

PRINCIPLES OF INFECTIOUS DISEASES

Course Organiser:	A Williams
Lecturers:	B Blacklaws, R Bujdoso, C Cantacessi, MJ Corke, P Mastroeni, JD Slater, L Tiley, R Wall, A Williams, J Wood
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*: microorganisms with unusual structure/biology PM

Respiratory diseases and abortion. Brief introduction to *Chlamydia/Chlamydophila* 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 PM

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. (Enterotoxic Clostridia will be covered in the Alimentary System course).

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

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: Helminths	CC
Terminology, basic taxonomy, Introduction to helminths (roundworms, flatworms). Roundworms – features of morphology and biology	
18. Ostertagiosis	CC
An example of a significant disease of cattle caused by a non-migratory nematode with a direct life cycle.	
19. Other bovine intestinal nematodes	CC
Other helminths of cattle that may contribute to parasitic gastro-enteritis.	
20. Bovine lungworm	CC
An example of a significant disease of cattle caused by a migratory nematode with a direct life cycle. Control of this disease will be contrasted with that of bovine intestinal nematodes.	
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: <i>Dicrocoelium</i> .	
22. Cestodes	CC
Morphology and life cycles of cestodes: <i>Echinococcus</i> , <i>Taenia</i> and <i>Diplydium</i> . The variety of diseases that they cause.	
23. Dipteran flies	RW
Nuisance and stress-causing biting flies (<i>Culicoides</i> , tabanids, <i>Stomoxys</i>). Myiasis caused by blow flies, warbles and bot flies. Diptera transmitting blood-borne parasites: midges, mosquitoes and sand flies. Mechanical transmission of contaminative bacteria by <i>Musca</i> .	
23a. Mites	RW
Species, and the animals they infest. Control	
24. Fleas	AW
Species, and the animals they infest. Control of parasites who spend most of their life off the host.	
25. Lice	CC
Chewing lice of poultry and livestock. Sucking lice of livestock and companion animals. Control of lice.	
26. Ticks	CC
Life cycles of 1-, 2- and 3-host hard ticks and soft ticks. How ticks feed. Significance and epidemiology of <i>Ixodes ricinus</i> 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

Introduction to protozoan life cycles; direct and indirect life cycles.
Gastrointestinal coccidian: *Eimeria* and *Isospora*.

28. Protozoa II CC

Systemic protozoa: *Toxoplasma*, *Neospora*, *Sarcocystis*.

29. Vectors of blood-borne parasites. CC

Blood-borne protozoa: *Leishmania*, *Babesia*. An emergent problem in UK?
Filarial parasites: blood-borne nematodes: *Dirofilaria* and *Onchocerca*.

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: Management, control and detection of BVDV

We shall look at the effect of BVDV on herd health, the gross and histopathology caused by BVDV, available tests (including ear notch samples and pen-side tests) and their usefulness and interpretation for BVDV infection. We shall finally consider control strategies for BVDV and if they are important.

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.

Handouts: will be provided

Further reading: will be indicated during the lecture series