AVBS3001 – Bacteriology and Mycology

Staphylococcus 8
- **Laboratory Features** 8
- **Significant animal pathogens** 9
- **Virulence – Parasitic properties** 9
- **Host and environment** 10
- **Disease** 11
  - Staphylococcus aureus - Background 11
  - Staphylococcus aureus – Staphylococcus bovine mastitis 12
  - Staphylococcus hyicus - Porcine Exudative Dermatitis 12
- **Disease management (control, prevent and treatment options)** 13

Streptococcus 14
- **Laboratory Features** 14
- **Significant animal pathogens** 15
- **Virulence – Parasitic properties** 15
- **Host and environment** 16
- **Disease management (control, prevent and treatment options)** 16
  - Streptococcal bovine mastitis 16
  - Streptococcal bovine mastitis – control and prevention 17
  - Strangles (S. equi subsp equi) – Background 17
  - Strangles (S. equi subsp equi) – identification and speciation 18
  - Strangles (S. equi subsp equi) – Control and prevention 18
  - S. equi subsp zooepidemicus 18
  - Porcine Streptococci 19
  - Streptococcal Disease in Pigs – Pathogenesis 19

Rhodococcus 20
- **Laboratory Features** 20
- **Significant animal pathogens** 20
  - Rhodococcus equi infections 21
- **Virulence** 21
- **Parasitic properties** 22
  - 'Rattles' (R. equi) – Epidemiology 22
- **Host and environment** 23
- **Disease management (control, prevent and treatment options)** 25
  - R. equi - Pathogenesis 27
  - 'Rattles '(R. equi) – Control and Treatment 27

Actinomyces 29
- **Laboratory Features** 29
- **Significant animal pathogens** 29
- **Virulence – Parasitic properties** 29
- **Host and environment** 29
- **Disease management (control, prevent and treatment options)** 30
  - Lumpy Jaw – Pathogenesis 30
  - Lumpy Jaw – Control and Prevention 30

Corynebacterium 31
- **Laboratory Features** 31
- **Significant animal pathogens** 31
- **Virulence – Parasitic properties** 32
- **Host and environment** 32
- **Disease management (control, prevent and treatment options)** 34
  - C. pseudotuberculosis – Pathogenesis 34
  - C. renale (pyelonephritis & 'pizzle rot' – Pathogenesis 34

Mycobacterium **35**
Laboratory Features **35**
Significant animal pathogens **35**
Virulence – Parasitic properties **35**
M. bovis – Parasitic Properties 35
M. avium subsp. paratuberculosis – Parasitic Properties 36
Host and environment **36**
Bovine tuberculosis (M. bovis) – Factors 36
Johne's disease (M. avium subsp. paratuberculosis) – Factors 36
Avian tuberculosis (M. avium subsp. avium) – Factors 37
Disease management (control, prevent and treatment options) **38**
Bovine tuberculosis (M. bovis) – Background 38
Bovine tuberculosis (M. bovis) – Pathogenesis 39
Bovine Tuberculosis (M. bovis) – Epidemiology 39
Bovine Tuberculosis (M. bovis) – Control and prevention 40
Johne's disease (M. avium subsp. paratuberculosis) – Background 40
Johne's disease (M. avium subsp. paratuberculosis) – Pathogenesis 40
Johne's disease (M. avium subsp. paratuberculosis) – Diagnostic (Issues) 41
Avian tuberculosis (M. avium subsp. avium) - Background 42
Avian tuberculosis (M. avium subsp. avium) – Control and Prevention 42

Nocardia **43**
Laboratory Features **43**
Significant animal pathogens **43**
Virulence – Parasitic properties **44**
Host and environment **44**
Disease management (control, prevent and treatment options) **45**
Nocardiosis (N. asteroides) – Forms of nocardiosis 45
Nocardiosis (N. asteroides) – Control and prevention 45

Dermatophilus **46**
Laboratory Features **46**
Significant animal pathogens **46**
D. congolensis – life cycle 46
Virulence – Parasitic properties **47**
Host and environment **47**
Disease management (control, prevent and treatment options) **48**
Dermatophilosis (D. congolensis) – Background 48
Dermatophilosis (D. congolensis) – Control, prevention and treatment 48

Listeria **50**
Laboratory Features **50**
Significant animal pathogens **50**
Virulence – Parasitic properties **50**
Host and environment factors **51**
L. monocytogenes infectious life cycle in man and domestic animal 52
Disease **53**
Listeriosis (L. monocytogenes) - Background 53
Visceral listeriosis (L. monocytogenes) – Pathogenesis 53
Neural listeriosis (L. monocytogenes) 53
Listeriosis food-borne disease outbreak 54
Disease management (control, prevent and treatment options) **54**

Erysipelothrix **55**
Laboratory Features **55**
Significant animal pathogens **55**
Virulence – Parasitic properties **55**
Host and environment **56**
Disease **57**
Septicaemia (E. rhusiopathiae) – Background 57

Skin (E. rhusiopathiae) – Background 57
Arthritis (E. rhusiopathiae) – Background 57
Valvular endocarditis (E. rhusiopathiae) – Background 58
Disease management (control, prevent and treatment options) 58

Bacillus 59
Laboratory Features 59
Significant animal pathogens 59
Virulence – Parasitic properties 60
Host and environment 61
Anthrax (B. anthracis) – Pathogenesis 62
Anthrax (B. anthracis) – Background 63
Anthrax (B. anthracis) – Control and Prevention 63

Clostridium 64
Laboratory Features 64
Significant animal pathogens 64
Virulence – Parasitic properties 66
Host and environment 67
Disease 68
Tetanus (C. tetani) – Pathogenesis 68
Botulism (C. botulinum) – Pathogenesis 68
Malignant oedema and black disease (C. novyi) – Pathogenesis 69
Blackleg (C. chauvoei) – Pathogenesis 69
'Pulpy kidney' (C. perfringens type D) – Background 70
'Pulpy kidney' (C. perfringens type D) – Pathogenesis 70
Haemorrhagic enteritis (C. perfringens) – Background 70
Haemorrhagic enteritis (C. perfringens type C) – Pathogenesis 71
Disease management (control, prevent and treatment options) 71
Tetanus (C. tetani) – Control, prevention and treatment 71
Botulism (C. botulinum) – Control, prevention and treatment 71
Blackleg (C. chauvoei) – Control and prevention 72
'Pulpy kidney' (C. perfringens type D) – Control and Treatment 72
C. perfringens – control and prevention (immunity) 72

Enterobacteriaceae 73
Laboratory Features 73
Significant animal pathogens 75
Virulence – parasitic properties 78
Host and environment 81
Disease 83
Enterotoxigenic E. coli ETEC (E. coli) – Pathogenesis 83
Enteropathogenic E. coli EPEC (E. coli) – Pathogenesis 84
Enterohaemorrhagic E. coli EHEC (E. coli) – Pathogenesis 84
Enterohaemorrhagic E. coli EHEC (E. coli) – Diagnostics 84
Enteroinvasive E. coli EIEC (E. coli) – Pathogenesis 85
Oedema disease in pigs (E. coli) – Background 85
Oedema disease in pigs (E. coli) – Pathogenesis 86
Bacteraemia (E. coli) – Pathogenesis 86
Mastitis (E. coli) – Pathogenesis 87
Respiratory colibacillosis in poultry (E. coli) – Pathogenesis 87
Genitourinary tract infection (E. coli) – Pathogenesis 87
Salmonellosis (Salmonella spp.) – Pathogenesis 88
Y. pseudotuberculosis – Pathogenesis 89
Y. pestis – Pathogenesis 89
Disease management (Control, prevent and treatment options) 90
Enterotoxigenic E. coli ETEC (E. coli) – Control, prevention and treatmetn 90
Oedema disease in pigs (E. coli) – Control and prevention 90
Respiratory colibacillosis in poultry (E. coli) – Control and prevention 90

Salmonellosis (Salmonella spp.) – Control, prevention and treatment 90
Yersiniosis (Yersiniaspp.) – Control, prevention and treatment 91

Pasteurellaceae 92
Features 92
Significant animal pathogens 92
Virulence – Parasitic properties 95
Host and environment 97
Disease 99
Wooden toungue (A. lignieresii) – Background 99
Wooden toungue (A. lignieresii) – Diagnostics 99
Wooden toungue (A. lignieresii) – Pathogenesis 99
Fibrinohaemorrhagic pneumonia (A. pleuropneumonia) – Pathogenesis 100
Fowl Cholera (P. mutocida) – Background 100
Epizootic haemorrhagic septicaemia (P. mutocida) – Background 101
Epizootic haemorrhagic septicaemia (P. mutocida) – Pathogenesis 101
Bronchopneumonia (P. mutocida) – Background 101
Atrophic Rhinitis (P. mutocida) – Background 102
Respiratory disease complex (M. haemolytica) – Pathogenesis 102
Infectious coryza (A. paragallinarium) - Pathogenesis 102
Glasser's disease (H. parasuis) – Pathogenesis 103
Disease management (Control, prevent and treatment options) 103
Pasteurella spp. – Control, prevention and treatment 103
Infectious coryza (A. paragallinarium) – Control, treatment and prevention 103
Glasser's disease (H. parasuis) – Control, treatment and prevention 104

Moraxella 105
Laboratory Features 105
Significant animal pathogens 105
Virulence – Parasitic properties 105
Host and environment 105
Disease 106
Pinkeye (M. bovis) – Pathogenesis 106
Pinkeye (M. bovis) – HPEI 106
Disease management (control, prevent and treatment options) 107
Pinkeye (M. bovis) – control, prevent and treatment 107

Brucella 108
Laboratory Features 108
Significant animal pathogens 108
Virulence – Parasitic properties 108
Host and environment 109
Disease 109
Brucellosis (Brucella spp.) – pathogenesis 109
Brucellosis (Brucella spp.) – diagnosis 109
Disease management (control, prevent and treatment options) 110

Pseudomonas 111
Laboratory Features 111
Significant animal pathogens 111
Virulence – Parasitic properties 112
Host and environment 114
Disease 115
P. aeruginosa infecton – Pathogenesis and epidemiology 115
Fleece rot (P. aeruginosa) – Background/ Pathogenesis 115
Canine otitis externa (P. aeruginosa) – Background / Pathogenesis 116
Disease management (control, prevent and treatment options) 116
P. aeruginosa infecton – Treatment 116
P. aeruginosa infecton – Control and prevention 116
Otisis externa (P. aeruginosa) – Control and prevention 117

Tail/ Fin Rot (P. fluorescens) – Control and prevention 117
Burkholderia 118
Laboratory Features 118
Significant animal pathogens 118
Virulence – Parasitic properties 119
Host and environment 119
Melioidosis (B. pseudomallei) – Background 120
Disease management (control, prevent and treatment options) 120
B. mallei infection – Prevention and control 120
Melioidosis (B. pseudomallei) – Prevention and control 120
Footrot 122
Features 122
Significant pathogens 122
..... 122
Footrot – pathogenesis 122
Virulence – Parasitic properties 123
Host and environment 124
Disease Management – Control, Prevention and Treatment 124
Campylobacter 126
Laboratory Features 126
Significant animal pathogens 126
Virulence - Parasitic properties 126
Host and environment 127
Disease 128
Campylobateriosis/ C. jejuni associated disease (c. jejuni) – Background 128
Campylobateriosis/ C. jejuni associated disease (c. jejuni) – Zoonoses 129
Campylobateriosis/ C. jejuni associated disease (c. jejuni) – Pathogenesis 129
Bovine veneral camplylobacteriosis (c. fetus subsp. venerealis) – Pathogenesis 130
Disease management (control, prevent and treatment options) 130
Lawsonia 131
Laboratory Features 131
Significant animal pathogens 131
Virulence – Parasitic properties 131
L. intracellularis – Pathogenesis 131
Host and environment 132
Disease management (control, prevent and treatment options) 132
Spirochaetales 133
Laboratory Features 133
Significant animal pathogens 133
Virulence – Parasitic properties 135
Host and environment 135
Disease 136
Swine dysentery (Brachyspira hyodysenteriae) – Pathogenesis 136
Disease management (control, prevent and treatment options) 136
Lyme disease (Borrelia burgdorferi) – Background 136
Lyme disease (B. burgdorferi) – Pathogenesis 137
Leptospirosis (Leptospira spp.) – Background 137
Leptospirosis (Leptospira spp.) – Pathogenesis 138
Leptospirosis (Leptospira spp.) – Immunity and Vaccination 139
Leptospirosis – Control and Prevention 139
Mycoplasma 140
Laboratory Features 140
Significant animal pathogens 140
Mycoplasma – epidemiology 141
Virulence – Parasitic properties 141

Host and environment **142**
Disease **142**
Contagious bovine pleuropneumonia (M. mycoides subsp. mycoides small colony type) – Background 142
Enzootic pneumonia of pigs EPP (M. hyopneumoniae) – Background 142
Respiratory disease (M. gallisepticum) – Background 143
Feline infectious anaemia (M. haemofelis) – Background 144
Disease management (control, prevent and treatment options) **144**

Coxiella **145**
Laboratory Features **145**
Significant animal pathogens **145**
Virulence – Parasitic properties **145**
Host and environment **145**
Disease management (control, prevent and treatment options) **145**
Q fever (C. burnetii) – Transmission 145
Q fever (C. burnetii) – Prevention and control 146
Q fever (C. burnetii) – Treatment 146

Rickettsiales **147**
Laboratory Features **147**
Significant animal pathogens **147**
Virulence – Parasitic properties **148**
Host and environment **148**
Disease management (control, prevent and treatment options) **148**
Fever and anemia (A. marginate & A. ovis) – Background 148
Fever and anaemia (A. marginate & A. ovis) - Prevention 148

Chlamydiales **149**
Laboratory Features **149**
Significant animal pathogens **149**
Virulence – Parasitic properties **149**
Order Chalmydiales 149
Host and environment **149**
Chlamydiosis (Chalamydia trachomatis) – HOST FACTORS (Pathogenesis) 150
Psittacosis (C. psittaci) - HOST FACTORS 150
Psittacosis (C. psittaci) – Transmission & Zoonosis 150
Disease **151**
Pneumonia (Chlamydophila. pneumonia) – Background 151
Psittacosis (C. psittaci) – Background 151
Disease management (control, prevent and treatment options) **152**
Chlamydiosis (Chalamydia trachomatis) – Pathogenesis 152
Psittacosis (C. psittaci) – Treatment 152

Mycoses **153**
Features (Mycoses) **153**
Significant animal pathogens (fungal pathogens) **154**
<1> Opportunistic mycoses 154
<2> Dermatophytes 155
<3> Systemic Mycoses 158
<4> Mycotoxicoses 159
Virulence – Parasitic properties **161**
Host and environment **162**
Disease – pathogenesis **164**
Dermatophyte – Pathogenesis 164
Coccidioidomycosis (C. immitis) – Background 164
Aflatoxicosis (Aspergillus flavus) – Pathogenesis 165
Ergostism (Claviceps spp.) – Pathogenesis 165
Facial eczema (P. chartarum) – Pathogenesis 165
Disease management – control, prevent and treatment options **166**
Aspergillosis (A. fumigatus) – Control, prevent and treatment 166

Cryptococcus neoformans – Background 166
Cryptococcus neoformans – Diagnosis 166
Dermatophyte – Diagnosis 166
Coccidioidomycosis (C. immitis) – Control, prevent and treatment 167
Aflatoxicosis (Aspergillus flavus) – Diagnosis 167
Aflatoxicosis (Aspergillus flavus) – Control, prevent and treatment 168
Ergostism (Claviceps spp.) – Diagnosis 168
Ergostism (Claviceps spp.) – Prevention 168
Ergostism (Claviceps spp.) – Treatment 168

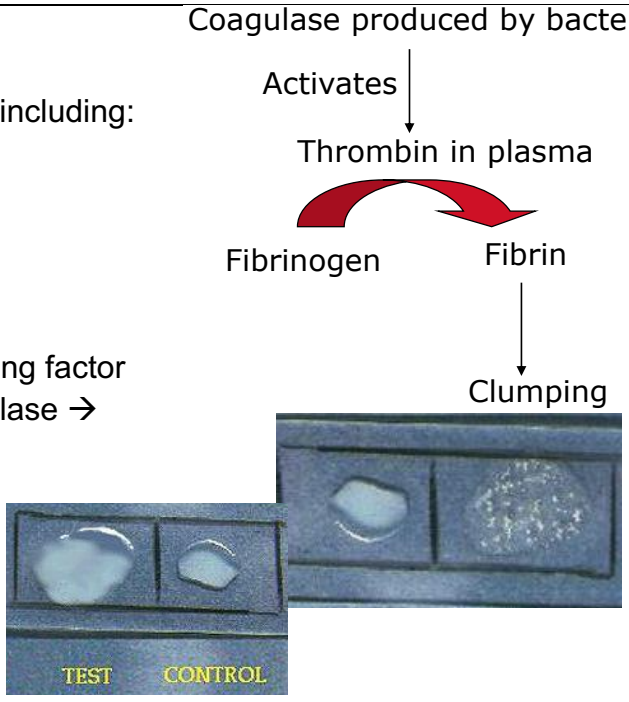
Staphylococcus

Laboratory Features

- Family Staphylococcaceae
- Produce catalase (breaking down hydrogen peroxide to H2O and O2)
  - $2H_2O_2 \rightarrow 2H_2O + O_2$
- Pathogen of animals and man
- Commensals (depends on the animal breed, ages, etc) @skin and mucous membranes, including:
  - Transient contaminants
  - Short-term residents
  - Long-term colonizers
- Predisposing factors
  - Parasitic opportunism
- Gram + cocci
- Clusters ("staphyle" – bunch of grapes)
- Facultative anaerobes (= an organism that makes ATP by aerobic respiration if oxygen is present, but is capable of switching to fermentation or **anaerobic** respiration if oxygen is absent)
- Catalase +
- Fermentative (able to utilise the env)
- Mannitol salt agar
  - Selective media
  - High NaCl levels
  - Fermetaion of mannitol
- Resistant to lysozyme
  - O-acetylation of muramic acid residue
- Plasmids
- Antimicrobial susceptibility
  - Bacteriophage (associated with genetic transfer)

Classification – with coagulase test

- Coagulase +ve
  - Results: clumping (producing coagulase), including:
    - S. aureus
    - S. intermedius
    - S. hyicus (mostly)
    - Others
- Tube VS slide coagulase test:
  - Slide: bacteria bound coagulase → clumping factor
  - Tube: free (exoenzyme) and bound coagulase → Staphylocoagulase



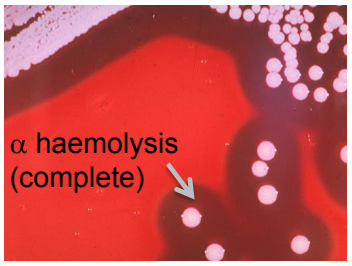
- Coagulase –ve:
  - Results: same as 'control', including:
    - S. epidermidis
    - S. hyicus (some)

Coagulase: an enzyme causing blood clot formation

Coagulase production: Coagulase is tightly bound to the surface of the bacterium *S. aureus* and can coat its surface with fibrin upon contact with blood. The fibrin clot may protect the bacterium from phagocytosis and isolate it from other defenses of the host.**The fibrin coat can therefore make the bacteria more virulent**.

Classification – Haemolysin
Haemolysis: the lysis of RBC

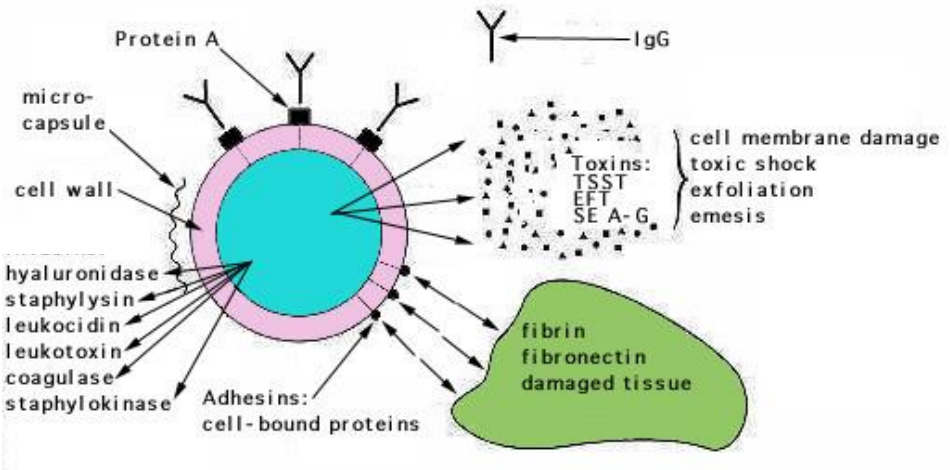
- α haemolysis: complete (completely 'digest' RBC) [L]
- β haemolysis: incomplete [R]
- non-haemolytic: no haemolysis (no change on the agar plate)



Significant animal pathogens

Genus	Example Species	
Staphylococcus	S. aureus	• Wound infections in animals • 'successful parasite' • Serious diseases: pneumonia, osteomyelitis, mastitis
	S. intermedius	• Carnivores
	S. epidermidis	• Skin commensal, occasional opportunistic pathogen
	S. saprophyticus	• Urinary tract
	S. hyicus	• Epidermitis in pigs, greasy pig disease
	S. schleiferi	• Otitis externa in dogs (inflammation of the ear, passage of the outer ear)

Virulence – Parasitic properties



- Adhesins
  - Cell-surface components or appendages of bacteria that facilitate adhesion or adherence to others cells or to surfaces, usually the host they are infecting or living in
  - Adhesins are a type of virulence factor
  - MSCRAMMs (Microbial Surface Components Recognising Adhesion Matrix Molecules)
  - Main adhesins:
    - Fibronectin
    - Collagen
    - Elastin