Family Pasteurellaceae & Bordetella

- **Actinobacillus spp.**
  - Pasteurella multocida
  - Mannheimia (formerly Pasteurella) haemolytica
  - Bibersteinia trehalosi
  - Histophilus somni (formerly Haemophilus somnus)
  - Haemophilus spp.
  - Avibacterium (formerly Haemophilus) paragallinarum

- **Bordetella spp.** - belong to a different family - Alcaligenaceae

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**Actinobacillus spp.**

- 9 species associated with animals
- Mucosal membranes of URT, GIT, & genital tract
- Gram-negative, pleomorphic rods “Morse code”

**Key Pathogens** include:

- **A. pleuropneumoniae** (APP) – Contagious Porcine Pleuropneumonia
- **A. suis** (swine) – septicemia, pneumonia & abortion, meningitis & Erysipelas-like dermatitis
- **A. equuli** subsp. **equuli** (equine & swine) – Sleepy Foal Disease
- **A. equuli** subsp. **haemolytica** (adult equine) – infections, metritis, endocarditis & meningitis
- **A. lignieresi** (ruminants) - Wooden Tongue
**A. pleuropneumoniae – Contagious Porcine Pleuropneumonia**

- Worldwide, 15 serotypes (1,5,7 in N.A)
- young pigs (<6 months age)
- high morbidity & mortality (30-50%)
- Outbreaks (fall/winter)
  - transmission by carrier into "clean herd"
  - or stressors in `low-load carrier` herd
  - ventilation/temp problems,
  - viral or mycoplasma infections
- Necrotizing hemorrhagic pneumonia
  - caudal lung lobe & fibrinous pleuritis
- Typically Peracute/Acute: high fever
  - Found dead
  - Fever ➔ coughing, dyspnea ➔ blood (nose-mouth)
- Survivors:
  - chronic lung lesions
  - abscesses, pleural adhesions, sequestra ➔ poor doers

**APP : Virulence Factors & Pathology**

- RTX toxins (“Repeats in ToXins”)
  - pore-forming & cytolytic - Apxl, Apx II, Apx III & Apx IV
  - Serotypes 1 & 5 ➔ Apxl, ApxII & ApxIV ➔ highly virulent
    - Apxl – hemolytic (CAMP-positive reaction), inhibit macrophage function
    - Apxll – cytotoxic (vascular endothelium) – microthrombi, ischemia, necrosis
    - ApxIV – ?
  - RTX toxin repertoire varies with serotype
- **Urease**
  - Capsule, LPS & fimbriae
  - Siderophores, hemophores + transferring-binding proteins
  - Sustained inflammatory response ➔ tissue necrosis
**APP: Dx & Intervention**

- **Diagnostics**
  - Plate on BA
  - Plate on BA + Staph streak – why you say?
  - Serotypes 1-12,15 require *Factor V*
    - NAD = Nicotinamide Adenosine Dinucleotide
    - Co-enzyme → electron transport
  - “satellite” colonies
    - APP in outer Staph hemolytic zone
- **CAMP- positive**
  - RTX + *Staph. aureus* beta toxin
- **Intervention**
  - Commercial Vaccines
  - Biosecurity measures
  - Management of Environment
  - Serological surveillance

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**A. lignieresii: Actinobacillosis (Wooden Tongue)**

- *A. lignieresii* → commensal in oropharynx/rumen of cattle/sheep
- Sporadic individual cases or outbreaks in cattle herds
- Granulomatous abscesses in sheep, cattle (humans, horses, dogs, udders of cows & sows)
- **Oropharygeal mucosal TRAUMA (coarse feeds, straw)**
  - penetrates to submucosa → pyogranulomatous lesions in tongue, soft tissues of neck, jaw → spread by lymphatics → lungs, stomachs, etc.
**Actinobacillosis: Signs, Dx & Intervention**

- **Signs:** drooling, salivating, protruding tongue, dysphagia, wt. loss
- **Lab Dx:**
  - “Sulphur granules” in exudate
  - gram-negative bacteria in (CaPO4), inflammatory debris
  - club-like filaments ➔ pathologist’s term = Splendore-Hoepli reaction
- **Treatment**
  - Sx drainage + tetracyclines
- **Recall Actinomyces bovis ‘Sulphur granules’ (Lumpy jaw)**
  - Granules more yellow, contain Gram-positive branching bacteria

**Actinobacillus equuli subsp. equuli**

- **Sleepy Foal Disease &**
- **Pathogenesis – neonatal foals (30% of foal deaths)**
  - normal mucous membrane flora of horses (& pigs)
  - Transmission at parturition, umbilical
  - Septicemia – can be lethal
    - Survivors develop microabscesses – lungs, kidneys & joints
- **Risk Factors**
  - FPT or Inadequate colostrum
- **Dx:** blood, urine, synovial culture
- **Note:** *A. equuli* - septicemia, acute pneumonia in piglets & adult pigs
**Bordetella spp. Upper & lower respiratory**

- aerobes, Gram-negative coccobacilli,
- variable hemolysis on BA, MAC +ve (NLF), don’t ferment sugars

- **B. pertussis** – whooping cough in humans (FYI)

- **B. bronchiseptica**
  - Canine Infections TracheoBronchitis (ITB or Kennel Cough)
  - Porcine NonProgressive Atrophic Rhinitis (NPAR) – see *P. multocida*
  - Rabbit Upper Resp. Infections - ‘‘Snuffles’’

- **B. parapertussis** – 2 biovariants
  - B. pertussis -like infections in humans
  - Ovine biovariant – low-grade, chronic, nonprogressive pneumonia

- **B. avium** – Turkey Coryza

- **B. hinzii** – mild resp. signs in turkey

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**Bordetella spp.: well adapted pathogen**

<table>
<thead>
<tr>
<th>Virulence Factors</th>
<th><em>B. bronchiseptica</em></th>
<th><em>B. avium</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Filamentous HemAgglutin (FHA) Colonization factor</td>
<td>Rostral respiratory tract</td>
<td>Not present</td>
</tr>
<tr>
<td>Fimbriae - Colonization</td>
<td>Trachea</td>
<td>same</td>
</tr>
<tr>
<td>Biofilm</td>
<td>colony maintenance</td>
<td>same</td>
</tr>
<tr>
<td>Adenylate Cyclase Toxin (ACT)</td>
<td>RTX-toxin - host phagocyte toxin</td>
<td>Not present</td>
</tr>
<tr>
<td>Dermonecrotokin (DNT)</td>
<td>Turbinate atrophy, osteoblast death</td>
<td>same</td>
</tr>
<tr>
<td>Tracheal Cytotoxin (TCT)</td>
<td>Ciliostatic, ciliated-cell death</td>
<td>same</td>
</tr>
<tr>
<td>LPS, Iron-acquisition TySS (not well defined)</td>
<td>Xenophores (steal other bacterial siderophores-hemophores)</td>
<td>same</td>
</tr>
</tbody>
</table>

All thermo-regulated but not on-off system........
**B. bronchiseptica:** ITB or bronchopneumonia

- Infectious TracheoBronchitis (canine)
  - “Kennel Cough”
  - Secondary to viruses: CpiV, CAV-2, CDV
  - Bacteria: *Mycoplasma spp.*, *S. canis*, *P. aeruginosa*, *Pasteurella*
  - High morbidity, self-limiting (1-3 wks), shedding 3 months
  - Signs: “honking” cough, retching, +/- fever, nasolacrimal discharge

- Risk Factors
  - Mixing with other dogs
  - Vaccine status
  - Viruses – CpiV, CAV-2, CDV
  - Bacteria - *Mycoplasma spp.*,

**Note:** Kittens < 10 wks - severe bronchopneumonia, septicemia, death - vaccine available, Doxycycline (a tetracycline) Abx of choice

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**Canine ITB**

- Dx – honking cough, no fever
  - culture tracheal aspirate
  - BA – hemolysis variable (thermoregulation)
  - MAC +ve (NLF – but pinkish/tan color)

- Intervention
  - Quarantine
  - Vaccine
    - Intra-Trac® ADT II→ Bb + CpiV) I.N.

- Clavamox, Doxycycline, Enrofloxacin
**B. avium - Turkey Coryza**

- **Bordetellosis** (turkeys/chickens) – N.A.
  - High morbidity, low mortality
  - Poults (1-6 wks) – mucoid upper resp. infection
  - Signs:
    - Sneezing, conjunctivitis, tearing, edema-eyelids, submaxillary sinus swelling
    - Beak-breathing, tracheal collapse, stunted growth

- **Dx:** signs, culture sinus/trachea, slide agglutination (colony i.d. or serology) PCR

- **Intervention:**
  - Biosecurity – sanitation after outbreaks
  - Vaccines (Art-Vax®) – avirulent live (spray delivery at one day of age)
  - Pen + Tet in H₂O efficacy? **Niacin supplement**