

LF904-40 MBio Research Skills (In House)

21/22

Department

Life Sciences

Level

Undergraduate Level 4

Module leader

Isabelle Carre

Credit value

40

Module duration

20 weeks

Assessment

80% coursework, 20% exam

Study locations

Distance or Online Delivery Primary
University of Warwick main campus, Coventry

Description

Introductory description

N/A.

Module aims

This module will provide students with a set of key skills in preparation for careers in Biological Research.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

(i) Data handling:

The taught elements will be delivered in seminar / workshops and online and through video resources. They will then complete the associated worksheets. New sets of materials will be made available weekly in weeks 3 to 24. Online help will be made available through Moodle and face-to-

face support will be available on student visit days through QuBIC.

The following topics will be covered:

1. The importance of statistics and probability in quantitative life science) research: Introduction and motivation
2. The nature of measurement: Random and systematic errors; repeatability and reproducibility; detection limits; blank correction; propagation of error
3. Basic notions of Probability: Events and probabilities; Intersections, unions and independence; Conditional probabilities; Bayes theorem; Combinatorics
4. Summarising data: Types of data; Exploratory data analysis - Graphical tools, Summary statistics; Common statistical distributions and their properties - Normal distribution (including central limit theorem), Binomial distribution, Poisson distribution; Estimates and confidence intervals - point estimates for Normal, Binomial and Poisson distributions, confidence intervals for the mean and for the difference between two means (including the t-distribution)
5. Statistical computing: Statistics with spreadsheets such as Excel; Choice of statistical packages - GenStat, R and Minitab
6. Testing hypotheses: Concept and language; Construction of a simple likelihood ratio test; Student's t-test for comparing means - one-sample, two-sample, paired sample, power; F-test for comparing variances; Chi-square test for association; non-parametric tests.
7. Simple analyses of continuous data: From a two-sample t-test to one-way analysis of variance (ANOVA); Finding the best fitting line; Comparison of these approaches
8. Solving real problems: Integrating a range of simple statistical approaches
9. The basics of experimental design: Main principles of good experimental design - Replication, Randomisation, Blocking and Representativeness; Separation of plot and treatment structure; Choice of treatments and treatment structure; factorial designs; response surfaces
10. Analysing designed experiments: Analysis of Variance (ANOVA) and testing assumptions; Extensions for more complicated designs.
11. Relationships between variables: Calibration and regression; Finding the best fitting line; Comparison of regression lines; Multiple linear regression and variable selection methods; Common non-linear regression models
12. Modelling counts and proportions - Generalised Linear Models, Log-linear models and Logistic Regression
13. Multivariate analysis: Data structure - the basic data matrix; principal component analysis; discriminant analysis, canonical variates analysis and multivariate analysis of variance; principal coordinates and cluster analysis; multidimensional scaling, principal component regression, partial least squares and other multivariate methods
14. Statistics in Action: Examples of the real-life application of the statistical methods introduced during the module, and identification of some more advanced methods that might be useful in research projects

(ii) Research skills workshops.

Each student will attend research skills workshops. These will take place in small groups (up to 12 students). On each of the days, each of the students will give a 15 minute presentation of a research paper, which will be followed by a brief group discussion. In addition, students will have further training to write research proposals.

Visit 1 (week 5)

Journal club session 1

Introduction to the research funding system.

Visit 2 (week 15)

Journal club session 2

How to write a grant application.

Visit 3: (week 25)

Journal club session 3

Peer assessment of research proposals submitted by the students in week 18: Mock funding panel.

(iii) Lab skills: students will receive training in a number of experimental methods that are required in order to complete their research. In order to assess this training, students will submit a piece of reflective writing describing the range of techniques, experimental approaches and other skills that they have learned as part of their industrial placement. Feedback from student supervisors will be considered as part of the marking process

Learning outcomes

By the end of the module, students should be able to:

- Students will gain practical experience of key lab-based techniques and data handling methods.
- They will learn to design and present research projects.
- They will learn to critically assess research proposals and research papers.

Indicative reading list

Degree-specific.

Subject specific skills

1. Lab skills and GLP
2. Data handling and quantitative skills
3. Peer review skills
4. Presentation skills
5. Grant proposal writing
6. Critical appraisal of primary sources

Transferable skills

1. Presentation skills
2. writing skills
3. Data handling
4. Project management

Study

Study time

Type	Required
Tutorials	9 sessions of 1 hour (2%)
Total	400 hours

Type	Required
Practical classes	10 sessions of 7 hours (18%)
Other activity	28 hours (7%)
Private study	293 hours (73%)
Total	400 hours

Private study description

Distance learning, self-study and preparation of assessments.

Other activity description

Quant Skills and technology enhanced statistics sessions

Costs

No further costs have been identified for this module.

Assessment

You do not need to pass all assessment components to pass the module.

Assessment group D

	Weighting	Study time
Lab book assessment	5%	
Data handling assessment 1	7%	
Data handling assessment 2	7%	
Data handling assessment 3	8%	
Data handling assessment 4	8%	
Journal Club presentation 1	5%	
Journal Club presentation 2	5%	
Journal Club presentation 3	5%	
Research proposal	15%	
Critical review of x3 research papers	8%	
Reflective assessment on research proposal	7%	
Lab skills viva	20%	

Feedback on assessment

Feedback will be provided electronically on each piece of written assessment. Feedback on oral presentations will be given in a one-to-one meeting with the academic running the session.

Seminars will be recorded to enable independent assessment by external examiners. The recordings will be made available to students as an additional method of feedback.

[Past exam papers for LF904](#)

Availability

Courses

This module is Core for:

- Year 4 of ULFA-C1A2 Undergraduate Biochemistry (MBio)
- Year 4 of ULFA-C1A1 Undergraduate Biological Sciences (MBio)
- Year 4 of ULFA-C1A3 Undergraduate Biomedical Science (MBio)
- Year 4 of ULFA-C1A4 Undergraduate Medical Microbiology and Virology (MBio)