

## Biology degrees

All biology degree courses require good quantitative skills. It is not just statistics but a range of mathematical techniques that is required from basic ratio to modelling with differential equations. On most courses you will be taught the mathematics required during your first year, although some mathematical knowledge may be assumed. The topics you will cover in the first year will be mostly content from GCSE and AS level Mathematics. There will also be some, particularly the probability and statistics and higher level calculus which is from A level Mathematics.

Whilst the mathematical content may vary from university to university, there are many topics that are common to all courses:

- Basic algebra such as solving linear equations and understanding power laws
- Use of scientific notation and standard form; the ability to manipulate very large and small numbers
- Probability models
- Statistical techniques and hypothesis testing
- Equations of straight line graphs
- Modelling techniques
- Exponential, Logarithmic and Trigonometric Functions
- Calculus and Differential Equations

## Overview of Mathematics covered in Biology Degrees

The table below shows typical areas of mathematics that might be studied in an undergraduate Biology degree course. The hyperlinked topics in red take you to examples of how this mathematics might be used in a Biology degree (some of these resources are in this folder on Integral).

| Straight Line Graphs                                    | Functions & Graphs                    | Calculus   |
|---|---------------------------------------|--|
| Equations of lines                                      | <a href="#">Exponentials</a>          | <a href="#">Rates of Change</a>                        |
| <a href="#">Reducing relationships to a linear form</a> | Logarithms                            | Differentiation  |
| Lines of best fit                                       | Trig Functions                        | Integration  |
|   | <a href="#">Rectangular Hyperbola</a> | <a href="#">Modelling using Differential Equations</a> |
|   |                                       | <a href="#">Recognising different functions</a>        |

| Basic Algebra     | Number                         | Probability                                   | Statistics                         |
|-------------------|--------------------------------|---|------------------------------------|
| Solving equations | <a href="#">Ratio</a>          | Discrete Probability Distributions            | Averages                           |
| Using power laws  | <a href="#">Compound Units</a> | <a href="#">Permutations and Combinations</a> | <a href="#">Standard Deviation</a> |
|                   | Percentages                    | <a href="#">The Normal Distribution</a>       | Histograms                         |

|  |                      |                              |                                   |
|--|----------------------|------------------------------|-----------------------------------|
|  | <b>Standard Form</b> | <b>Hypothesis Testing</b>    | Using Cumulative Frequency Graphs |
|  | <b>Estimation</b>    | <b>Goodness of Fit Tests</b> | <b>Regression and Correlation</b> |

## Example Careers

The work of the NHS Blood and Transfusion service is underpinned by the **research of a team of mathematicians** (document in this folder on Integral).

## Useful links

The following websites and books have useful information about the mathematical topics you will study during your Biology degree together with other resources to support your preparation for Biology at university:

**BioNRICH** - a section of the Nrich website with problems and articles specific to applications of Mathematics in Biology. It is for students aged 14 - 19 and is designed to complement and enhance the study of biology. Many of the examples in the table above are from this website.

**BioMaths** - a comprehensive blog of information on Maths in Biology Education, maintained by Jenny Koenig of Lucy Cavendish College, Cambridge.

**Handbook of Biological Statistics by John H McDonald** - an online textbook which evolved from a set of notes for a Biological Data Analysis class at the University of Delaware.

**Resources for Mathematics Education for Biology Students** - a website that lists resources collected for the Quantitative Curriculum for Life Science Students project in the USA.

**The Maths Centre** - this site was developed by a group from the Universities of Loughborough, Leeds and Coventry and has been set up to deliver mathematics support to students looking for post-16 maths help.

**Mathbench** - University of Maryland supported modules that introduce students to the mathematics in introductory biology courses.

### Textbooks

**Mathematics for Biological Scientists** By Mike Aitken, Bill Broadhurst, Stephen Hladky ISBN 9780815341369 - an undergraduate textbook which covers the mathematics necessary for biology students to understand, interpret and discuss biological questions.

**Biomeasurement: A Student's Guide to Biological Statistics** By Dawn Hawkins ISBN 9780199219995 - an introduction to the use of statistics in the study of the biosciences with an emphasis on why statistical techniques are essential tools for bioscientists.

**Maths from Scratch for Biologists** By Alan J Cann ISBN 9780471498353 - focuses on why numerical skills are useful to biologists and explains step by step how and why you need to tackle maths within the biological sciences.