

CH923-10 Statistics for Data Analysis

26/27

Department

Chemistry

Level

Taught Postgraduate Level

Module leader

Simon Spencer

Credit value

10

Module duration

10 weeks

Assessment

100% coursework

Study location

University of Warwick main campus, Coventry

Description

Introductory description

The aim of this module is to give students a basic understanding of the statistical methods appropriate to data analysis in analytical science, and to provide guidance on some statistical tools for more advanced study. Topics include: basic probability; error analysis and calibration; summarising data and testing simple hypotheses; statistical computing (software and practice, including simple graphics); experimental design and analysis of variance; sampling methods and quality control; simple analysis of multivariate data. Each session will combine lecture and data analysis workshop. At the end of the course the student should be able to appreciate the added value that statistical analysis can bring to research to perform basic statistical analyses of simple data sets using statistical software to design simple experiments.

[Module web page](#)

Module aims

To equip students with the skills needed to perform basic statistical analyses themselves and sufficient knowledge to understand more advanced techniques that they might meet in the scientific literature.

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.

The role of statistics within science and the nature of measurement

Summarising data

Probability and distributions

Testing hypotheses

ANOVA and linear models

Statistical computing

Designing experiments

A selection of advanced material will be presented to the students from the list below, the aim of which is to give students an entry level understanding of the advanced statistical topics that they might meet during their research careers.

Advanced material:

The analysis of designed experiments

Statistical modelling and model choice

Analyses for non-Normal data

Markov chains and stochastic processes

Multivariate methods and clustering

Bootstrap methodology

Introduction to Bayesian statistics and modern computational statistics.

Learning outcomes

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

- (a) Subject knowledge and understanding Be familiar with key probability distributions. Be familiar with commonly used statistical methods.
- (b) Key Skills Use statistical methods to determine data quality and extract key quantities of interest. Perform parameter estimation. Able to formulate and implement an appropriate hypothesis test to determine statistical significance. Use appropriate statistical software.
- (c) Cognitive Skills Understand how probability can be used to describe variation in experimental data. Understand how hypothesis testing can be used to quantify the amount of evidence in favour of a scientific hypothesis.
- (d) Subject-Specific/Professional Skills Know how to analyse data from a range of techniques. Summarise data, implement parameter estimation and appropriate statistical tests. Follow discussion of more advanced statistical techniques in the scientific literature.

Subject specific skills

(a) Subject knowledge and understanding

Be familiar with key probability distributions.

Be familiar with commonly used statistical methods.

(b) Key Skills

Use statistical methods to determine data quality and extract key quantities of interest.

Perform parameter estimation.

Able to formulate and implement an appropriate hypothesis test to determine statistical significance.

Use appropriate statistical software.

(c) Cognitive Skills

Understand how probability can be used to describe variation in experimental data.

Understand how hypothesis testing can be used to quantify the amount of evidence in favour of a scientific hypothesis.

(d) Subject-Specific/Professional Skills

Know how to analyse data from a range of techniques.

Summarise data, implement parameter estimation and appropriate statistical tests.

Follow discussion of more advanced statistical techniques in the scientific literature.

Transferable skills

1 Critical thinking

- Recognise patterns, themes and key messages from sometimes confused and incomplete data.
- Make informed decisions on the value of a range of sources allowing an evidence based conclusion based on this analysis.

2 Problem solving

- Use rational and logical reasoning to deduce appropriate and well-reasoned conclusions.
- Retain an open mind, optimistic of finding solutions, thinking laterally and creatively to look beyond the obvious.
- Knows how to learn from failure.

4 Communication

- Communicate orally in a clear and sensitive manner which is appropriately varied according to different audiences.
- Written: Present arguments, knowledge and ideas, in a range of formats. Active listening: questioning, reflecting, summarising.

7 Digital literacy

- Has the capabilities that enable living, learning and working in a digital society.
- Comfortable with using digital media to communicate, solve problems, manage information, collaborate, create and share content.

11 Professionalism

- Prepared to operate autonomously.
- Aware of how to be efficient and resilient.
- Manages priorities and time.
- Self-motivated, setting and achieving goals, prioritising tasks.

Study

Teaching split

Provider	Weighting
Statistics	85%
Chemistry	15%

Study time

Type	Required
Lectures	12 sessions of 2 hours (24%)
Seminars	16 sessions of 2 hours (32%)
Private study	44 hours (44%)
Total	100 hours

Private study description

No private study requirements defined for this module.

Costs

No further costs have been identified for this module.

Assessment

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

Students can register for this module without taking any assessment.

Assessment group A5

	Weighting	Study time	Eligible for self-certification
Assessment component			
Assessed work	50%		Yes (extension)
Final assessment			

Reassessment component is the same

Assessment component

Class Test	50%		No
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Reassessment component is the same

Feedback on assessment

Written work will be annotated and returned to students. An hour long assessment feedback session will be held to give students feedback on the class test.

Availability

Courses

This module is Core for:

- Year 1 of TCHA-F1PY Postgraduate Taught Analytical Science and Instrumentation
- Year 1 of TCHA-F1PL Postgraduate Taught Molecular Analytical Science

This module is Core optional for:

- TMDA-B91Z Postgraduate Taught Interdisciplinary Biomedical Research
 - Year 1 of B91Z Interdisciplinary Biomedical Research
 - Year 1 of B91Z Interdisciplinary Biomedical Research

This module is Optional for:

- Year 1 of TBSA-C1P9 Postgraduate Taught Systems Biology

This module is Core option list A for:

- Year 2 of TCHA-F1PY Postgraduate Taught Analytical Science and Instrumentation

This module is Core option list B for:

- Year 1 of TCHA-F1PY Postgraduate Taught Analytical Science and Instrumentation

This module is Option list A for:

- Year 1 of RCHA-F1P9 Postgraduate Research Analytical Science
- Year 2 of TBSA-C1P9 Postgraduate Taught Systems Biology

This module is Option list B for:

- Year 1 of TBSA-C1P9 Postgraduate Taught Systems Biology