BS354-15 Laboratories and Assessments for Biological Sciences

24/25

Department
Life Sciences
Level
Undergraduate Level 3
Module leader
Daniel Franklin
Credit value
15
Module duration
30 weeks
Assessment
Multiple
Study location
University of Warwick main campus, Coventry

Description

Introductory description

Subject specific laboratory classes and a small group tutorial programme.

Module aims

To complete the development of students' research and transferrable skills through a program of laboratory and tutorial activities (continuation of programs in Years 1 and 2).

- To complete the development of students’ research and transferrable skills through a set of field, laboratory and workshop activities, continuing programs undertaken in Years 1 and 2.
- To teach field, laboratory and data analysis skills as part of a multidisciplinary investigation that brings together environmental biology, ecology, microbiology, statistics and bioinformatics.
- To help students understand about the importance of ecosystems in environmental and human health and the threats to them from human activity.
- To teach and test skills involving the interpretation of scientific data and communication of results.
- To help students work effectively as a group, collecting large data sets to be shared in order

to provide better outcomes, insights and understanding compared to working individually.

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.

Students will complete the third year of a laboratory and tutorial-based skills program.
The following sequence of instruction, teaching and learning will be undertaken in the lab:

- The students will complete a scientific investigation of the environmental and ecological status of the river Dene, Warwickshire, and the impacts of a sewage treatment plant (STP) on the river.
- The investigation will embed final year level practical, data analysis, and literature research skills. This will be achieved through a multidisciplinary investigation involving ecology, environmental science, microbiology, molecular biology, statistics, bioinformatics.
- The investigation will be taught using field work, laboratory studies, lectures, and workshops.
- Students will collect environmental samples at different points on the river Dene at Wellesbourne in relation to an STP outflow into the river. Samples will be brought back to the laboratory. A set of procedures will be undertaken to do the following: (1) quantify levels of nitrate and phosphate in river samples using chemical assays; (2) plating serial dilutions of river water onto agar media selective for different types of bacteria, and quantifying the concentration of bacteria in water samples using counts of colony forming units; (3) identifying and counting populations of macroinvertebrates inhabiting the river bed, obtained by kick sampling, and determine a range of biodiversity metrics.
- Students will plan out how to visualise and statistically analyse the data, and then carry this out.
- Samples of enteric bacteria, isolated from the river by University staff, will be processed for gene and genome sequencing. Students will undertake a bioinformatics analysis of the data to provide insights into the types of bacteria identified, their biology and function, and their potential impact on human and environmental health.
- Students will take part in lectures and workshops that provide (1) information of the background context and scientific theory underpinning the study, and (2) teaching and guidance in the methods / techniques required for data analysis and interpretation.

Learning outcomes

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

- Students should be able to critically analyse the primary research literature
- Students should be able to design experiments
- Students should be able to navigate ethical approval
- carry out a scientific investigation in environmental biology, working as a group, that requires the collection of different types of data using a combination of field work, laboratory studies (involving chemical, microbiological and ecological assays) and data analysis.
- Demonstrate understanding of: (i) the role of freshwater (river & stream) ecosystems in environmental and human health; (ii) threats to rivers from pollution caused by human

activity; (iii) the use of different methods for monitoring river ecology and environmental status.
- Demonstrate ability to plan and execute the statistical analysis of data, including data visualisation, summary, appropriate testing, interpretation and forming conclusions. Demonstrate an ability to work with large data sets using data pooled from the whole class.
- Be able to use a web based bioinformatics portal to run analysis of bacterial genome sequence data. Be able to construct a simple phylogenetic tree from bacteria gene sequence data using online GUI software. Demonstrate ability to interpret and draw meaningful conclusions from the analysis.
- Synthesise information from the investigation and present it as a report written to a professional standard.

Subject specific skills

- Demonstrate clear understanding of the scientific topic:
  o The ecosystem function of, and services provide by, rivers.
  o Pollution threats to rivers and catchments;
  o Use of biological indicators, chemical assays and microbiological techniques for pollution monitoring;
  o The biology, ecology, environmental fate and behaviour of coliform bacteria released into river systems from STPs and their potential impact on human health including the evolution of antimicrobial resistance in human pathogens.
- Ecology field techniques for sample / data collection;
- Gene and genome sequencing, bioinformatics data pipelines and analysis.
- Statistical analysis of data.
- Systematic searching of literature data bases, extended reading, integration of material obtained through literature searches not provided in lectures & workshops.
- Demonstrate independent thought and deep understanding.
- Construct complex scientific arguments using different kinds of evidence and bring these together to draw own conclusions.

Transferable skills

Critical appraisal of source material
Self directed learning
Ability to work in a group.
Data analysis, making conclusions and inference.
Critical analysis and synthesis of ideas.
Communication of complex topics and areas.

Study

Study time

Type	Required
Tutorials	12 sessions of 1 hour (8%)
Practical classes	50 sessions of 1 hour (33%)
Private study	88 hours (59%)
Total	150 hours

Private study description

Labs - data analysis and report writing.
Tutorials - preparation of material for each contact session, and assessment reports.

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 A2

	Weighting	Study time
Environmental lab report Submission of lab report	48%	
Experimental design 1	10%	
Ethical approval tutorial	10%	
Popular Science Article	32%	

Assessment group R2

	Weighting	Study time
No reassessment	100%	

Feedback on assessment

Written individual feedback

Availability

Courses

This module is Core for:

- UBSA-3 Undergraduate Biological Sciences
  - Year 3 of C100 Biological Sciences
  - Year 3 of C100 Biological Sciences
- Year 3 of ULFA-C1A1 Undergraduate Biological Sciences (MBio)
- Year 4 of ULFA-C113 Undergraduate Biological Sciences (with Placement Year)
- Year 3 of ULFA-C1A5 Undergraduate Biological Sciences with Industrial Placement (MBio)