LF301-12 Bacteria: Genes to Behaviour

21/22

Department
Life Sciences
Level
Undergraduate Level 3
Module leader
Yin Chen
Credit value
12
Module duration
10 weeks
Assessment
100% exam
Study location
University of Warwick main campus, Coventry

Description

Introductory description

This module constitutes part of the final year teaching of the school's provision of advanced level microbiology teaching. This module builds in an integrative fashion on key microbiological modules from previous years.

Module web page

Module aims

This module allows students an opportunity to study molecular and cellular microbiology at the level of current research. The module covers the study of the mechanisms of gene regulation in bacteria at the molecular and cellular level and includes the rapidly developing area of bacterial cell biology. Students will be introduced to a range of molecular mechanisms which show how bacteria respond to their environment including invasion of the host by pathogenic bacteria. The information on gene content of organisms generated by comparative genomics can only be useful if we can understand how gene expression is co-ordinated, including the integration of metabolism, cell growth and environmental responses. One of the principle aims of the module is, to consider bacteria as complex systems that respond to changes in their external and internal environments by overlapping response mechanisms, which exhibit a considerable degree of conservation throughout the microbial world.

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.

1-3. A consideration of the range of mechanisms by which organisms can respond to environmental change including, cAMP, ppGpp, c-di-GMP, two component sensory systems, alternative -factors, small regulatory RNAs and the CRP-FNR and Ara families of transcriptional regulators. The bacterial cell cycle and the architecture of the chromosome (DAH)

4-5 Cell to cell signalling, including quorum-sensing in Gram-positive and Gram-negative bacteria and sex pheromones in Gram-positive bacteria. (DAH)

6-9 A general description of motility and taxes in bacteria, followed by a detailed examination of the mechanism and regulation of flagellar assembly and chemotaxis in bacteria. Type III secretion systems and type IV pilus. Biofilms - environmental and medical significance (DAH)

10-13 The process of sporulation in Bacillus from the biology of the genus through to the molecular mechanisms involved in spore formation. This includes the latest reports from meetings concerning the mechanisms of sporulation induction and establishing different gene expression paths in mother and forespore cells derived from a single parental cell. (DAH)

14-16 Integration of bacterial metabolism through two-component regulatory systems. Coordination of nitrogen metabolism in bacteria will be used as a model to understand the mechanisms by which bacteria regulate gene expression. Discussion of nitrogen fixation by bacteria; detailed mechanisms of regulation; sensing of nitrogen in the environment and how microorganisms adapt to changing nitrogen regimes. (JCM)

17-20. The roles of two component regulatory systems, alternative sigma factors, quorum sensing and transcriptional regulators in the control of virulence gene expression in bacteria using Vibrio cholerae, Pseudomonas spp. and Bordetella pertussis as examples. (JCM)

Learning outcomes

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

- Understand and discuss the elucidation of the regulation, integration and coordination of macromolecular synthesis during microbial cell cycles.
- Understand and discuss a range of intracellular and extracellular response mechanisms.
- Understand and discuss molecular mechanisms of bacterial motility and taxes.
- Understand and discuss the role of two-component sensing systems in bacterial nutrition and pathogenesis.
- Understand and discuss the process of sporulation in Bacillus as an example of cellular differentiation in bacteria.
- Understand and discuss cell-cell interactions at the molecular and cellular level.

Indicative reading list

General Microbiology information can be found in the recommended first and second year texts

especially Brock’s Biology of Microorganisms (Madigan et al.).

Most reference is made to the primary literature in handouts during the lectures. Specific journal references will be recommended during the module. For example, a background reference for lectures 14-16 would be: Dixon & Kahn (2004) Nature Reviews Microbiology, 2: 621-631.

Subject specific skills

a. Demonstrate clear understanding of the scientific topic

b. Contain evidence of extended reading and lateral integration of material not covered in the lectures

c. Demonstrate independent thought and deep understanding

d. Specifically answer the set question using information from multiple lectures and sources

e. Be structured and formatted in a way that demonstrates understanding and logical flow

f. Use multiple sources to construct complex scientific arguments and integrating these to build and develop the student's own scientific conclusions.

Transferable skills

1. Critical appraisal of source material
2. Self directed learning
3. Adult learning

Study

Study time

Type	Required
Lectures	20 sessions of 1 hour (17%)
Private study	100 hours (83%)
Total	120 hours

Private study description

Independent learning, self directed learning and revision for final year exams.

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group B1

	Weighting	Study time
Written Examination	100%	

Feedback on assessment

Summative: In-module assessment will be marked and detailed feedback provided.

Past exam papers for LF301

Availability

Courses

This module is Core for:

- Year 3 of UBSA-3 Undergraduate Biological Sciences

This module is Option list A 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)
- UBSA-C1B9 Undergraduate Biomedical Science
  - Year 3 of C1B9 Biomedical Science
  - Year 3 of C1B9 Biomedical Science
  - Year 3 of C1B9 Biomedical Science
- ULFA-C1A3 Undergraduate Biomedical Science (MBio)
  - Year 3 of C1A3 Biomedical Science
  - Year 3 of C1B9 Biomedical Science