

# ST341-15 Statistical Genetics

**24/25**

**Department**

Statistics

**Level**

Undergraduate Level 3

**Module leader**

Paul Jenkins

**Credit value**

15

**Module duration**

10 weeks

**Assessment**

Multiple

**Study location**

University of Warwick main campus, Coventry

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## Description

### Introductory description

This module will introduce students to probabilistic models and statistical methods used in the analysis of genetic data.

This module is available for students on a course where it is a listed option and as an Unusual Option to students who have completed the prerequisite modules.

### Pre-requisites

- Statistics Students:
  - ST218 Mathematical Statistics A; or,
  - ST228 Mathematical Methods for Statistics and Probability and ST229 Probability for Mathematical Statistic.
- Non-Statistics Students:
  - ST220/ST226 Introduction to Mathematical Statistics; or,
  - ST232/ST233 Introduction to Mathematical Statistics.

[Module web page](#)

## Module aims

Students will gain a basic understanding of the probabilistic models underlying the field of population genetics, and be exposed to practical applications of common statistical tests.

## 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.

Discrete-time reproductive models - Wright-Fisher, Moran. Coalescent limit. Properties of the standard coalescent, models of mutation, summary statistics and tests for neutrality, e.g. Tajima's D. Hardy-Weinberg laws, recombination, linkage mapping, linkage disequilibrium, association testing, an overview of genome-wide association studies.

## Learning outcomes

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

- Describe simple discrete-time reproductive models and use them to derive the standard coalescent model
- Apply the predictions of coalescent theory to test for departures from neutrality, using simple datasets of DNA sequence variation
- Use simple datasets to evaluate the evidence for associations between genetic loci and Mendelian diseases
- Discuss the practical issues involved in scaling up association testing to whole genomes.

## Indicative reading list

[View reading list on Talis Aspire](#)

## Subject specific skills

Formulation of models for population genetic data, model-based predictions of genetic diversity, parameter estimation and hypothesis testing from DNA sequence data, genome-wide association studies

## Transferable skills

Inference from data, assessment of uncertainty, evaluation of evidence, academic writing, computation

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## Study

## Study time

Type	Required	Optional
Lectures	30 sessions of 1 hour (20%)	2 sessions of 1 hour
Private study	90 hours (60%)	
Assessment	30 hours (20%)	
Total	150 hours	

## Private study description

Weekly revision of lecture notes and materials, wider reading, practice exercises and preparing for examination.

## 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 D5

	Weighting	Study time	Eligible for self-certification
Assignment 1	10%	15 hours	No
The assignment will contain a number of questions for which solutions and / or written responses will be required.			
The number of words noted below refers to the amount of time in hours that a well-prepared student who has attended lectures and carried out an appropriate amount of independent study on the material could expect to spend on this assignment. 500 words is equivalent to one page of text, diagrams, formula or equations; your ST341 Assignment 1 should not exceed 15 pages in length.			
Assignment 2	10%	15 hours	No
The assignment will contain a number of questions for which solutions and / or written responses will be required.			
The number of words noted below refers to the amount of time in hours that a well-prepared student who has attended lectures and carried out an appropriate amount of independent study on the material could expect to spend on this assignment. 500 words is equivalent to one page of text, diagrams, formula or equations; your ST341 Assignment 2 should not exceed 15 pages in length.			
In-Person Examination	80%		No
The examination paper will contain four questions, of which the best marks of THREE questions			

	Weighting	Study time	Eligible for self-certification
will be used to calculate your grade.			
<hr/> <ul style="list-style-type: none"> <li>• Answerbook Pink (12 page)</li> <li>• Students may use a calculator</li> </ul>			

## Assessment group R3

	Weighting	Study time	Eligible for self-certification
On-campus Examination - Resit	100%		No
The examination paper will contain four questions, of which the best marks of THREE questions will be used to calculate your grade.			

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- Answerbook Pink (12 page)
  - Students may use a calculator
  - Graph paper

## Feedback on assessment

Marked assignments will be available for viewing at the support office within 20 working days of the submission deadline. Cohort level feedback and solutions will be provided, and students will be given the opportunity to receive feedback via face-to-face meetings.

Solutions and cohort level feedback will be provided for the examination.

[Past exam papers for ST341](#)

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## Availability

### Anti-requisite modules

If you take this module, you cannot also take:

- ST418-15 Statistical Genetics and Advanced Topics

## Courses

This module is Optional for:

- Year 3 of UCSA-G4G1 Undergraduate Discrete Mathematics
- Year 3 of UCSA-G4G3 Undergraduate Discrete Mathematics
- Year 4 of UCSA-G4G4 Undergraduate Discrete Mathematics (with Intercalated Year)
- Year 4 of UCSA-G4G2 Undergraduate Discrete Mathematics with Intercalated Year
- USTA-G300 Undergraduate Master of Mathematics, Operational Research, Statistics and Economics
  - Year 3 of G300 Mathematics, Operational Research, Statistics and Economics
  - Year 4 of G300 Mathematics, Operational Research, Statistics and Economics

This module is Option list A for:

- Year 4 of USTA-G1G3 Undergraduate Mathematics and Statistics (BSc MMathStat)
- USTA-G1G4 Undergraduate Mathematics and Statistics (BSc MMathStat) (with Intercalated Year)
  - Year 4 of G1G4 Mathematics and Statistics (BSc MMathStat) (with Intercalated Year)
  - Year 5 of G1G4 Mathematics and Statistics (BSc MMathStat) (with Intercalated Year)
- Year 3 of USTA-GG14 Undergraduate Mathematics and Statistics (BSc)
- Year 4 of USTA-GG17 Undergraduate Mathematics and Statistics (with Intercalated Year)
- Year 3 of USTA-Y602 Undergraduate Mathematics, Operational Research, Statistics and Economics
- Year 4 of USTA-Y603 Undergraduate Mathematics, Operational Research, Statistics, Economics (with Intercalated Year)

This module is Option list B for:

- Year 3 of USTA-G1G3 Undergraduate Mathematics and Statistics (BSc MMathStat)

This module is Option list C for:

- Year 3 of USTA-G302 Undergraduate Data Science
- Year 3 of USTA-G304 Undergraduate Data Science (MSci)
- Year 4 of USTA-G303 Undergraduate Data Science (with Intercalated Year)

This module is Option list D for:

- Year 4 of USTA-G300 Undergraduate Master of Mathematics, Operational Research, Statistics and Economics
- Year 5 of USTA-G301 Undergraduate Master of Mathematics, Operational Research, Statistics and Economics (with Intercalated Year)

This module is Option list E for:

- Year 4 of USTA-G300 Undergraduate Master of Mathematics, Operational Research, Statistics and Economics
- Year 5 of USTA-G301 Undergraduate Master of Mathematics, Operational Research, Statistics and Economics (with Intercalated Year)

This module is Option list F for:

- USTA-G301 Undergraduate Master of Mathematics, Operational Research, Statistics and Economics (with Intercalated
  - Year 3 of G30H Master of Maths, Op.Res, Stats & Economics (Statistics with Mathematics Stream)
  - Year 4 of G30H Master of Maths, Op.Res, Stats & Economics (Statistics with Mathematics Stream)

This module is Unusual option for:

- Year 3 of USTA-G300 Undergraduate Master of Mathematics, Operational Research, Statistics and Economics