



# BIOL12105 *Scientific Analysis and Statistics*

## Term 3 - 2020

Profile information current as at 26/04/2024 07:37 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 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, and nested ANOVA designs, as well as multivariate analyses), 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: SCIE11023 Scientific Research Fundamentals or ESSC11004 Study and Research Skills for Health Science or 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 - 2020

- 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. **Online Quiz(zes)**

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 Moodle feedback

##### Feedback

One student suggested that the unit could be improved by providing practice questions they could work through before the end-of-term quiz

##### Recommendation

Multiple past exams/quiz questions are already provided on the Moodle site, and additional questions will be provided in future offerings.

#### Feedback from Emails

##### Feedback

There was some apparent confusion from a couple of students regarding the scope of the first assessment.

##### Recommendation

Upon review of the assessment description, there was some ambiguity in the language of the specific tasks set. The wording will subsequently be modified to remove this ambiguity.

#### Feedback from Moodle feedback

##### Feedback

A comment was provided that noted the breakdown of the unit content into smaller, more digestible units helped their ability to learn and accumulate the knowledge across the length of the term.

##### Recommendation

This format will be continued for future offerings, with the recommendation that additional opportunities to deliver content in the same way be identified within the unit.

## 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 |
| <b>1 - Written Assessment - 25%</b> | •                 |   |   | • | • |   |   |

| Assessment Tasks               | Learning Outcomes |   |   |   |   |   |   |
|--------------------------------|-------------------|---|---|---|---|---|---|
|                                | 1                 | 2 | 3 | 4 | 5 | 6 | 7 |
| 2 - Practical Assessment - 25% |                   | • | • |   |   |   |   |
| 3 - Online Quiz(zes) - 50%     | •                 | • |   | • | • | • | • |

### Alignment of Graduate Attributes to Learning Outcomes

| Graduate Attributes                                 | Learning Outcomes |   |   |   |   |   |   |
|---|-------------------|---|---|---|---|---|---|
|   | 1                 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1 - Communication                                   |                   |   |   | • | • |   | • |
| 2 - Problem Solving                                 |                   | • | • |   | • | • | • |
| 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 - Online Quiz(zes) - 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)

## 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](mailto:a.irving@cqu.edu.au)

## Schedule

### Week 1 - 09 Nov 2020

#### Module/Topic

- Unit introduction
- What is science, logic, and reasoning?
- The scientific method

#### Chapter

McKillup Chapters 1 & 2

#### Events and Submissions/Topic

### Week 2 - 16 Nov 2020

#### Module/Topic

- Types of data
- Fundamentals of sampling and experimental design

#### Chapter

McKillup Chapters 3 & 4

#### Events and Submissions/Topic

### Week 3 - 23 Nov 2020

#### Module/Topic

- Making decisions from data
- The normal distribution

#### Chapter

McKillup Chapters 6 - 8

#### Events and Submissions/Topic

### Week 4 - 30 Nov 2020

#### Module/Topic

#### Chapter

#### Events and Submissions/Topic

- One sample tests
- Two sample tests
- Decision errors

McKillup Chapters 9 - 10

#### Vacation Week - 07 Dec 2020

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

#### Week 5 - 14 Dec 2020

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

- Analysis of Variance (ANOVA)
- Multiple comparisons

McKillup Chapters 11 & 12

**Critique of a research project** Due: Week 5 Friday (18 Dec 2020) 11:45 pm AEST

#### Week 6 - 21 Dec 2020

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

- Assumptions and transformations for ANOVA
- Two-Way ANOVA

McKillup Chapters 13 & 14

#### Vacation Week - 28 Dec 2020

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

#### Week 7 - 04 Jan 2021

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

- Correlation
- Regression

McKillup Chapters 16 & 17

#### Week 8 - 11 Jan 2021

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

- Non-parametric tests
- Chi-square and related tests

McKillup Chapters 19 - 20

#### Week 9 - 18 Jan 2021

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

- Non-parametric correlation

McKillup Chapter 21

#### Week 10 - 25 Jan 2021

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

- Introduction to multivariate statistics
- Principal components analysis
- Multi-dimensional scaling
- Cluster analysis

McKillup Chapter 22

#### Week 11 - 01 Feb 2021

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

- Choosing the right test
- Ethics in research

McKillup Chapters 23 & 5

**Practical analysis of research data** Due: Week 11 Friday (5 Feb 2021) 11:45 pm AEST

#### Week 12 - 08 Feb 2021

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

- Unit revision

#### Exam Week - 15 Feb 2021

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

**End of term quiz** Due: Exam Week Monday (15 Feb 2021) 11:45 pm AEST

## 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 summary description of a research project that will contain flaws in the approach, experimental design, logic of thought, analysis and/or conclusions 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 2000 words for this assignment.

#### Assessment Due Date

Week 5 Friday (18 Dec 2020) 11:45 pm AEST

Please submit your work as a Word document via Moodle

#### Return Date to Students

Week 7 Friday (8 Jan 2021)

Return will be done through 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

Please submit your work as a Word document via Moodle. No PDF files will be accepted.

#### 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

## 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 Friday (5 Feb 2021) 11:45 pm AEST

Please submit your work as a Word document via Moodle

### Return Date to Students

Exam Week Friday (19 Feb 2021)

Return will be done 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 (25 %)

Correct use of statistical test (50 %)

Correct interpretation of the outcome(s) of statistical tests (25 %)

### Referencing Style

- [Harvard \(author-date\)](#)

### Submission

Online

### Submission Instructions

Please submit your work as a Word document via Moodle. No PDF files will be accepted.

### 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

## 3 End of term quiz

### Assessment Type

Online Quiz(zes)

### Task Description

You will be required to complete an end of term online quiz that will test your knowledge of the entire content of the unit. The quiz will be in a similar format to a traditional end of term exam, requiring you to complete the task within a defined period of time (up to 3 hours will be allocated). Some basic calculations will be required.

### Number of Quizzes

1

### Frequency of Quizzes

Other

### Assessment Due Date

Exam Week Monday (15 Feb 2021) 11:45 pm AEST

Please complete your work on Moodle as instructed



**Return Date to Students**

Exam Week Friday (19 Feb 2021)

Return will be via Moodle

**Weighting**

50%

**Minimum mark or grade**

50 %

**Assessment Criteria**

This quiz is worth 50 % of your overall unit grade. Each question in the quiz will be worth a different amount of marks depending on its complexity. Please attempt ALL questions to ensure you can get the highest mark possible. Examples of past similar questions will be provided for you as a study aid on Moodle. Please note the exact timing of the quiz during exam week will be determined in consultation with class timetabling to avoid large numbers of similar end of term assessments being due on the same day. An update on the exact timing will be provided on Moodle as soon as possible. As such, the listed due date above of the 15th of February 2021, is indicative of the start of exam week only.

**Referencing Style**

- [Harvard \(author-date\)](#)

**Submission**

Online

**Submission Instructions**

Please complete the quiz on Moodle as instructed

**Learning Outcomes Assessed**

- Describe the uses, pitfalls and limitations of parametric and non-parametric statistical tests
- Choose an appropriate statistical test for a set of data
- 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
- Design realistic experiments with appropriate control and replicates
- Explain the rationale behind statistical testing and probability levels.

**Graduate Attributes**

- Communication
- Problem Solving
- Critical Thinking
- Ethical practice

## 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