LF213-18 Infection

20/21

Department
Life Sciences
Level
Undergraduate Level 2
Module leader
David Scanlan
Credit value
18
Module duration
10 weeks
Assessment
100% exam
Study location
University of Warwick main campus, Coventry

Description

Introductory description

The content in this Virology section of LF213 (Infection) builds on the introductory first year virology component of BS127 Agents of Infectious Disease.
This component covers the replication strategies of important viruses, antiviral therapies, diagnosis and clinical case studies. Viral replication strategies, within their cellular context, are the cornerstone of all virology – telling us how viruses reproduce inside our cells – and will be required knowledge for Virology modules in the final year of Virology and Biomedical Science degree courses. The medically related aspects of virology (how virus infections are diagnosed and treated) are important in combating viral disease, which should be of particular interest to both virologists and biomedical scientists.

Microbial pathogens introduces you primarily to a range of important microparasites, the diseases they cause and the parasite-host and environmental interactions that govern their biology and approaches to control. Examples include vector-borne and/or zoonotic organisms from Mycobacterium, Trypanosomes to fungi. This module also includes a focus on bacterial nutrition and nutrient acquisition by addressing the growth characteristics of selected pathogens in the environment (or natural reservoir) and how these are modified and adapted with infection of the host. We also look at epidemiological factors involved in their invasion, spread, and colonisation, and the host defense systems that they have to overcome. Techniques used in the diagnosis of infection, and both current and novel approaches to their control will be discussed. We will also look at the impact of infectious disease over the centuries and how they have been perceived and

dealt with by society.

Module web page

Module aims

The aim of the module is to explain the biology of important pathogens. Through study of a variety of microbes, students will gain an appreciation of the diversity of pathogens and pathogenic mechanisms in human infectious disease.

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.

Lecture Outlines

Microbial Pathogens (LF223)

1. Introduction to bacterial pathogens; temperature tolerance, especially cold shock response and Listeria virulence; Legionella and heat shock proteins.
2. pH tolerance, particularly of acidic conditions e.g. by Salmonella typhimurium and Helicobacter pylori.
3. Anaerobiosis and the effect of oxygen on growth and pathogenicity e.g. of Clostridium botulinum, C. tetani.
   4-6. African trypanosomes. The evolutionary biology of African human and cattle trypanosomes and their vectors causing sleeping sickness in humans, and nagana and related diseases in livestock. Important issues relating to zoonotic control include maintaining endemic stability in the context of circulating tick-borne diseases.
4. Apicomplexan parasites: Plasmodium.
   This lecture will provide an introduction to apicomplexan biology, including structure, life cycles, and vectors but focus on Plasmodium, the causative agent of malaria. The clinical significance, pathogenesis, epidemiology and control strategies will be discussed.
5. Apicomplexan parasites: Toxoplasma and Cryptosporidium.
   Toxoplasma is a coccidian parasite which infects humans as well as a wide variety of mammals and birds. It exhibits a predator-prey type life cycle and felines are the only definitive host. Cryptosporidium, a parasite commonly found in lakes and rivers, especially when the water is contaminated with sewage and animal wastes, is a parasite of the intestinal tracts of fishes, reptiles, birds, and mammals.
6. Infections featuring slow growing bacteria: examples, collective problems of diagnosis and treatment.
7. Focus on diseases associated with slow growing mycobacteria: leprosy, historical aspects, treatment and irradiation. Unique features of M. leprae genome and virulence determinants; Buruli ulcers and M. ulcerans.

8. Tuberculosis and its re-emergence as a major global pathogen of the developing and developed world. Association with HIV, diagnosis and treatment: problems for both especially multidrug resistant strains.

12-13. Trypanosoma cruzi (Chagas' disease). The epidemiology of domestic and sylvatic transmission cycles and its implications for the Southern Cone Project working towards its elimination.

14-15. Fungi as pathogens of medical importance; survey and general properties of medically important fungi; prevalence and incidence of fungal diseases, mechanisms of pathogenicity. Biology and pathogenesis of major groups of fungi causing both superficial and deep mycoses. Selected examples will include Aspergillus, Candida, Cryptococcus and Histoplasma including case histories, diagnosis and treatment.
Part B: Virology
Lectures 1-9: Viral Replication Strategies
1-3. Viruses as pathogens, effects on the host, role of the immune system. Introduction to viral replication, summary of the different types of viral genome. Influenza virus replication. Entry into cell and site of replication. Segmented genome structure. Transcription/replication of genome, translation of virus proteins. Assembly and exit from the cell.

1. Measles. Entry into cell. Non-segmented genome structure. Transcription/replication of genome. Transcriptional regulation. RNA editing. Assembly and exit from the cell.

   5-7. Retroviruses, specifically HIV. Genome structure. Receptor binding and entry. Reverse transcription, integration into host cell genome. Transcription and nuclear export of RNA. Ribosomal frameshifting. Assembly and maturation.
   Hepadnaviruses, specifically hepatitis B virus. Structure of genome. DNA completion and repair. Transcription and translation. Reverse transcription. Assembly and exit from the cell. Comparison of hepadnaviruses and retroviruses.

   1. Herpesviruses. Entry into cell and site of replication. Genome structure. DNA replication. Temporal phasing of gene expression. Packaging of genomes into viral particles.
2. Poliovirus replication. Entry into cell. Genome structure. Gene expression and protein production. Assembly and exit from the cell.

Lectures 10-16: Prevention, Diagnosis and Treatment of Viral Infections
10. Vaccination, using poliovirus as an example. Worldwide eradication attempts.

11.Diagnosis. Types of approach used in routine diagnosis, traditional versus new rapid methods. Direct detection of virus / viral components versus detection of specific immune responses.
12-14. Antiviral therapy. Rationale of antiviral drugs. Approaches to drug design including high throughput screening and rational design. Drug development and testing in clinical trials. Antiviral drugs used in the treatment of herpesviruses, influenza and HIV.

15-16. Principles of case management illustrated through clinical case studies.

Learning outcomes

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

- Understand a range of important microparasites, the diseases they cause and the parasite-host and environmental interactions that govern their biology and approaches to control. Examples include vector-borne and/or zoonotic organisms from Mycobacterium, Trypanosomes to fungi. Understand bacterial nutrition and nutrient acquisition by addressing the growth characteristics of selected pathogens in the environment (or natural reservoir) and how these are modified and adapted with infection of the host. Explain epidemiological factors involved in the invasion, spread, and colonisation of pathogens, and the host defense systems that they have to overcome. Understand techniques used in the diagnosis of infection, and both current and novel approaches to their control will be discussed. We will also look at the impact of infectious disease over the centuries and how they have been perceived and dealt with by society. Understand the replication strategies of selected RNA viruses, DNA viruses and retroviruses, and the fundamental differences between them. Understand the principles of diagnosis of viral infections. Understand the different types of current antiviral therapy, how they are discovered, developed and trialled.

Indicative reading list

Part A: Microbial Pathogens:

Madigan, Bender, et al. Eds. Brock Biology of Microorganisms, 15th edn. (Pearson, Benjamin Cummings, 2018). [ISBN 1-292-23510-1]

Mims, et al. Medical Microbiology, updated 3rd edn. (Mosby, 2005). [ISBN 0-323-03575-2]

Murray, Rosenthal and Pfaller. Medical Microbiology, 5th edn. (Mosby, 2005). [ISBN 0-323-03303-2]

Salyers, A. A. and Whitt, D. D. Bacterial Pathogenesis: a Molecular Approach (ASM Press, 2002). [ISBN 1-55581-171-X]

Part B: Virology

Dimmock, N. J., Easton, A. J. and Leppard, K. N. Introduction to Modern Virology, 7th edn. (Wiley-Blackwell, 2016).

Other books to consult:
Collier, L. and Oxford, J. Human Virology, 3rd edn. (Oxford University Press, 2006).

Mims, C. A., Nash, A. and Stephens, J. Mims' Pathogenesis of Infectious Disease, 5th edn. (Academic Press, 2001).

Subject specific skills

Understand a range of important microparasites, the diseases they cause and the parasite-host and environmental interactions that govern their biology and approaches to control. Examples include vector-borne and/or zoonotic organisms from Mycobacterium, Trypanosomes to fungi.

Understand bacterial nutrition and nutrient acquisition by addressing the growth characteristics of selected pathogens in the environment (or natural reservoir) and how these are modified and adapted with infection of the host.

Explain epidemiological factors involved in the invasion, spread, and colonisation of pathogens, and the host defense systems that they have to overcome.
Understand techniques used in the diagnosis of infection, and both current and novel approaches to their control will be discussed. We will also look at the impact of infectious disease over the centuries and how they have been perceived and dealt with by society.

Understand the replication strategies of selected RNA viruses, DNA viruses and retroviruses, and the fundamental differences between them.

Understand the principles of diagnosis of viral infections.

Understand the different types of current antiviral therapy, how they are discovered, developed and trialled.

Transferable skills

Adult learning, self directed learning, team based learning and quantitative skills

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Study

Study time

Type	Required
Lectures	31 sessions of 1 hour (17%)
Private study	149 hours (83%)
Total	180 hours

Private study description

149 hrs of self directed learning and revision

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
Online Examination	100%	

	Weighting	Study time

- Online examination: No Answerbook required

Feedback on assessment

Pastoral tutorial with academic tutor

Past exam papers for LF213

Availability

Courses

This module is Core for:

- UBSA-C1B9 Undergraduate Biomedical Science
  - Year 2 of C1B9 Biomedical Science
  - Year 2 of C1B9 Biomedical Science
  - Year 2 of C1B9 Biomedical Science
- ULFA-C1A3 Undergraduate Biomedical Science (MBio)
  - Year 2 of C1A3 Biomedical Science
  - Year 2 of C1B9 Biomedical Science
- Year 2 of ULFA-C1A7 Undergraduate Biomedical Science with Industrial Placement (MBio)
- Year 2 of UBSA-CB19 Undergraduate Biomedical Science with Intercalated Year