

PRINCIPLES OF INFECTIOUS DISEASES

Course Organiser:	A Williams
Lecturers:	B Blacklaws, R Bujdoso, MJ Corke, M Fox, JD Slater, L Tiley, A Williams, J Wood, C Cantacessi, R Wall
Term:	Michaelmas

Aims:

The overall aims of the course are:

- consolidate knowledge and understanding gained from MVST Part IB Pathology
- provide veterinary examples of key principles
- gain an understanding of the range of diagnostic tests for infectious diseases, how they can be used in different situations, and their limitations
- gain an (initial) understanding of relationships between structure of pathogen, causation and spread of disease and disease control
- consideration of animal husbandry/management not only in maintaining healthy animals but also as measures in restricting/controlling extent of ill health
- use named organisms/diseases as exemplars – further details/variations can be picked up in systems/species courses.

Objectives

The course will allow understanding on main themes of microbiological diseases that affect domesticated species. This will act as core knowledge and a foundation on which to base pathogenesis, pathology and clinical manifestations of diseases discussed in the systems courses and then species courses. It also includes basic principles that students should have awareness of before embarking on clinical EMS.

Pre-requisites for the course

Knowledge and understanding of material covered in MVST Part IB Pathology is assumed, and should be revised before starting this course.

Lecture List

1. Introduction: The balance between defence and attack AW

The generic causes of disease. Defensive barriers to infection; innate responses. Colonisation vs infection; carriers of disease; role of environment/housing. Diseases in populations; vets as vectors.

Virology and the pathogenesis of viral diseases

The aim of these lectures is to give key examples of different types of virus disease, highlighting aspects of viral structure, pathogenicity and epidemiology as they relate to important diseases of animals. Not all virus families will be covered in this Principles of Infectious Diseases of Animals course – important viral infections will also be covered in relevant systems/species courses.

2. Orthomyxo and paramyxoviruses: an example of complex RNA virus biology LT

Equine, swine and avian influenza viruses; Highly pathogenic avian influenza viruses (HPAIs); Newcastle disease virus. Genetic mutation rate. Emerging diseases and zoonoses. Other myxo viruses will be mentioned but covered in more detail elsewhere in the curriculum, eg: Canine Distemper virus, PI-3 (Shipping fever), Newcastle Disease virus.

3. Herpesviruses: an example of a large DNA virus, multisystemic disease and neuronal latency BB

Types of herpesvirus; herpesvirus biology. Multisystemic disease. Spectrum of diseases caused by herpesviruses. Porcine and bovine herpes viruses including Aujeszky's disease (pseudorabies) in pigs; cattle diseases: infectious bovine rhinotracheitis, bovine mammillitis, and malignant catarrhal fever. Neuronal latency - methods for detection and eradication of reservoirs of infection.

4. Pestiviruses: post-natal and ante-natal infections, strains and immunity LT

Bovine viral diarrhoea virus (BVD, Mucosal disease), with comparative aspects as they relate to Border disease; hog cholera (classical swine fever).

5. Virus diseases of complex aetiology BB

PCV-2, bovine respiratory syndrome/shipping fever are examples of diseases where viruses play a role, but in a complex aetiology for which all the details are not yet known. Such diseases will be discussed.

6. Arthropod-Borne viruses LT

Examples of viruses spread by insects and the consequences for disease control will be considered, eg: Bluetongue, African Horse Sickness. Issues relating to improper/inappropriate use of vaccination will be discussed.

7. Important and emerging virus diseases LT

Current high-profile virus infections, not normally present in the UK but which are threats to UK livestock and economy, will be discussed.

8. Oncogenic viruses BB

Oncogenic DNA viruses and mechanisms underlying oncogenesis. Bovine and other papillomaviruses and cofactors required for tumour formation. Retroviruses: feline leukaemia. Virus-induced immunosuppression.

9. Prion diseases: scrapie in sheep and lessons from surveillance RB

Classical and atypical scrapie. Strain variation and host genotype susceptibility. Genotype basis for disease control. Lessons from surveillance. BSE, vCJD.

Bacteriology

The aim of these lectures is to consider some important classes of bacteria that cause disease of different organ systems. Further bacterial groups will be covered in the systems courses. The relevance of bacterial structure and biology to anti-microbial use and anti-microbial resistance will be introduced and its impact on human and veterinary medicine discussed.

10. Staphylococci: Example of a common bacterial family causing wide variety of conditions JDS

Different species of Staphylococci, diseases caused and laboratory diagnostic features; virulence factors (e.g. different haemolysin types); mastitis in different species; skin diseases; abscesses and suppurative diseases; surgical infection; antibiotic treatment and consideration of MRSA; *S. hyicus* in the pig.

11. Streptococci and Enterococci: pathogens of different organ systems JDS

Different species of streptococci; mastitis-causing bacteria, *S. equi* (strangles in horses). *S. suis* (various manifestations in pigs including meningitis and arthritis, zoonosis), and *S. pneumoniae*. Bacterial features (Lancefield group etc.) and laboratory diagnosis. Pathogenesis and disease patterns. Potential for vaccines; treatments and problems with resistant enterococci with consideration of antibiotic resistance in human medicine (e.g. vancomycin-resistant *enterococci*, VRE).

12. *Haemophilus, Actinobacillus, Pasteurella, Bordetella*: an introduction to respiratory pathogens JDS

Pasteurella infections in a number of hosts etc. concentrating on *P. multocida* in its many manifestations. Mention will also be made to Kennel cough; atrophic rhinitis. Brief resume of important diseases caused by these pathogens, including *H. somnus* in cattle, *Actinobacillus* in pigs

13. *Mycoplasma and Chlamydia*: microrganisms with unusual structure/biology AW

Respiratory diseases and abortion. Brief introduction to *Chlamydia/Chalmydophila* and *Mycoplasma*: habitat/reservoir, route of infection, morphology, isolation, identification and pathogenesis. Examples of chlamydial diseases. Transmission to man. Mycoplasma-induced diseases.

14. *Neurotoxic and histotoxic Clostridia*: examples of bacterial diseases caused by toxins AW

Neuropathogenic clostridia - tetanus and botulism. Principal species of neurotoxic clostridia and their toxins (*C. tetani, C. botulinum*). Pathogenesis, clinical disease, diagnosis; vaccines. Histotoxic clostridia causing gas gangrene and their toxins. Examples of diseases caused by histotoxic species: blackleg; malignant oedema; big head in rams. (Enterotoxigenic Clostridia will be covered in the Alimentary System course).

15. *Leptospira, Brucella, Dermatophilus, Erysipelothrix, Listeria*: selected other bacteria of veterinary importance. AW

Brief introduction to *Leptospira* and *Brucella*: habitat/reservoir, route of infection, morphology, isolation, identification. Pathogenesis of leptospirosis. Leptospirosis in domestic animals. Pathogenesis of brucellosis. Principal species of *Brucella* pathogenic for animals and humans. Common syndromes associated with *Brucella* infections in animals: abortion, orchitis, arthritis, infertility. *Brucella* infections as zoonoses. Brief introduction to *Dermatophilus congolensis* (actinomycetes) and *Erysipelothrix rhusiopathiae*: habitat/reservoir, route of infection, morphology, isolation, identification. Dermatophilosis in animals; transmission to humans. Swine erysipelas; septicaemia; vegetative endocarditis and arthritis. Transmission to man. Listerial infections in animals and possible transmission to humans.

Fungi

16. Fungi

MJC

A broad review of the important fungal agents that affect domestic animals by infection, intoxication or induction of hypersensitivity reactions.

17. Introduction to Parasitology

CC

Terminology, basic taxonomy. Introduction to helminths (roundworms, flatworms), features of morphology and biology.

- 18. Ostertagiosis** MF
An example of a significant disease of cattle caused by a non-migratory nematode with a direct life cycle.
- 19. Gastrointestinal parasites of small ruminants** CC
Key helminths of sheep that may contribute to parasitic gastro-enteritis; *Teladorsagia* spp.; *Haemonchus* spp.; *Nematodirus* spp.; elements of epidemiology, pathogenesis, diagnosis, treatment and control.
- 20. Lungworms** CC
Dictyocaulus viviparus and *D. filaria* (ruminants); *Angiostrongylus vasorum*, *Oslerus osleri* (dogs); *Aelurostrongylus abstrusus* (cats); elements of epidemiology, pathogenesis, diagnosis, treatment and control.
- 21. Trematodes: the liver fluke** AW
Fasciolosis as an example of a trematode and a life cycle with an intermediate host. Implications of this life cycle for disease control. Elements important in Veterinary Public Health. Other liver flukes: *Dicrocoelium*.
- 22. Cestodes** CC
Zoonotic cestodes and their relevance for Public Health: *Echinococcus granulosus* and *Taenia* spp.; Key aspects of cestodes of veterinary importance: *Dipylidium caninum*, *Anoplocephala* spp. and *Moniezia* spp.
- 23. Dipteran flies** RW
Myiasis, with a particular focus on blowfly strike. Epidemiology, life cycle, pathogenesis, clinical signs, diagnosis, treatment and control.
- 23a. Mites** RW
Mange, with a particular focus on sheep scab. Epidemiology, life cycle, pathogenesis, clinical signs, diagnosis, treatment and control.
- 24. Fleas** MF
Species, and the animals they infest. Control of parasites who spend most of their life off the host.
- 25. Lice** CC
Key species of sucking and chewing lice of poultry, livestock and companion animals; elements of epidemiology, pathogenesis, diagnosis, treatment and control.
- 26. Ticks** MF
Life cycles of 1-, 2- and 3-host hard ticks and soft ticks. How ticks feed. Significance and epidemiology of *Ixodes ricinus* in UK. World-wide veterinary and public health importance of ticks as pathogens and transmitters of disease. Trans-stadial and transovarian transmission of disease. Approaches to tick control in UK and overseas.

27. Protozoa I CC
Key gastrointestinal Coccidia: *Eimeria* and *Isospora*; elements of epidemiology, pathogenesis, clinical signs, diagnosis, treatment and control.

28. Protozoa II CC
Key systemic protozoa: *Toxoplasma*, *Neospora*; elements of epidemiology, pathogenesis, clinical signs, diagnosis, treatment and control.

29. Key blood-borne parasites transmitted by arthropod vectors. CC
Key blood-borne protozoa: *Leishmania* (an emergent problem in UK?), *Babesia*. Key blood-borne nematodes: *Dirofilaria* and *Onchocerca*.

13. Alimentary System course - Parasites

Key ascarids of companion animals and livestock. Life cycles, elements of epidemiology, pathogenesis, clinical signs, diagnosis, treatment and control.

Detection and diagnosis

30–31. Diagnostic tests: approaches and methods BB, JW
What different tests (ELISAs, PCRs, serological tests) tell us as aids to diagnosis and as tools for disease control. Pathogen detection v. specific antibody detection v. specific pathology detection. Pathogen detection: culture based pathogen detection methods; direct detection of pathogens (smears, etc); immunological detection; nucleic acid based methods. Role of serology in diagnosis. Interpretation of test results. Disease monitoring: the importance of surveillance; types of surveillance – passive, active, targeted.

Containment and control

32. Containment of bacterial disease: Bovine Tuberculosis JW
Tuberculosis in cattle, badgers and man – challenges of working with imperfect tests

33. Biosecurity, containment and clearance of viral diseases LT
Biosecurity under normal management, eg: pigs, poultry. Microbial containment (disinfection/sterilisation) under epidemic infection conditions and then the aftermath to clear up.

34. Practicalities of disease control JW
Complexities and realities of disease control: specific exemplars to illustrate on-farm, national and international issues. Tuberculosis, FMDV, and a vector-borne disease as possible examples.

Systemic pathology of infectious disease

35. Tissue responses to infection

AW

Lymphoid system responses – lymph node (reactive node, lymphadenitis, total node response), spleen. (Knowledge of general pathology covered in Part IB pathology is assumed).

36. Systemic vascular disease

AW

Systemic pathology induced by bacteria/viruses – vasculitis, endotoxaemia, endotoxic shock, DIC, septic emboli, multi-organ failure – with specific reference to diseases of veterinary importance.

Practicals:

1. Demonstration practical: detecting diseases

Examples of a range of commonly-used diagnostic tests for diseases in animals, including PCRs, ELISAs, various serological tests, etc. will be demonstrated together with examples of **modern/future rapid 'diagnostics'** and pen-side tests. BVDV – how to interpret antibody and antigen test results. Tests of the future – isothermal amplification (rather than PCR). Differentiating infected from vaccinated ELISAs (eg: FMDV, Aujesky's, bTB).

2. Parasitology I: Nematodes

Demonstration of key parasitic nematodes of livestock and companion animals. Faecal egg counts (McMaster technique).

3. Parasitology II: Entomology

Demonstration of specimens of key arthropod groups; Flies; Ticks; Lice; Fleas. Identifying ectoparasites to species using morphological keys.

4. Parasitology III: Protozoa

Histology of protozoan-infected tissues; *Eimeria*; *Toxoplasma*; *Leishmania*; *Babesia*.

5. Systemic pathology

A pathology-based practical to draw out key points from pathology lectures – to include questions on extrapolating from pathology to management of clinical scenarios.

Directed-Learning Sessions:

1. Principles of intestinal parasite control

A computer programme-based session – attempt to design your own management system to reduce parasitism on a dairy farm.

2. Fleas

Formulation of a flea control programme.

3. Tick-borne diseases

Impact of different tick control measures on the endemic stability of a tick-borne disease.

Handouts: will be provided

Further reading: will be indicated during the lecture series