



# BIOL12105 *Scientific Analysis and Statistics*

## Term 3 - 2017

Profile information current as at 02/05/2024 10:20 am

All details in this unit profile for BIOL12105 have been officially approved by CQUniversity and represent a learning partnership between the University and you (our student). The information will not be changed unless absolutely necessary and any change will be clearly indicated by an approved correction included in the profile.

### General Information

#### Overview

An understanding of experimental design, statistical methods, ethics and the ability to critically analyse scientific reports is essential for graduates in the biological sciences. In this unit, you will study experimental design, ethics and commonly used statistical procedures. You will be introduced to hypothesis testing and experimental design, parametric and non-parametric analyses, one, two and multi sample analyses (including one way, two way, nested and randomised block ANOVA designs), correlation and regression, and data transformation. The learning and teaching strategy uses a clear, conceptual approach, which assumes that you have little or no statistical background.

#### Details

Career Level: *Undergraduate*

Unit Level: *Level 2*

Credit Points: 6

Student Contribution Band: 7

Fraction of Full-Time Student Load: 0.125

#### Pre-requisites or Co-requisites

Prerequisite: SCIE11024 Science Investigation

Important note: Students enrolled in a subsequent unit who failed their pre-requisite unit, should drop the subsequent unit before the census date or within 10 working days of Fail grade notification. Students who do not drop the unit in this timeframe cannot later drop the unit without academic and financial liability. See details in the [Assessment Policy and Procedure \(Higher Education Coursework\)](#).

#### Offerings For Term 3 - 2017

- Distance

#### Attendance Requirements

All on-campus students are expected to attend scheduled classes – in some units, these classes are identified as a mandatory (pass/fail) component and attendance is compulsory. International students, on a student visa, must maintain a full time study load and meet both attendance and academic progress requirements in each study period (satisfactory attendance for International students is defined as maintaining at least an 80% attendance record).

#### Residential Schools

This unit has a Optional Residential School for distance mode students and the details are:

Click here to see your [Residential School Timetable](#).

#### Website

[This unit has a website, within the Moodle system, which is available two weeks before the start of term. It is important that you visit your Moodle site throughout the term. Please visit Moodle for more information.](#)

## Class and Assessment Overview

### Recommended Student Time Commitment

Each 6-credit Undergraduate unit at CQUniversity requires an overall time commitment of an average of 12.5 hours of study per week, making a total of 150 hours for the unit.

### Class Timetable

#### [Regional Campuses](#)

Bundaberg, Cairns, Emerald, Gladstone, Mackay, Rockhampton, Townsville

#### [Metropolitan Campuses](#)

Adelaide, Brisbane, Melbourne, Perth, Sydney

### Assessment Overview

#### 1. **Practical Assessment**

Weighting: 25%

#### 2. **Written Assessment**

Weighting: 25%

#### 3. **Examination**

Weighting: 50%

### Assessment Grading

This is a graded unit: your overall grade will be calculated from the marks or grades for each assessment task, based on the relative weightings shown in the table above. You must obtain an overall mark for the unit of at least 50%, or an overall grade of 'pass' in order to pass the unit. If any 'pass/fail' tasks are shown in the table above they must also be completed successfully ('pass' grade). You must also meet any minimum mark requirements specified for a particular assessment task, as detailed in the 'assessment task' section (note that in some instances, the minimum mark for a task may be greater than 50%). Consult the [University's Grades and Results Policy](#) for more details of interim results and final grades.

## CQUniversity Policies

**All University policies are available on the [CQUniversity Policy site](#).**

You may wish to view these policies:

- Grades and Results Policy
- Assessment Policy and Procedure (Higher Education Coursework)
- Review of Grade Procedure
- Student Academic Integrity Policy and Procedure
- Monitoring Academic Progress (MAP) Policy and Procedure – Domestic Students
- Monitoring Academic Progress (MAP) Policy and Procedure – International Students
- Student Refund and Credit Balance Policy and Procedure
- Student Feedback – Compliments and Complaints Policy and Procedure
- Information and Communications Technology Acceptable Use Policy and Procedure

This list is not an exhaustive list of all University policies. The full list of University policies are available on the [CQUniversity Policy site](#).

## Previous Student Feedback

### Feedback, Recommendations and Responses

Every unit is reviewed for enhancement each year. At the most recent review, the following staff and student feedback items were identified and recommendations were made.

#### Feedback from Student feedback survey.

##### Feedback

Overall, the student feedback was very positive. Students generally felt that the weekly tutorials and the hands on experience they received in the residential schools were essential in understanding the unit material.

##### Recommendation

No recommendations required.

## Unit Learning Outcomes

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

1. Describe the uses, pitfalls and limitations of parametric and non-parametric statistical tests
2. Choose an appropriate statistical test for a set of data
3. Correctly use software programs for analysing scientific data
4. Know when experiments require ethical clearance and explain the basic principles of ethical experimentation
5. Critique scientific reports and research proposals in terms of the quality of their experimental design
6. Design realistic experiments with appropriate control and replicates
7. Explain the rationale behind statistical testing and probability levels.

## Alignment of Learning Outcomes, Assessment and Graduate Attributes



### Alignment of Assessment Tasks to Learning Outcomes

Assessment Tasks	Learning Outcomes						
	1	2	3	4	5	6	7
1 - Written Assessment - 25%	•			•	•		
2 - Practical Assessment - 25%		•	•				
3 - Examination - 50%	•	•		•	•	•	•

### Alignment of Graduate Attributes to Learning Outcomes

Graduate Attributes	Learning Outcomes						
	1	2	3	4	5	6	7
1 - Communication				•	•		•
2 - Problem Solving	•	•	•		•	•	•

Graduate Attributes	Learning Outcomes						
	1	2	3	4	5	6	7
3 - Critical Thinking	•	•	•	•	•	•	
4 - Information Literacy							
5 - Team Work							
6 - Information Technology Competence			•				
7 - Cross Cultural Competence							
8 - Ethical practice	•	•		•	•	•	
9 - Social Innovation							
10 - Aboriginal and Torres Strait Islander Cultures							

## Alignment of Assessment Tasks to Graduate Attributes

Assessment Tasks	Graduate Attributes									
	1	2	3	4	5	6	7	8	9	10
1 - Written Assessment - 25%	•	•	•	•				•		
2 - Practical Assessment - 25%	•	•	•			•				
3 - Examination - 50%	•	•	•					•		

## Textbooks and Resources

### Textbooks

BIOL12105

#### Prescribed

#### Statistics Explained

Edition: 2nd (2012)

Authors: McKillup, S.C.

Cambridge University Press

Cambridge, UK

ISBN: 978-0-521-18328-4

Binding: Paperback

#### Additional Textbook Information

Either the first (2005) or second edition (2012) of the textbook will be suitable for 2017.

[View textbooks at the CQUniversity Bookshop](#)

### IT Resources

**You will need access to the following IT resources:**

- CQUniversity Student Email
- Internet
- Unit Website (Moodle)
- IBM SPSS Statistics Graduate Pack edition. Version 19 or higher.

## Referencing Style

**All submissions for this unit must use the referencing styles below:**

- [American Psychological Association 6th Edition \(APA 6th edition\)](#)
- [Harvard \(author-date\)](#)

For further information, see the Assessment Tasks.

## Teaching Contacts

**Olivia Daniels** Unit Coordinator

[o.daniels@cqu.edu.au](mailto:o.daniels@cqu.edu.au)

## Schedule

### Week 1 - 06 Nov 2017

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"><li>• Introduction to Scientific Analysis and Statistics</li><li>• The scientific method of 'doing' science</li></ul>	1 and 2 of the study guide. Textbook Chapters: <ul style="list-style-type: none"><li>• McKillup (2005) - Chapters 1 and 2</li></ul> <b>OR</b> <ul style="list-style-type: none"><li>• McKillup (2012) - Chapters 1 and 2</li></ul>	

### Week 2 - 13 Nov 2017

Module/Topic	Chapter	Events and Submissions/Topic
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- Types of data
  - Essential concepts of sampling and experimental design
- 3 and 4 of the study guide.  
Textbook chapters:
- McKillup (2005) - Chapters 3 and 4
- OR**
- McKillup (2012) - Chapters 3 and 4

### Week 3 - 20 Nov 2017

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> <li>• Making decisions about the result of an experiment</li> <li>• Working with samples</li> </ul>	5 and 6 of the study guide. Textbook chapters: <ul style="list-style-type: none"> <li>• McKillup (2005) - Chapters 5 and 6</li> </ul> <b>OR</b> <ul style="list-style-type: none"> <li>• McKillup (2012) - Chapters 6 and 8</li> </ul>	

### Week 4 - 27 Nov 2017

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> <li>• Normal distributions - simple tests for one and two samples</li> <li>• Type I errors, Type II errors and sample size</li> </ul>	7 and 8 of the study guide. Textbook chapters: <ul style="list-style-type: none"> <li>• McKillup (2005) - Chapters 7 and 8</li> </ul> <b>OR</b> <ul style="list-style-type: none"> <li>• McKillup (2012) - Chapters 9 and 10</li> </ul>	

### Vacation Week - 04 Dec 2017

Module/Topic	Chapter	Events and Submissions/Topic
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### Week 5 - 11 Dec 2017

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> <li>• Normal distributions - tests for more than two independent samples</li> <li>• Multiple comparisons after doing a one factor ANOVA</li> </ul>	9 and 10 of the study guide. Textbook chapters: <ul style="list-style-type: none"> <li>• McKillup (2005) - Chapters 9 and 10</li> </ul> <b>OR</b> <ul style="list-style-type: none"> <li>• McKillup (2012) - Chapters 11 and 12</li> </ul>	

### Week 6 - 18 Dec 2017

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> <li>• Two factor analysis of variance</li> <li>• Assumptions of ANOVA tests</li> <li>• Transformations</li> </ul>	11 and 12 of the study guide. Textbook chapters: <ul style="list-style-type: none"> <li>• McKillup (2005) - Chapters 11 and 12</li> </ul> <b>OR</b> <ul style="list-style-type: none"> <li>• McKillup (2012) - Chapters 13 and 14</li> </ul>	<b>Practical Assessment Due:</b> Week 6 Monday (18 Dec 2017) 11:55 pm AEST

### Week 7 - 01 Jan 2018

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> <li>• Correlation analysis</li> <li>• Simple linear regression</li> </ul>	13 and 14 of the study guide. Textbook chapters: <ul style="list-style-type: none"> <li>• McKillup (2005) - Chapters 14 and 15</li> </ul> <b>OR</b> <ul style="list-style-type: none"> <li>• McKillup (2012) - Chapters 16 and 17</li> </ul>	

### Week 8 - 08 Jan 2018

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> <li>• Non-parametric statistics</li> </ul>	15 of the study guide. Textbook chapters: <ul style="list-style-type: none"> <li>• McKillup (2005) - Chapter 16</li> </ul> <b>OR</b> <ul style="list-style-type: none"> <li>• McKillup (2012) - Chapter 19</li> </ul>	<b>Critique of a scientific paper Due:</b> Week 8 Monday (8 Jan 2018) 11:55 pm AEST

### Week 9 - 15 Jan 2018

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> <li>Non-parametric tests for nominal scale and categorical data</li> </ul>	16 of the study guide. Textbook chapters: <ul style="list-style-type: none"> <li>McKillup (2005) - Chapter 17</li> </ul> <b>OR</b> <ul style="list-style-type: none"> <li>McKillup (2012) - Chapter 20</li> </ul>	
<b>Week 10 - 22 Jan 2018</b>		
Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> <li>Rank correlation and tests for ratio, interval and ordinal scale data</li> <li>Introduction to multivariate analysis</li> </ul>	17 and 18 of the study guide. Textbook chapters: <ul style="list-style-type: none"> <li>McKillup (2005) - Chapter 18</li> </ul> <b>OR</b> <ul style="list-style-type: none"> <li>McKillup (2012) - Chapters 21 and 22</li> </ul>	
<b>Week 11 - 29 Jan 2018</b>		
Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> <li>Choosing the right statistical test</li> <li>Ethics</li> </ul>	19 and 20 of the study guide. Textbook chapters: <ul style="list-style-type: none"> <li>McKillup (2005) - Chapters 19 and 20</li> </ul> <b>OR</b> <ul style="list-style-type: none"> <li>McKillup (2012) - Chapters 23 and 5</li> </ul>	
<b>Week 12 - 05 Feb 2018</b>		
Module/Topic	Chapter	Events and Submissions/Topic
	Revision	
<b>Review/Exam Week - 12 Feb 2018</b>		
Module/Topic	Chapter	Events and Submissions/Topic

## Assessment Tasks

### 1 Practical Assessment

#### Assessment Type

Practical Assessment

#### Task Description

You are required to evaluate the data from three different experiments, suggest an appropriate statistical test for each, carry out the tests using IBM SPSS statistics package and interpret the results. An assessment template with further instructions will be provided on the unit Moodle site. You must use this template to complete the assessment.

**All assessments will automatically be submitted to the similarity detection website Turnitin, in accordance with CQUniversity policy. Please ensure all work is your own and has not previously been submitted elsewhere.**

#### Assessment Due Date

Week 6 Monday (18 Dec 2017) 11:55 pm AEST

#### Return Date to Students

Week 8 Friday (12 Jan 2018)

#### Weighting

25%

#### Minimum mark or grade

50 %

#### Assessment Criteria

Marks will be awarded for:

- Appropriate choice of test (20 marks)
- Correct use of the software (20 marks)

- Correct and complete statistics presented (30 marks)
- Complete, correct and appropriate interpretation of the outcome (30 marks)
- Correct grammar/English expression (30 Marks)

### Referencing Style

- [American Psychological Association 6th Edition \(APA 6th edition\)](#)
- [Harvard \(author-date\)](#)

### Submission

Online

### Submission Instructions

Students must submit the assessment via the unit Moodle site.

### Learning Outcomes Assessed

- Choose an appropriate statistical test for a set of data
- Correctly use software programs for analysing scientific data

### Graduate Attributes

- Communication
- Problem Solving
- Critical Thinking
- Information Technology Competence

## 2 Critique of a scientific paper

### Assessment Type

Written Assessment

### Task Description

You are required to critique one published scientific paper, chosen from a list of four papers provided on the unit Moodle site. Your assessment of the published scientific paper should include the following:

- A clear and succinct description of the experiment(s)
- Comments on ethical clearance or lack of
- Flaws in the experimental design
- Interpretation of results and conclusions drawn.

You are also required to provide your own constructive suggestions for improvement. Links to four scientific papers are provided on the unit Moodle site. Please choose one of these papers for your critique. **There is more information and help with the assignment on the Moodle site for BIOL12105.**

Your assessment should be approximately 1500 words (absolute maximum of 1800 words). Penalties will apply for assessments that go over the maximum word count. Your assessment must be written using correct grammar and English expression. Your assessment should also be well presented using a plain text such as Times New Roman or Arial size 12 font. Please use 'double space' line spacing and do not use background images or themes. Your assessment should have your name, student number and a title on the first page of your critique.

**All essays will automatically be submitted to the similarity detection website Turnitin, in accordance with CQUniversity policy. Please ensure all work is your own and has not previously been submitted anywhere.**

### Assessment Due Date

Week 8 Monday (8 Jan 2018) 11:55 pm AEST

### Return Date to Students

Week 10 Friday (26 Jan 2018)

### Weighting

25%

### Minimum mark or grade

50 %

### Assessment Criteria

**A breakdown of the marks is as follows:**

- Correct grammar and English expression (20 marks)
- Correct citing / referencing of the journal paper that has been used for your critique (5 marks)
- Clear and succinct description of the experiment (5 marks)

- Faults in experimental design and interpretation identified and deficiencies explained (25 marks)
- Constructive diplomatic style used throughout the assessment (25 marks)
- Original style explaining concepts in your own words and explained clearly and logically (25 marks)

A marking rubric has been provided on the unit Moodle site.

### Referencing Style

- [American Psychological Association 6th Edition \(APA 6th edition\)](#)
- [Harvard \(author-date\)](#)

### Submission

Online

### Submission Instructions

Please submit your assessment via the unit Moodle site.

### Learning Outcomes Assessed

- Describe the uses, pitfalls and limitations of parametric and non-parametric statistical tests
- Know when experiments require ethical clearance and explain the basic principles of ethical experimentation
- Critique scientific reports and research proposals in terms of the quality of their experimental design

### Graduate Attributes

- Communication
- Problem Solving
- Critical Thinking
- Information Literacy
- Ethical practice

## Examination

### Outline

Complete an invigilated examination.

### Date

During the examination period at a CQUniversity examination centre.

### Weighting

50%

### Length

180 minutes

### Minimum mark or grade

50%

### Exam Conditions

Closed Book.

### Materials

No calculators permitted

Dictionary - non-electronic, concise, direct translation only (dictionary must not contain any notes or comments).

## Academic Integrity Statement

As a CQUniversity student you are expected to act honestly in all aspects of your academic work.

Any assessable work undertaken or submitted for review or assessment must be your own work. Assessable work is any type of work you do to meet the assessment requirements in the unit, including draft work submitted for review and feedback and final work to be assessed.

When you use the ideas, words or data of others in your assessment, you must thoroughly and clearly acknowledge the source of this information by using the correct referencing style for your unit. Using others' work without proper acknowledgement may be considered a form of intellectual dishonesty.

Participating honestly, respectfully, responsibly, and fairly in your university study ensures the CQUniversity qualification you earn will be valued as a true indication of your individual academic achievement and will continue to receive the respect and recognition it deserves.

As a student, you are responsible for reading and following CQUniversity's policies, including the [Student Academic Integrity Policy and Procedure](#). This policy sets out CQUniversity's expectations of you to act with integrity, examples of academic integrity breaches to avoid, the processes used to address alleged breaches of academic integrity, and potential penalties.

### What is a breach of academic integrity?

A breach of academic integrity includes but is not limited to plagiarism, self-plagiarism, collusion, cheating, contract cheating, and academic misconduct. The Student Academic Integrity Policy and Procedure defines what these terms mean and gives examples.

### Why is academic integrity important?

A breach of academic integrity may result in one or more penalties, including suspension or even expulsion from the University. It can also have negative implications for student visas and future enrolment at CQUniversity or elsewhere. Students who engage in contract cheating also risk being blackmailed by contract cheating services.

### Where can I get assistance?

For academic advice and guidance, the [Academic Learning Centre \(ALC\)](#) can support you in becoming confident in completing assessments with integrity and of high standard.

### What can you do to act with integrity?



#### Be Honest

If your assessment task is done by someone else, it would be dishonest of you to claim it as your own



#### Seek Help

If you are not sure about how to cite or reference in essays, reports etc, then seek help from your lecturer, the library or the Academic Learning Centre (ALC)



#### Produce Original Work

Originality comes from your ability to read widely, think critically, and apply your gained knowledge to address a question or problem