.

· **Inform convener that you have submitted consideration and ensure the role is marked accordingly**

· **The course convener will process your special consideration. If approved it is your responsibility to arrange with the tutor/practical convener to do assignment or practical at another time.**

Neglect (i.e. forgot or just slack)

· **Be honest!**

· **Contact the practical convener to plead your case.**

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 must be lodged through *Tracker*. All applications for special consideration or extension must be sought before the due date,** unless this is absolutely impossible. Details on special consideration are provided here:

http://www.student.mq.edu.au/ses/Special%20Consideration.html

Returning assessment tasks

Assessment tasks and feedback will be returned via iLearn.

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 the 10th of September and the on-campus practical sessions 14th and 15th September. Enclosed shoes are needed for every practical class in accordance with standard 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 notebook for the practical classes for your own notes and reference.

Recommended readings

The unit typically does not have a prescribed text and a bunch of readings will be required. However recently a text has come out that mostly covers the material in the course and it will be referred to a number of times throughout the unit. It is by Giovanni Galizia, and is called “Neurosciences: from molecule to behaviour”. It is available as a free download through the library. Its title may confuse you slightly given the course is called behavioural genomics. However to understand how the genome influences behaviour we must understand the pathways from genes to the expression of a behavioural phenotype and of course that involves understanding the neural pathways. Hence the first part of the course will examine behaviour, neural mechanisms and sensory systems while the second half of the course looks at genes and gene regulation of neural pathways that lead to the expression of behaviour.

For a higher-level unit such as this it is expected that you are also 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	Biology the Dynamic Science Russell et al 2008 Ch 37 QH308.2 .B562 2008
2	Nervous systems, and how they make decisions	An introduction to Nervous Systems Greenspan 2007 Ch 2 & 3 QP361 .G67 2007
3	Motivation, reinforcement and addiction	Fundamental Neuroscience 3rd Ed.Squire et al 2008 Ch 43 QP355.2 .F862 2008
4	Learning and cognitive ecology	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 How genes influence behaviour Flint et al 2010 Ch 10
6	Sound and hearing	Foundations of Neurobiology Delcomyn 1998 Ch 12 Nerve cells and animal behaviour Simmons and Young 1999 Ch 6 QP356 .Y68/ 1999
7	Vision and visual navigation	Nerve cells and animal behaviour Simmons and Young 1999 QP356 .Y68/1999
8	Genes and behaviour	An introduction to behavior genetics Bazzett 2008 Ch 6, 9 QH457 B37 2008
9	Genomes and behaviour	How genes influence behaviour Flint et al 2010 Ch 6, 9, 11
10	Sex	Biological Psychology (10th ed) Kalat 2009 Ch 11 QP360 K33 2007
11	Social behaviour	How genes influence behaviour Flint et al 2010 Ch 8
12	Genes, genomes and human behaviour	Biological Psychology (10th ed) Kalat 2009 Ch 11 QP360 K33 2007 How genes influence behaviour Flint et al 2010 Ch 2, 3, 6, 9, 11

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

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

Unit Schedule

Practicals:

This course will have regular practicals during the semester and an on campus session run during the semester break. However note the practicals are not every week and some of these practicals are more like tutorials, discussions and/or technical practice. The practicals during semester will be in 1-4pm Thursday according to the schedule below in E8A 120 & E8A 160. The on campus session will be in the **E8C Labs 1 and 2 – these are the brand spanking new labs just off the biology courtyard. These days will be from 9-4pm.**

Practical	Dates	Activity
1	3rd September	Meet the researchers/ Major Project/ Course Issues
2	10th September	Dissecting brains
Mid-semester break		
3	14th September	Visualising brain function
4	15th September	Visualising brain function
Mid-semester break		
8	1st October	Major project: Lateralisation
9	8th October	Meet the researchers/Data collection
10	15th October	Data collection/Analyses
11	22nd October	Data analyses/Report
12	29th October	No practical unless required
13	4th November	No practical

Lecture program. All lectures are 2 hours

To understand how the genome influences behaviour we must understand the pathways from genes to the expression of a behavioural phenotype, which requires an understanding of relevant neural pathways. Hence the first part of the course will examine behaviour, neural mechanisms and sensory systems while the second half of the course looks at genes and gene regulation of neural pathways that lead to the expression of behaviour.

Week	Date	Topic Topic	Lecturer
1	29th July	Lecture 1: Course Introduction Lecture 2: Neurons the basics	Matthew Bulbert Naïla Even
2	5th August	Lecture 3: Circuits and Nervous Systems I Lecture 4: Circuits and Nervous Systems II	Naïla Even Naïla Even

3	12th August	Lecture 5: Neuroendocrinology Lecture 6: Motivation, reinforcement, addiction	Naïla Even Andrew Barron
4	19th August	Lecture 7: Learning Lecture 8: Cellular mechanisms of learning and memory	Ken Cheng Andrew Barron
5	26th August	Lecture 9: Memory I Lecture 10: Memory II	Andrew Barron Andrew Barron
6	2nd September	Lecture 11: Sound and hearing Lecture 12: Taste and Smell	Naïla Even Naïla Even
7	9th September	Lecture 13: Vision Lecture 14: Navigation	Nathan Hart Ajay Narendra
		Mid semester break	
8	30th September	Lecture 15: Genes and behaviour I Lecture 16: Genes and behaviour II	Andrew Barron Andrew Barron
9	7th October	Lecture 17: Genomes and behaviour I Lecture 18: Genomes and behaviour II	Andrew Barron Andrew Barron
10	14th October	Lecture 19: Sex I Lecture 20: Sex II	Andrew Barron Andrew Barron
11	21st October	Lecture 21: Social behaviour I Lecture 22: Social behaviour II	Andrew Barron Andrew Barron
12	28th October	Lecture 23: Genomes and human behaviour I Lecture 24: Genomes and human behaviour II	Andrew Barron Andrew Barron
13	4th November	Revision and review	Matthew Bulbert

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.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

Disruption to Studies Policy 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/

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://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

- Source primary scientific literature to research an essay on
- Generate hypotheses, and design new experiments to test hypotheses

Assessment tasks

- Selling your neurotransmitter
- Essay outline
- Essay
- Project report
- 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

- Explain patterns of nervous system evolution
- Explain the complexities when relating behavioual phenotypes to the genome
- Critique, review and discuss primary scientific papers

Assessment tasks

- Selling your neurotransmitter
- Essay outline
- Essay
- Project 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

- Explain the complexities when relating behavioual phenotypes to the genome
- Source primary scientific literature to research an essay on
- Execute a small independent scientific project.
- Critique, review and discuss primary scientific papers

Assessment tasks

- Selling your neurotransmitter
- Essay outline
- Essay
- Project 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

- Explain the complexities when relating behavioual phenotypes to the genome
- Source primary scientific literature to research an essay on
- Generate hypotheses, and design new experiments to test hypotheses
- Execute a small independent scientific project.
- Critique, review and discuss primary scientific papers

Assessment tasks

- Selling your neurotransmitter

- Project report
- 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 outcomes

- Present experimental findings as a paper written in the style of a recognised scientific journal
- Present a research project orally

Assessment tasks

- Selling your neurotransmitter
- Project 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:

Assessment tasks

- Selling your neurotransmitter
- Project report