# BIOL12105 *Scientific Analysis and Statistics*
## Term 2 - 2019

Profile information current as at 12/10/2024 05:07 pm

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 2 - 2019

- Online

### 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).

### 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. **Written Assessment**
Weighting: 25%
2. **Practical 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 Self reflection.

**Feedback**

Face to face tutorials were conducted, however, attendance was very low (one student). This was likely due to students not being able to attend at the time specified by timetabling.

**Recommendation**

Allow students an opportunity to select a preferred day/time for tutorials, form a list of available day/time slots.

## 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

— N/A Level | • Introductory Level | • Intermediate Level | • Graduate Level | ◦ Professional Level | ◦ Advanced Level

### 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, Steve C.
Cambridge University Press
Cambridge , UK
ISBN: 978-0521183284
Binding: Paperback

**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 style: Harvard (author-date)
For further information, see the Assessment Tasks.

## Teaching Contacts

**Andrew Irving** Unit Coordinator
a.irving@cqu.edu.au

## Schedule

**Week 1 - 15 Jul 2019**

| Module/Topic | Chapter | Events and Submissions/Topic |
|---|---|---|
| • Introduction to Scientific Analysis and Statistics<br>• The Scientific Method revisited | McKillup Chapters 1 & 2 | |

**Week 2 - 22 Jul 2019**

| Module/Topic | Chapter | Events and Submissions/Topic |
|---|---|---|
| • Types of data<br>• Essential concepts of sampling and experimental design | McKillup Chapters 3 & 4 | |

**Week 3 - 29 Jul 2019**

| Module/Topic | Chapter | Events and Submissions/Topic |
|---|---|---|
| • Making decisions about the results of an experiment<br>• Working with samples | McKillup Chapters 5 & 6 | |

**Week 4 - 05 Aug 2019**

| Module/Topic | Chapter | Events and Submissions/Topic |
|---|---|---|
| • Normal distributions - simple tests for one and two samples<br>• Type I and Type II errors, and sample size | McKillup Chapters 7 & 8 | |

**Week 5 - 12 Aug 2019**

| Module/Topic | Chapter | Events and Submissions/Topic |
|---|---|---|
| • Normal distributions - tests for more than two independent samples<br>• Multiple comparisons after doing a one-factor ANOVA | McKillup Chapters 9 & 10 | |

**Vacation Week - 19 Aug 2019**

| Module/Topic | Chapter | Events and Submissions/Topic |
|---|---|---|

**Week 6 - 26 Aug 2019**

| Module/Topic | Chapter | Events and Submissions/Topic |
|---|---|---|
| • Two-factor Analysis of Variance<br>• Assumptions of ANOVA tests<br>• Data transformations | McKillup Chapters 11 - 14 | **Critique of a research project** Due: Week 6 Friday (30 Aug 2019) 11:45 pm AEST |

**Week 7 - 02 Sep 2019**

| Module/Topic | Chapter | Events and Submissions/Topic |
|---|---|---|
| • Correlation analysis<br>• Simple linear regression | McKillup Chapters 14 - 17 | |

| Week 8 - 09 Sep 2019 | | |
|---|---|---|
| **Module/Topic** | **Chapter** | **Events and Submissions/Topic** |
| • Non-parametric statistics | McKillup Chapters 16 & 19 | |

| Week 9 - 16 Sep 2019 | | |
|---|---|---|
| **Module/Topic** | **Chapter** | **Events and Submissions/Topic** |
| • Non-parametric tests for nominal, scale, and categorical data | McKillup Chapters 17 & 20 | |

| Week 10 - 23 Sep 2019 | | |
|---|---|---|
| **Module/Topic** | **Chapter** | **Events and Submissions/Topic** |
| • Rank correlation and tests for ratio, interval, and ordinal scale data<br>• Introduction to multivariate analyses | McKillup Chapters 18 - 22 | |

| Week 11 - 30 Sep 2019 | | |
|---|---|---|
| **Module/Topic** | **Chapter** | **Events and Submissions/Topic** |
| • Choosing the right statistical test<br>• Ethics | McKillup Chapters 19 - 23 | **Practical analysis of research data**<br>Due: Week 11 Monday (30 Sept 2019) 11:45 pm AEST |

| Week 12 - 07 Oct 2019 | | |
|---|---|---|
| **Module/Topic** | **Chapter** | **Events and Submissions/Topic** |
| • Revision | | |

| Review/Exam Week - 14 Oct 2019 | | |
|---|---|---|
| **Module/Topic** | **Chapter** | **Events and Submissions/Topic** |

| Exam Week - 21 Oct 2019 | | |
|---|---|---|
| **Module/Topic** | **Chapter** | **Events and Submissions/Topic** |

## Term Specific Information

Please note that this unit is delivered entirely online, and as such, will require your dedication to keep up with the lecture and unit content throughout term. The Moodle page will be a central resource for accessing content, assignment instructions, as well as the teaching staff.

## Assessment Tasks

### 1 Critique of a research project

**Assessment Type**
Written Assessment

**Task Description**
You are required to critique the summary of a research project, using the knowledge you have gained so far in the unit. You will be provided with a detailed description of a research project that will contain flaws in the approach, experimental design, logic of thought, etc. for you to consider. In your critique submission, you will need to:

- Identify the flaws in logic, methodology, analytical approach, etc., and describe why you consider it a flaw, and
- Present your solution to remedy the flaw, if possible (if not possible, explain why).

You may present your findings as either regular prose (i.e. akin to an essay or report), as an expanded list of dot points, or as a table. Please choose whichever written format you consider will be most suited to conveying your thoughts. There is a limit of 1000 words for this assignment.

**Assessment Due Date**
Week 6 Friday (30 Aug 2019) 11:45 pm AEST

Submission via Moodle

**Return Date to Students**
Week 8 Friday (13 Sept 2019)

Return via Moodle

**Weighting**
25%

**Minimum mark or grade**
50 %

**Assessment Criteria**
This assessment is worth 25 % of your overall unit grade, and will be marked according to the following criteria:

- Flaw identification and reasoning (40 %)
- Solutions to flaws (40 %)
- Spelling and grammar (20 %)

**Referencing Style**

- Harvard (author-date)

**Submission**
Online

**Submission Instructions**
Submit your assignment as a Word document in Moodle. No PDF files please.

**assessmentOutcome**

- 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

**assessmentGradAttribute**

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

## 2 Practical analysis of research data

**Assessment Type**
Practical Assessment

**Task Description**
You are required to evaluate the data acquired from three different experiments, suggest an appropriate statistical test for each, do the tests using the IBM SPSS statistics computer program, and interpret your results. An assessment template with the data and questions to answer will be provided on the Moodle site. You will be able to type your answers directly into this template, and resubmit the file to Moodle for assessment.

**Assessment Due Date**
Week 11 Monday (30 Sept 2019) 11:45 pm AEST

Submission via Moodle

**Return Date to Students**
Review/Exam Week Monday (14 Oct 2019)

Return via Moodle

**Weighting**
25%

**Minimum mark or grade**
50 %

**Assessment Criteria**
This assessment is worth 25 % of your overall unit grade, and will be marked based on the following criteria:

- Appropriate choice of statistical test (12 %)
- Correct use of statistical test (36 %)
- Correct interpretation of the outcome(s) of statistical tests (36 %)
- Spelling and grammar (16 %)

**Referencing Style**

- Harvard (author-date)

**Submission**
Online

**Submission Instructions**
Submit your assignment as a Word document in Moodle. No PDF files please.

**assessmentOutcome**

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

**assessmentGradAttribute**

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

## 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**
Dictionary - non-electronic, concise, direct translation only (dictionary must not contain any notes or comments).
Calculator - non-programmable, no text retrieval, silent only

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**assessmentOutcome**

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**assessmentGradAttribute**

## 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