Module Definition Form (MDF)

Module code: MOD007179	**Version:** 4 **Date Amended:** 12/Jul/2023

1. Module Title
Quantitative Techniques and Tools for Biologists

2a. Module Leader
Dawn Hawkins

2b. School
School of Life Sciences

2c. Faculty
Faculty of Science and Engineering

3a. Level
4

3b. Module Type
Standard (fine graded)

4a. Credits
30

4b. Study Hours
300

5. Restrictions

Type	Module Code	Module Name	Condition
Pre-requisites:	None		
Co-requisites:	None		
Exclusions:	None		
Courses to which this module is restricted:			

LEARNING, TEACHING AND ASSESSMENT INFORMATION

6a. Module Description

Quantitative skills are essential for understanding biological systems and undertaking biological research and are relevant to a wide range of graduate employment opportunities. These skills will also allow you to critically evaluate whether quantitative information is being honestly and clearly communicated, whether in a scientific, commercial or political context.

You will develop your skills in a range of mathematical and statistical techniques and software tools. As you do so you will develop your ability to analyse data, construct and use graphs, write and run code, think logically to solve problems, and report quantitative information effectively. Mathematical topics in which you will build competency are size & scale, ratio & proportion, using formulae & equations, modelling and describing rates of change. Statistical topics in which you will build competency are understanding data and sampling, descriptive statistics, estimation, and null hypothesis significance testing. Types of software in which you will build competency are include spreadsheets (such as Excel or Google sheets) and statistical programmes (such as SPSS or R).

Material introduced during interactive lectures and tutorials is reinforced with hands-on computer practical sessions. There is an emphasis throughout on the use of real datasets within a biological context and reference to a wide range of biological examples.

6b. Outline Content

- Importance of quantitative skills in biology: understanding processes, asking and answering questions, case studies
- Understanding data: variables (dependent, independent, interdependent, confounding), levels of measurement, units of measurement
- Size & scale: scientific & standard notation, prefixes, exponentials, logarithms (base 2, e &10), logarithmic scale (including pH)
- Ratio & proportion: part-to-part & part-to-whole ratios, ratios, fractions & percentages, concentration & dilutions, directly proportional relationships (including magnification)
- Using formulae & equations: equations & graphs, equations as models, rearranging formulae, converting between units
- Using graphs: graphs as models, exploring data, communicating data, presentation of graphs
- Describing rates of change: graphical representation of rates of change
- Understanding sampling: probability, populations, samples & sample error, related & unrelated designs
- Descriptive statistics & estimation; mean, median, mode, range, interquartile range, variance & standard deviation, frequency distributions, standard error & confidence intervals
- Null hypothesis significance testing (NHSTs): Tests of frequencies (one-way chi-square, two-way chi-square), Tests of difference (t-test & Mann Whitney U test, paired t-test & Wilcoxon matched pairs test, Anova, Kruskal-Wallis test), Tests of relationship (bivariate regression, Pearson correlation & Spearman correlation
- Assessing patterns in data: choosing and using of graphs, NHSTs and other ways of assessing patterns in data, choosing NHSTs, NHST procedure in general
- Introduction to coding: writing and executing code to organise, analyse and present data.
- Use of spreadsheets: principles of data organisation, manipulation, analysis and presentation using spreadsheets.

6c. Key Texts/Literature

The reading list to support this module is available at: https://readinglists.aru.ac.uk/

6d. Specialist Learning Resources

Computer facility and software (SPSS, R and Excel). Supporting material available through the intranet and/or module VLE.

7. Learning Outcomes (threshold standards)		
No.	**Type**	**On successful completion of this module the student will be expected to be able to:**
1	Knowledge and Understanding	Show competence in, and an understanding of, the importance of, the basic quantification skills required to undertake the study of biology.
2	Knowledge and Understanding	Identify the structure and features of biological data and follow guidelines to select and conduct appropriate analyses.
3	Intellectual, practical, affective and transferrable skills	Understand how the results of data analyses are communicated effectively and according to standard formats.
4	Intellectual, practical, affective and transferrable skills	Exploit the basic features of spreadsheets and statistical computing packages and have the confidence and motivation to expand this ability as needed.
5	Intellectual, practical, affective and transferrable skills	Write and run basic code to analyse and present data.

8a. Module Occurrence to which this MDF Refers				
Year	**Occurrence**	**Period**	**Location**	**Mode of Delivery**
2026/7	ZZF	Template For Face To Face Learning Delivery		Face to Face

8b. Learning Activities for the above Module Occurrence			
Learning Activities	**Hours**	**Learning Outcomes**	**Details of Duration, frequency and other comments**
Lectures	44	1-3	22 x 2 hr active learning sessions
Other teacher managed learning	28	1-5	24 x 1 hr computer tutorials, help, troubleshooting and revision sessions + 2 x 2 hrs test
Student managed learning	228	1-5	Background reading, online activities, preparation for lectures and practicals, and completion of assessments
TOTAL:	300		

9. Assessment for the above Module Occurrence

The assessment for some modules includes a presentation (see below for details on how this particular module is assessed). We recognise that presenting, especially to a large group, can cause significant anxiety or distress for some students. If this may affect you, please contact your Module Leader or the Disability and Neurodiversity Service as early as possible. We will work with you to consider appropriate reasonable adjustments. Depending on your individual needs, these might include, for example, presenting to a smaller group or presenting only to a member of academic staff.

Assessment No.	Assessment Method	Learning Outcomes	Weighting (%)	Fine Grade or Pass/Fail	Qualifying Mark (%)
010	Coursework	1,3	50 (%)	Fine Grade	30 (%)
In-Class Tests (up to 3,000 word equivalent)					

Assessment components for Element 010

Component No.	Assessment Title	Submission Method	Weighting (%)	Components needed for Mark Calculation?
010/1	MCQ 1	Scheduled Activity: Timetabled assessment task	50 (%)	All
010/2	MCQ 2	Scheduled Activity: Timetabled assessment task	50 (%)	

Assessment No.	Assessment Method	Learning Outcomes	Weighting (%)	Fine Grade or Pass/Fail	Qualifying Mark (%)
011	Coursework	2,4,5	50 (%)	Fine Grade	30 (%)
Workbook of exercises (up to 3000 word equivalent)					

Assessment components for Element 011

Component No.	Assessment Title	Submission Method	Weighting (%)	Components needed for Mark Calculation?
011/1	Workbook Part 1	Canvas	25 (%)	All
011/2	Workbook Part 2	Canvas	25 (%)	
011/3	Workbook Part 3	Canvas	25 (%)	
011/4	Workbook Part 4	Canvas	25 (%)	

In order to pass this module, students are required to achieve an overall mark of 40% (for modules at levels 3, 4, 5 and 6) or 50% (for modules at level 7*).

In addition, students are required to:
(a) achieve the qualifying mark for each element of fine graded assessment as specified above
(b) pass any pass/fail elements

[* the pass mark of 50% applies for all module occurrences from the academic year 2024/25 – see Section 3a of this MDF to check the level of the module and Section 8a of this MDF to check the academic year]