BIOL115

The Thread of Life

S2 Day 2014

Dept of Biological Sciences

Contents

General Information

Unit convenor and teaching staff
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Credit points
3

Prerequisites

Corequisites

Co-badged status

Unit description
This unit deals with the nuts and bolts of life on earth. Throughout the unit there is a single unifying theme – that all of the processes that give rise to life are derived from DNA. We show students that DNA controls life by acting as a blueprint for the construction of proteins, and that those proteins build cells which act as the basic structural and functional units of all life. To demonstrate these processes to students, we start by talking about the structure and function of DNA to show how it can act as a simple code for the construction of proteins. Students are then shown how proteins are constructed from the DNA code, and how those proteins can be used to build and maintain cells. Having established these basic principles, the unit then goes on to explain how cells construct multicellular organisms during development, and how the proper functioning of those organisms is maintained by regulating cellular activity. We also demonstrate that the DNA code is essentially immortal because it can be copied from generation to generation, from cell to cell.

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:

Understand how biological information is encoded in the structure of the genetic molecule, DNA.

Explain how the Central Dogma explains the flow of biological information in living systems.

Describe the Cell Theory, which defines the basic unit of life.

Describe how large macromolecules, such as nucleic acids and proteins are constructed from simpler building blocks

Evaluate how gene expression is regulated

Explain how eukaryotic cells are constructed, in terms of the structure and functions of organelles.

Explain how genetic information is transmitted from one generation to the next through cellular replication processes

Understand how DNA provides a record of the evolutionary history of individuals and populations.

Develop the basic elements of scientific writing, including gathering relevant information from the literature and synthesise that information into a cogent essay or other activities.

Undertake quantitative and quantitative analyses of scientific data and draw meaningful conclusion from them.

General Assessment Information

Exams

Final examination

The final exam will test all of the information presented to you in lectures and practical classes. Additional study from textbooks and other sources is not necessarily required to pass this unit. However such additional study would be a significant advantage in obtaining higher grades. The format of the final exam will be announced later.

Mid-Semester examination

The mid-semester exam will be held during the week before the mid-semester break (internals) and during the second on-campus session (externals). The test will be in multiple-choice format and will examine all work up to Lecture 12 and Practical 4.

ASSIGNMENTS

Assignments are designed not only to test your mastery of scientific concepts, but also of

ancillary skills that you should acquire for higher-level courses and your future careers. The table on page 9 relates the assignments with learning goals and graduate capabilities. Importantly, you should use the assignments as part of your overall learning in this unit. There will be 4 assignments. The precise topics and formats for those assignments will be described both during lectures and on the iLearn site. Rubrics and details instructions will be made available on iLearn. For all assignments and assessments, you may lose marks for the following:

1. Not following instructions completely.
2. Not submitting your work on time. Marks (5% per day, to a maximum of 30%) will be deducted for assignments submitted after those dates. You will be provided with feedback on your performance on those assignments.
3. Plagiarism. You will lost marks for minor cases of plagiarism. You will also lose marks for not submitting assignments to Turnitin (where appropriate). Serious cases of plagiarism will result in the student being referred to the Head of Department and The Faculty of Science Disciplinary Committee. Severe penalties for plagiarism offenses include expulsion from the University.

Assignment 1 ***Abstract***
Worth 10%
Due on 28 Aug
You will be required to produce a 300-word abstract on a scientific publication that will be provided to you. Here, you will have to summarise the content of the paper into a meaningful abstract. In addition, you will have to identify two other peer-reviewed publications that are based on the paper that you have summarised. This assignment will introduce you to a key element of scientific writing - abstracting.

Assignment 2 ***Poster***
Worth 10%
Due on 8 Oct
You will prepare an ePoster on your favourite cell. This poster, which is prepared using Powerpoint, will introduce your readers to your cell-of-choice and describe a research project in which your cell type has been used.

Assignment 3

Peerwise

Worth 10%

Due on 12 Nov

Peerwise is an online collaboration tool. You will use Peerwise to develop context-specific questions and attempt problems. This is a semester-long assignment. Details will be provided later.

Assessment Tasks

Name	Weighting	Hurdle	Due
Assignment 1: Abstract writing	10%	No	28 August
Assignment 2. Poster	10%	No	8 October
Assignment 3: Peerwise	10%	No	12 November
Practical / Quizzes	10%	No	weekly
Mid-Semester Exam	10%	No	TBA
Final Exam	50%	No	Exam Period

Assignment 1: Abstract writing

Due: **28 August**
Weighting: **10%**

You will be required to produce a 300-word abstract on a scientific publication that will be provided to you

On successful completion you will be able to:

- Understand how DNA provides a record of the evolutionary history of individuals and populations.
- Undertake quantitative and quantitative analyses of scientific data and draw meaningful

conclusion from them.

Assignment 2. Poster

Due: **8 October**
Weighting: **10%**

You will prepare an ePoster on your favourite cell.

On successful completion you will be able to:

- Understand how DNA provides a record of the evolutionary history of individuals and populations.
- Undertake quantitative and quantitative analyses of scientific data and draw meaningful conclusion from them.

Assignment 3: Peerwise

Due: **12 November**
Weighting: **10%**

Peerwise is an online collaboration tool.

On successful completion you will be able to:

- Understand how DNA provides a record of the evolutionary history of individuals and populations.
- Undertake quantitative and quantitative analyses of scientific data and draw meaningful conclusion from them.

Practical / Quizzes

Due: **weekly**
Weighting: **10%**

quiz within prac classes

On successful completion you will be able to:

- Undertake quantitative and quantitative analyses of scientific data and draw meaningful conclusion from them.

Mid-Semester Exam

Due: **TBA**

Weighting: **10%**

The test will be in multiple-choice format and will examine all work up to Lecture 12 and Practical 4.

On successful completion you will be able to:

- Understand how biological information is encoded in the structure of the genetic molecule, DNA.
- Explain how the Central Dogma explains the flow of biological information in living systems.
- Describe the Cell Theory, which defines the basic unit of life.
- Describe how large macromolecules, such as nucleic acids and proteins are constructed from simpler building blocks
- Evaluate how gene expression is regulated
- Explain how eukaryotic cells are constructed, in terms of the structure and functions of organelles.

Final Exam

Due: **Exam Period**
Weighting: **50%**

The final exam will test all of the information presented to you in lectures and practical classes.

On successful completion you will be able to:

- Understand how biological information is encoded in the structure of the genetic molecule, DNA.
- Explain how the Central Dogma explains the flow of biological information in living systems.
- Describe the Cell Theory, which defines the basic unit of life.
- Describe how large macromolecules, such as nucleic acids and proteins are constructed from simpler building blocks
- Evaluate how gene expression is regulated
- Explain how eukaryotic cells are constructed, in terms of the structure and functions of organelles.
- Explain how genetic information is transmitted from one generation to the next through cellular replication processes

- Understand how DNA provides a record of the evolutionary history of individuals and populations.
- Develop the basic elements of scientific writing, including gathering relevant information from the literature and synthesise that information into a cogent essay or other activities.

Delivery and Resources

Advice on doing well in Biol115

Learning is a human behaviour, and as with most other behaviours, involves the development and accumulation of many useful traits. **Active learning** has been demonstrated to be one of the best approaches to develop good learning habits. Active learning involves receiving, processing and applying information. You need to test your understanding through problem solving. It goes beyond rote memorisation, requires new information to be processed in such a way that it transforms into knowledge. Information is one-dimensional, while knowledge is multi-dimensional. To be knowledgeable means that you will be able to use your prior learning to adapt and respond to new situations (including unexpected exam questions!). To get a good grade in Biol115, you need to demonstrate mastery of the concepts discussed in this unit. Those concepts are not stand-alone concepts, but are linked in many ways. You need to establish those links in your own mind. Active learning in Biol115 may involve using the online tutorials, such as those in ***Principles of Biology*** and doing ***Peerwise***. Forming small study groups (**collaborative learning** is another powerful way of learning. By questioning and teaching others (your fellow students), you will gain good skills in learning and teaching. Most importantly, these activities will deepen your understanding of the concepts you will learn in thus unit. *Finally, make an effort to attend every class and completing all of the learning activities in this unit*.

Practical class assessment and attendance

You'll be asked to keep a Practical Book in which you record all of your notes, diagrams, thoughts and conclusions from practical classes and tutorials. You practical book will not be assessed, but it will be essential to help you study for the mid-semester test and the final exam. The assessment of practical classes will be based on short online quizzes. Failure to attend practical classes will be penalized. There are two web-based computer tutorials in Biol115. There will be no formal practical classes held during the weeks listed for those tutorials in the timetable. That will give you time to study the tutorials and complete the short quizzes associated with each tutorial. Once you have completed each tutorial, submit your answers for assessment in the usual manner

Some advice

The practicals/tutorials will complement the lecture series in Biol115. You must keep a comprehensive record of the experiments/tutorials/discussions that are conducted during the practical sessions. You'll need to bring along:

- A book in which to record your own observations, data etc (ring binders are good because you can interleave your own observations with the printed notes).
- A USB flash drive to store your data/images.

Safety

Safety is paramount in research laboratories. Your behaviour in the laboratory is crucial to your safety, as well as to that of the others around you. While you will be provided with a comprehensive briefing on laboratory safety, it is important that you are appropriately attired for the practical classes. Lab coats are not necessary, but you must wear closed-in shoes at all times in the laboratory. Any breaches of the dress-code or the safety rules will result in your expulsion from the laboratory.

Category	Title	URL
Biol115	iLearn	• https://ilearn.mq.edu.au/login/MQ/
	Peerwise	• http://peerwise.cs.auckland.ac.nz/
	Centre for Open Education	• http://mq.edu.au/about_us/offices_and_units/centre_for_open_education/
	Pubmed (scientific literature database)	• http://www.ncbi.nlm.nih.gov/pubmed/
	Referencing (Harvard style)	• http://www.usq.edu.au/library/referencing/harvard-agps-referencing-guide
Learning	Uniwise	• http://www.students.mq.edu.au/support/learning_skills/undergraduate/
	Writing skills (and others)	• http://www.students.mq.edu.au/support/learning_skills/undergraduate/academic_skills_quickguides/
	Numeracy skills	• http://maths.mq.edu.au/numeracy/
	Learning styles	• http://www.vark-learn.com/english/page.asp?p=questionnaire
Help	Special consideration	• http://www.mq.edu.au/policy/docs/special_consideration/policy.html • http://www.mq.edu.au/policy/docs/special_consideration/procedure.html
	Ask	• https://ask.mq.edu.au/splash.php

	IT Help	• http://mq.edu.au/about_us/offices_and_units/informatics/help/
	Student wellbeing	• http://students.mq.edu.au/campus_life/campus_wellbeing_support_services/
	Timetables	• https://timetables.mq.edu.au/
	Health - medical	• http://students.mq.edu.au/campus_life/campus_wellbeing_support_services/medical_service/
	Health - other	• http://www.mq.edu.au/clinics/
	Disability services	• http://students.mq.edu.au/campus_life/campus_wellbeing_support_services/disability_service/
	Counselling	• http://students.mq.edu.au/campus_life/campus_wellbeing_support_services/counselling/
University policies	Academic honesty and schedule of penalties	• http://www.mq.edu.au/policy/docs/academic_honesty/policy.html • http://www.mq.edu.au/policy/docs/academic_honesty/schedule_penalties.html
	Assessment	• http://www.mq.edu.au/policy/docs/assessment/policy.html • http://www.mq.edu.au/policy/docs/assessment/guideline.html
	Final exam	• http://www.mq.edu.au/policy/docs/examination/policy.html • http://www.mq.edu.au/policy/docs/examination/procedure.html
	Grade appeal	• http://www.mq.edu.au/policy/docs/gradeappeal/policy.html • http://www.mq.edu.au/policy/docs/gradeappeal/procedure.html
	Grading	• http://www.mq.edu.au/policy/docs/grading/policy.html
	Peer-Assisted Learning (PAL)	• http://www.mq.edu.au/policy/docs/peer_assisted/policy.html • http://www.mq.edu.au/policy/docs/peer_assisted/procedure.html
	Student feedback	• http://www.mq.edu.au/policy/docs/student_feedback/policy.html
	Withdrawal	• http://www.mq.edu.au/policy/docs/withdrawal_penalty/policy.html • http://www.mq.edu.au/policy/docs/withdrawal_penalty/procedure.html

Unit Schedule

Lectures

There are two lectures per week; **Monday**, 10-11 am (Macquarie Theatre (W2.4A)) and **Thursday** 12-1 pm Lotus Theatre (W6D)).

THEME	LECTURE	TITLE
Introduction	1	Introduction to Biol115: Aims, hopes and aspirations
	2	A: This thing called science B: “Of endless things most beautiful and wonderful”: Evolution
The Central Dogma	3	The Thread of Life: DNA and the double helix
	4	At home in the nucleus: DNA and chromosomes
	5	Getting the message: DNA transcription
	6	Tongue twisters: translation and protein synthesis
	7	In 4 dimensions: protein structure
	8	The blueprint of life: Information flow and the Central Dogma
Cell structure and diversity	9	House and home: the makings of a cell
	10	Bricks and mortar: the cytoskeleton and cellular connections
	11	Life at the edge: biological membranes and molecular transport
	12	The Green Revolution: Photosynthesis
	13	No boundaries here: prokaryotes
Regulation of cellular activities	14	The cellular internet: signal transduction in cells
	15	Intelligence Central: Information control: regulating gene expression
	16	Multiplicity: Gene regulation and cellular differentiation in eukaryotes

THEME	LECTURE	TITLE
Change and perpetuation: reproduction and evolution	17	Cycles and convergence: The cell cycle, DNA replication and mitosis
	18	Fatality: Mutation, Aging and Death
	19	The emperor of maladies: cancer
	20	Go forth and multiply: Sex and meiosis
	21	Complexity is simple: Phases of development
	22	Genetic footprints of time: molecular evolutionary history
Revision	23	Back to the future: Revision

Practicals and Tutorials

In Biol115, practicals and tutorials are held concurrently. Practicals include experiments and other laboratory activities that introduce commonly used techniques in cell and molecular biology. During the tutorials, we will discuss essential concepts that form the core themes of the unit. Attendance at practicals/tutorials is compulsory.

DAY	TIME
Monday	12:00pm - 3:00pm; 3:00pm - 6:00pm
Tuesday	9:00am -12:00pm; 2:00pm - 5:00pm
Wednesday	9:00am - 12:00pm; 12:00pm - 3:00pm; 3:00pm - 6:00pm
Thursday	9:00am - 12:00pm
Note: At each session, two classes will operate concurrently (E8A120 and E8A160)	

WEEK	TOPIC
1	*No pracs this week for internal students*
2	Prac 1: The cellular basis of life
3	Prac 2: DNA
4	Prac 3: Proteins 1: Flagella regeneration
5	Prac 4: Proteins 2: Protein Quantification
6	*No pracs this week for internal students*
7	Mid-Semester exam
8	*No pracs this week for internal students*
9	Prac 6: Regulation of gene expression: the *lac* operon
10	Prac 7: Mitosis
11	Prac 8: Meiosis
12 & 13	Revision week

Notes:

During Revision week, there will not be formal classes. However, the teaching staff will be available if you need to contact us about questions you have about the course content or the final exams.

On campus sessions for external students

External students must attend the on-campus sessions for the practicals. There are two blocks (2 days each), and all external students must attend BOTH blocks. The dates are: Block 1 (30-31 Aug) and Block 2 (22-23 Sep)

Learning and Teaching Activities

Lectures

Lectures The lectures in Biol115 focus on key concepts in cell and molecular biology from a variety of perspectives. The underlying theme is that cellular processes are ultimately controlled by information DNA.

Practicals and Tutorials

In Biol115, practicals and tutorials are held concurrently. Practicals include experiments and other laboratory activities that introduce commonly used techniques in cell and molecular biology. During the tutorials, we will discuss essential concepts that form the core themes of the unit. Attendance at practicals/tutorials is compulsory.

Written assignments

Assignments are designed not only to test your mastery of scientific concepts, but also of ancillary skills that you should acquire for higher-level courses and your future careers. This table relates the assignments and assessments with learning goals and graduate capabilities. Importantly, you should use the assignments as part of your overall learning in this unit. There will be three assignments. The precise topics and formats for those assignments will be described both during lectures and on our website. All assignments will begin and end at specified dates. Assignments 1 and 2 will be marked against predefined standards, which will be made available to you before the submission of your assignments. You will be provided with feedback on your performance on those assignments.

Peerwise

Peerwise is an online collaboration tool. During the second half of the semester you will use Peerwise to develop context-specific questions and attempt problems. This activity will promote higher levels of learning and reasoning, as students will compose questions based on their understanding of the scientific concepts discussed in Biol115.

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/

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

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

- Understand how biological information is encoded in the structure of the genetic molecule, DNA.
- Explain how the Central Dogma explains the flow of biological information in living systems.
- Describe the Cell Theory, which defines the basic unit of life.
- Describe how large macromolecules, such as nucleic acids and proteins are constructed from simpler building blocks
- Evaluate how gene expression is regulated
- Explain how eukaryotic cells are constructed, in terms of the structure and functions of organelles.
- Explain how genetic information is transmitted from one generation to the next through cellular replication processes
- Understand how DNA provides a record of the evolutionary history of individuals and populations.
- Develop the basic elements of scientific writing, including gathering relevant information from the literature and synthesise that information into a cogent essay or other activities.
- Undertake quantitative and quantitative analyses of scientific data and draw meaningful conclusion from them.

Assessment tasks

- Assignment 1: Abstract writing
- Assignment 2. Poster
- Assignment 3: Peerwise
- Practical / Quizzes
- Mid-Semester Exam
- 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 how the Central Dogma explains the flow of biological information in living systems.
- Describe the Cell Theory, which defines the basic unit of life.
- Explain how genetic information is transmitted from one generation to the next through cellular replication processes
- Develop the basic elements of scientific writing, including gathering relevant information from the literature and synthesise that information into a cogent essay or other activities.

Assessment tasks

- Assignment 1: Abstract writing
- Assignment 2. Poster
- Assignment 3: Peerwise
- Practical / Quizzes
- Mid-Semester Exam
- 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

- Understand how biological information is encoded in the structure of the genetic molecule, DNA.
- Explain how eukaryotic cells are constructed, in terms of the structure and functions of organelles.
- Understand how DNA provides a record of the evolutionary history of individuals and populations.
- Undertake quantitative and quantitative analyses of scientific data and draw meaningful conclusion from them.

Assessment tasks

- Practical / Quizzes
- 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:

Assessment tasks

- Assignment 2. Poster
- Assignment 3: Peerwise
- Practical / Quizzes
- 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

- Explain how genetic information is transmitted from one generation to the next through cellular replication processes
- Develop the basic elements of scientific writing, including gathering relevant information from the literature and synthesise that information into a cogent essay or other activities.

Assessment tasks

- Practical / Quizzes
- Final Exam