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Avian Mycoplasmosis

Naola Ferguson-Noel, DVM, MAM, PhD




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What are Mycoplasmas?????

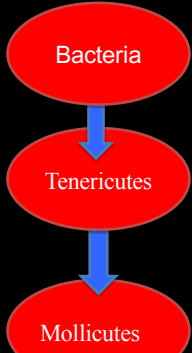
- Eaton et. al 1945
 - primary atypical pneumonia (PAP) walking pneumonia
 - virus? (Eaton's Agent)
 - M.pneumonia* (1963)
- Lo et. al 1985
 - AIDS patients
 - "novel virus" – VLIA
 - M. incognitus*
- L-form bacteria
 - Gram-positive bacteria that have lost cell wall

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What are Mycoplasmas?




Bacteria Domain

Tenericutes Phylum

Mollicutes Class

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Mollicutes

- Tend to be host specific
- Humans, animals, plants, & insects

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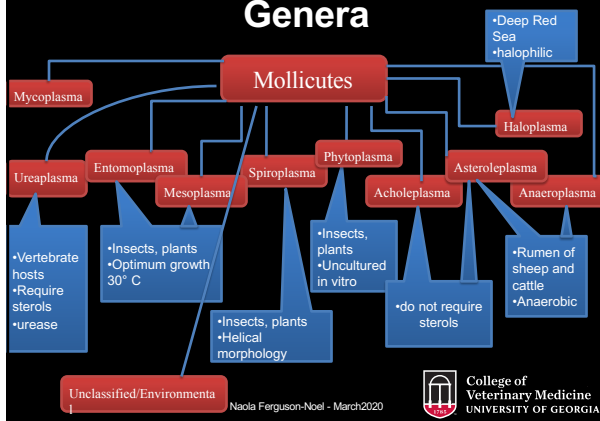
Mollicutes

- Tend to be host specific
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Genera





Mycoplasmas of Avian Species

Species	Usual Host
<i>M. anatis</i>	Duck
<i>M. anseris</i>	Goose
<i>M. columbinasale</i>	Pigeon
<i>M. columbinum</i>	Pigeon
<i>M. columborale</i>	Pigeon
<i>M. gallisepticum</i>	Various
<i>M. gallopavonis</i>	Wild Turkey
<i>M. synoviae</i>	Various
<i>M. imitans</i>	Duck, goose, partridge
<i>M. meleagridis</i>	Raptors?

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Other Avian Mycoplasmas

Buteo hawk
M. buteonis

Black vulture
M. corogypsi

Saker Falcon
M. falconis

Griffon vulture
M. gypsis

European starling
M. sturni

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Mycoplasmas of Pheasants

- *Mycoplasma gallisepticum*
- *Mycoplasma synoviae*
- *Mycoplasma glyophilum*
- *Mycoplasma gallinaceum*
- *Mycoplasma pullorum*
- *Mycoplasma iners*

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Characteristics of Mycoplasmas

Smallest free-living organisms

Large Virus
100 nm

Mycoplasma
150-250 nm

E.coli
2 μ m

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Characteristics of Mycoplasmas

Smallest genome of any free-living organism

- 580 -1,350 kb

- *E.coli* – 4,600 kb

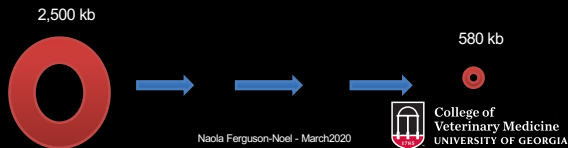


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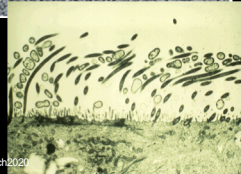
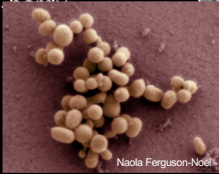
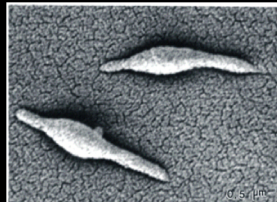
Degenerative Evolution

- Mycoplasmas did not evolve as simple organisms
- Common ancestor with Gram + anaerobes (Clostridia closest bacterial relatives)
- Cell wall lost during evolution



Characteristics of Mycoplasmas

- No cell wall
- Pleomorphism
 - Round, pear-shaped, filamentous
- Penicillin resistance
- Non-fermentative



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Characteristics of Mycoplasmas

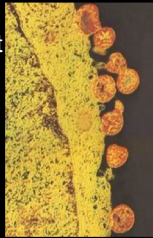
- Lack many metabolic pathways
 - Complex nutritional requirements
 - Require sterols (10 – 15% animal serum)
- Tend to grow slowly
- Tolerate thallium acetate

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Characteristics of Mycoplasmas

- Colonize mucosal surfaces
 - Respiratory and urogenital tract
- Some can invade host cells



Mycoplasma pneumoniae On the surface of a cell
<http://www.thenakedscientists.com/fo-run/index.php?topic=11352.0>

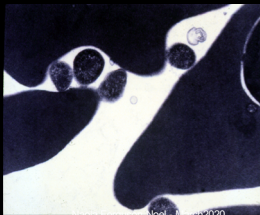


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Characteristics of Mycoplasmas

- Hemagglutination of erythrocytes
 - *M. gallisepticum*, *M. synoviae*, *m. meleagridis*



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Mycoplasma Pathogenesis

- Usually do not invade
- Attach to mucosal surfaces
- Emit toxic products and invoke host response
- Carrier state is usual

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Possible Factors in Pathogenesis of Mycoplasmas

- Attachment
- Ciliostasis
- Depletion of cell nutrients
- Local toxins
- Penetration of cells?
- Stimulation of immunopathological reaction
- Effects on lymphoid cells & macrophages
- Antigen variation - immune evasion



Strain Variability

- Mycoplasma strains vary in:
 - Virulence
 - Tissue tropism
 - Antigenic makeup

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Expression of Antigens

- Expression of surface antigens is **variable**
- Specific epitopes can be turned on or off
- Expression may be partial
- May explain testing problems and ability to persist in face of strong immune response

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Possible Factors in Pathogenesis of Mycoplasmas

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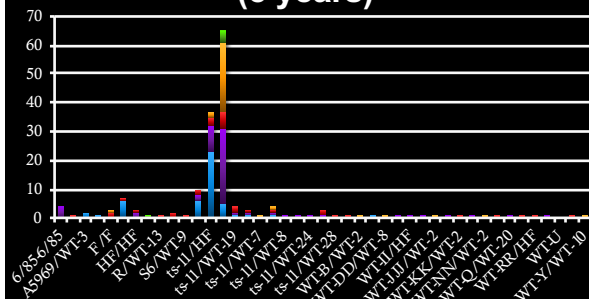
Strain Variability

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 - Virulence
 - Tissue tropism
 - Antigenic makeup

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MG Types – US Broiler-Type (5 years)



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Avian Mycoplasma Diagnosis

- Serology - SPA, HI and ELISA
- PCR – conventional and real-time
- Culture
- Bioassay



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Why is Control Important?...

- Clinical disease – pathogenic strains

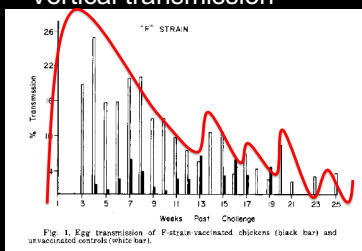


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Why is Control Important?...

- Vertical transmission



Glisson (USDA) & Ferguson-Noel (1994) Dis. 28



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Why is Control Important?...

- Disease complexes
- Economics...
 - Reduced weight gain & feed efficiency

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MG Economic Significance

- Increased condemnations at processing
- Reduced weight gain & feed efficiency
- More culls
- Increased mortality
- Egg production losses
- Medication costs
- Vaccination costs
- Surveillance costs

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Approaches to Control

- Keep it out
 - Surveillance
 - Quarantine and Slaughter
- Live with it
 - Medication
 - Vaccines

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The Case for Eradication...

- Better performance
 - Avoiding challenge vs protecting against challenge
- Economics – impact on export and sales
- Avoids complicating diagnostics
- Avoids some risk
- Is absolute eradication feasible?

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The Case for Control...

- No farm is an island
- Eradication is a long and expensive process – commitment and cooperation
- Avirulent strains

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Considerations

- Multiple age complexes
- Dense poultry populations
- Economics (export)
- Cooperation of industry
- Severity of disease/challenge



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Sources of Infection

- Egg transmission
 - Rate of transmission unpredictable
- Horizontal transmission
 - Direct or indirect contact with infected birds
 - Biological carriers
 - Mechanical carriers – dust, droplets, feathers
 - Aerosol transmission possible over short distances

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Maintaining Mycoplasma Free Flocks

- Use only negative replacements
- Single age farms, isolated if possible
- Depopulate and disinfect between flocks
- Maintain good biosecurity
- Set up monitoring program

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Handling of Infected Breeders

- Elimination of flock is safest
- Isolate flock as much as possible
- Segregate eggs and chicks
- Egg transmission reduced over time (inconsistent)

- Effective medication may reduce MG population and reduce egg transmission

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Reduction of Egg Transmission

- Egg dipping
- Egg heating
- Egg inoculation
- Medication may reduce transmission
- Vaccination (may reduce shed)
- Rear progeny in small, isolated groups

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Handling Infected Progeny

- Keep progeny of infected breeders segregated and isolated
- Use good husbandry practices
- Use mildest vaccination program possible
- Prophylactic antibiotics may reduce problem and reduce risk of spread
- Treatment relatively unsuccessful

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Medication

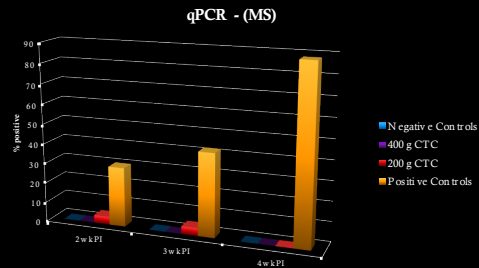
- Helps prevent clinical signs and lesions
- Reduces egg production losses
- Reduces egg transmission?
- Will not eliminate infection
- May reduce level of infection
- Antibiotic resistance may develop

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Prophylactic Medication?

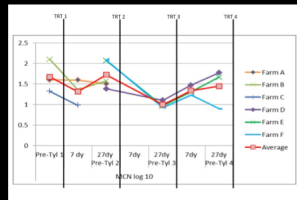


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E. Myers & Ferguson-Noel, N., Unpublished (manuscript in preparation)



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Tylosin Treatments Less Effective Over Time



A. Kiers & Ferguson-Noel, N., Unpublished (manuscript in preparation)
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Immunizing Agents Available for MG

- Inactivated oil-emulsion bacterins
- Recombinant MG Vaccine
- Live vaccines
 - F Strain
 - ts-11
 - 6/85

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Reasons to Vaccinate

- Prevent clinical disease
- Prevent egg production losses
- Reduce egg transmission
- Eradicate virulent field strains
- Reduce antibiotic usage

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Thank you

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