Interaction of Gumboro and other Immunosuppressive Diseases on Respiratory Disease

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II SEMINARIO INTERNACIONAL AVICOLA MERIAL

PANAMA CITY, PANAMA

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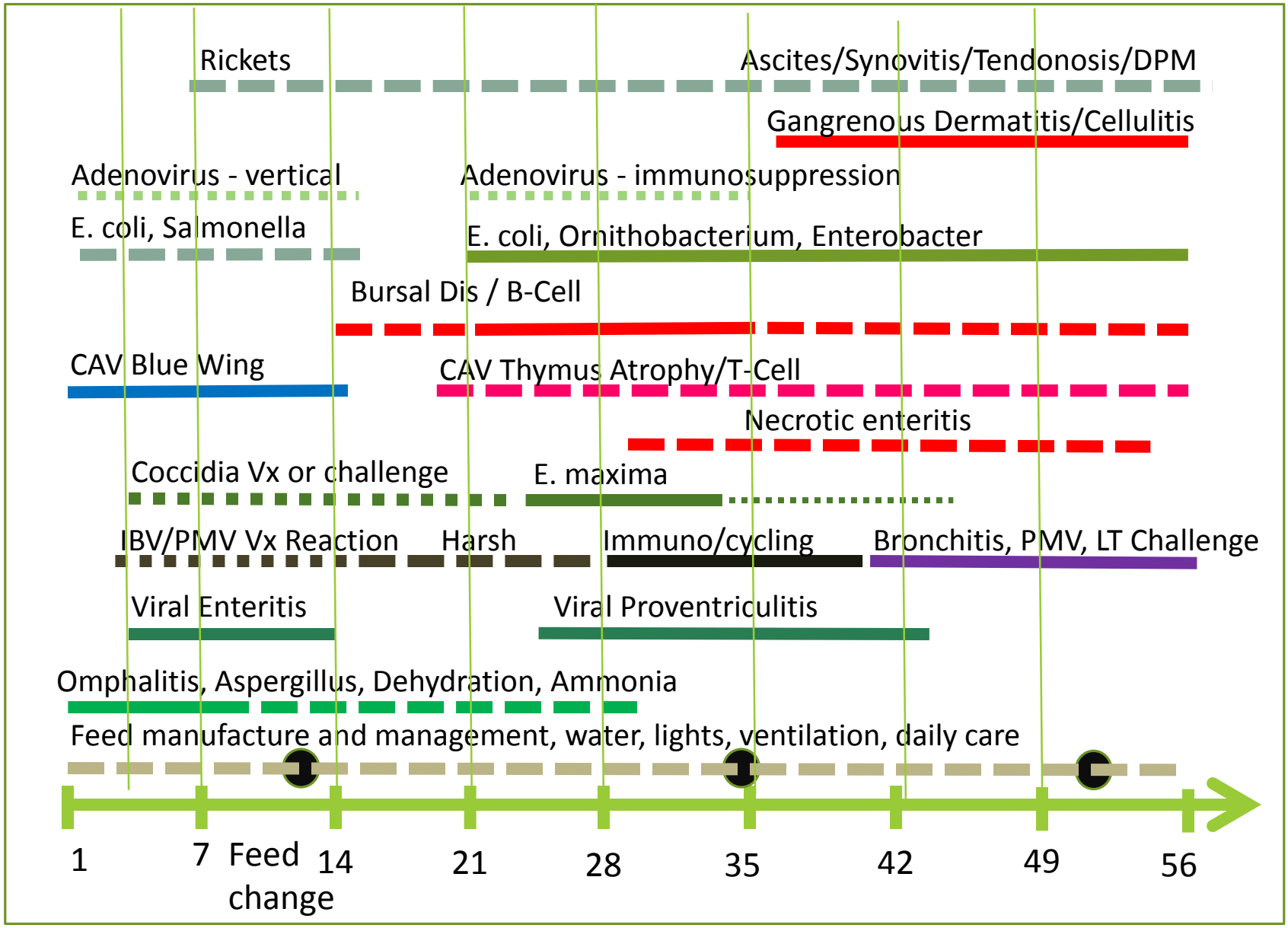
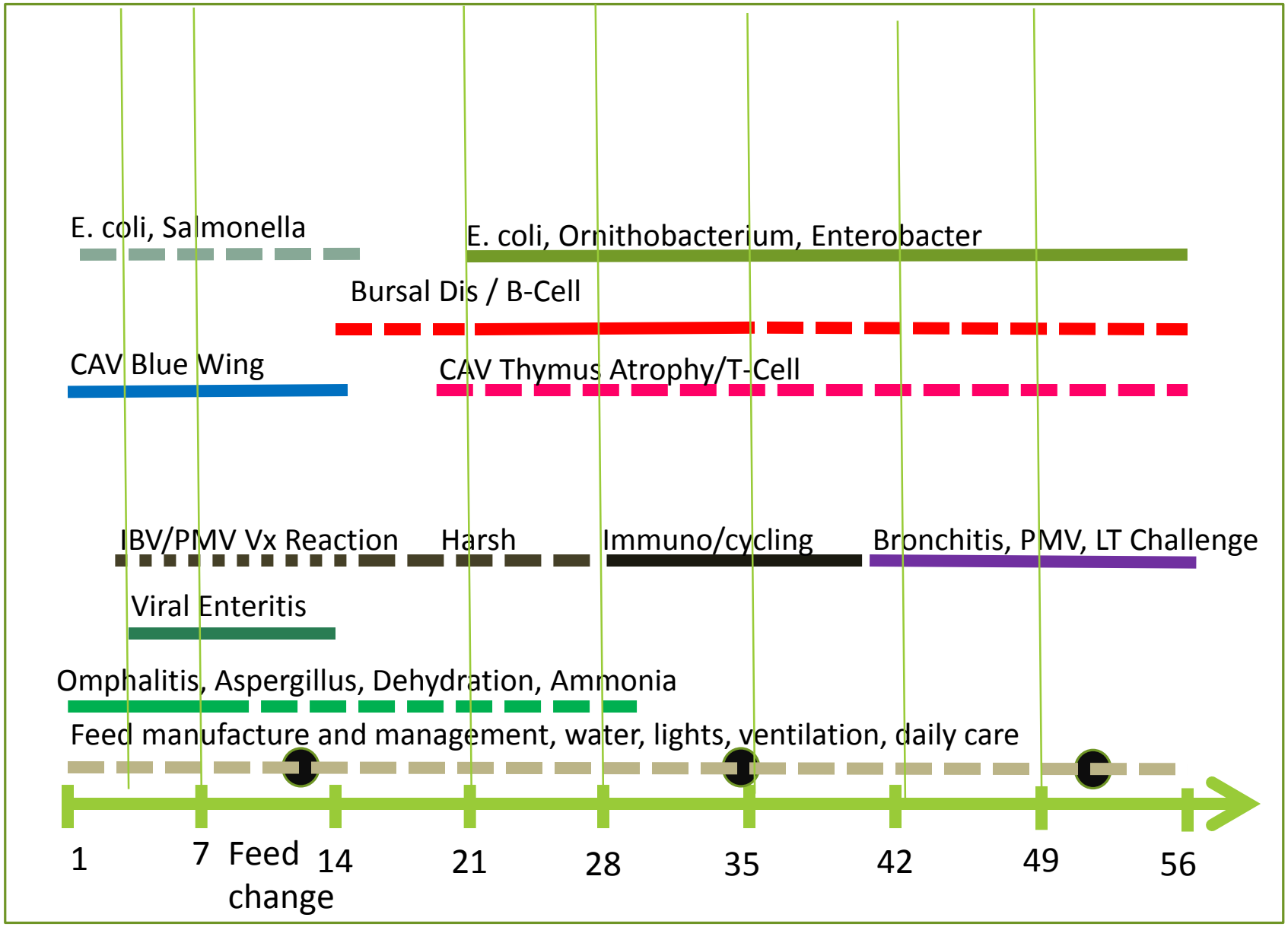
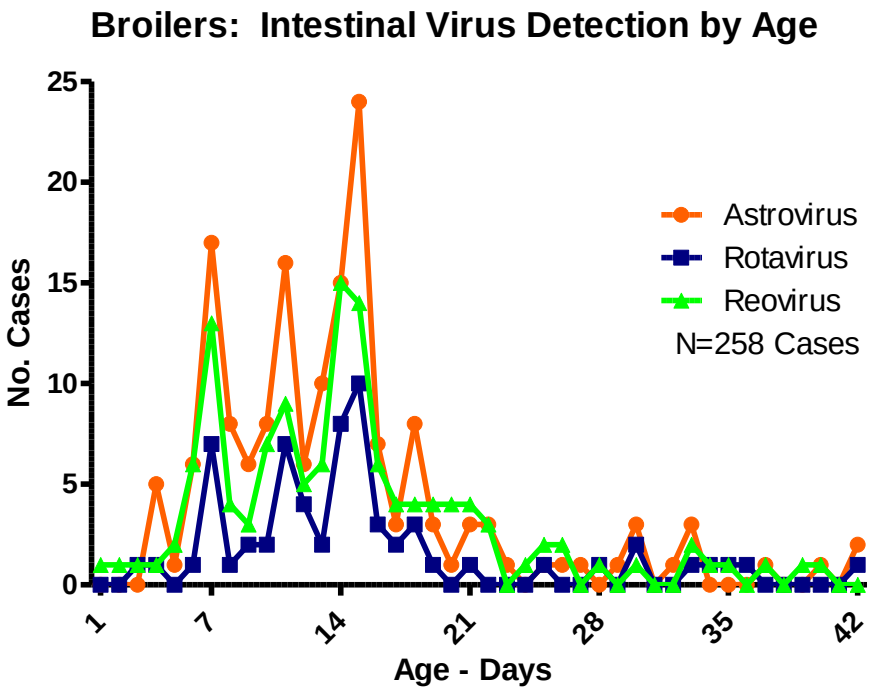
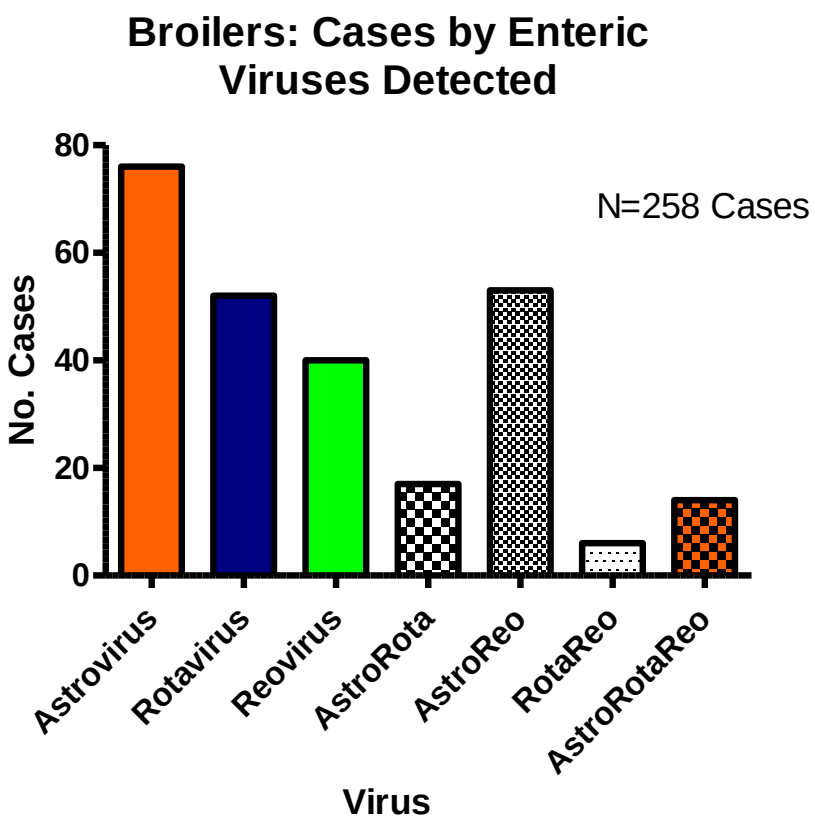
Broiler Disease by Age



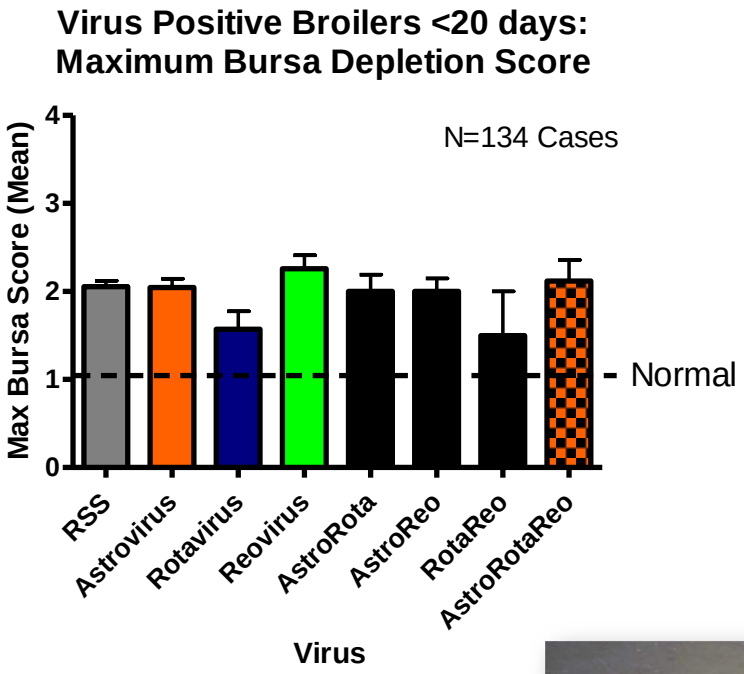
Immunosuppression & Respiratory Disease by Age

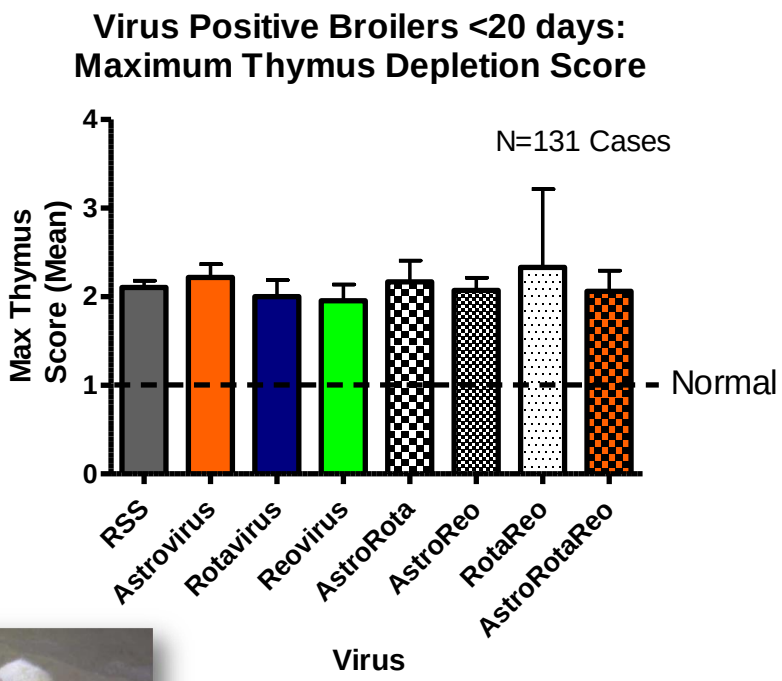



Broilers: Intestinal Virus Detection by Age
No. Cases
25
20
15
10
5
0
1
7
14
21
28
35
42
Age - Days
Astrovirus
Rotavirus
Reovirus
N=258 Cases

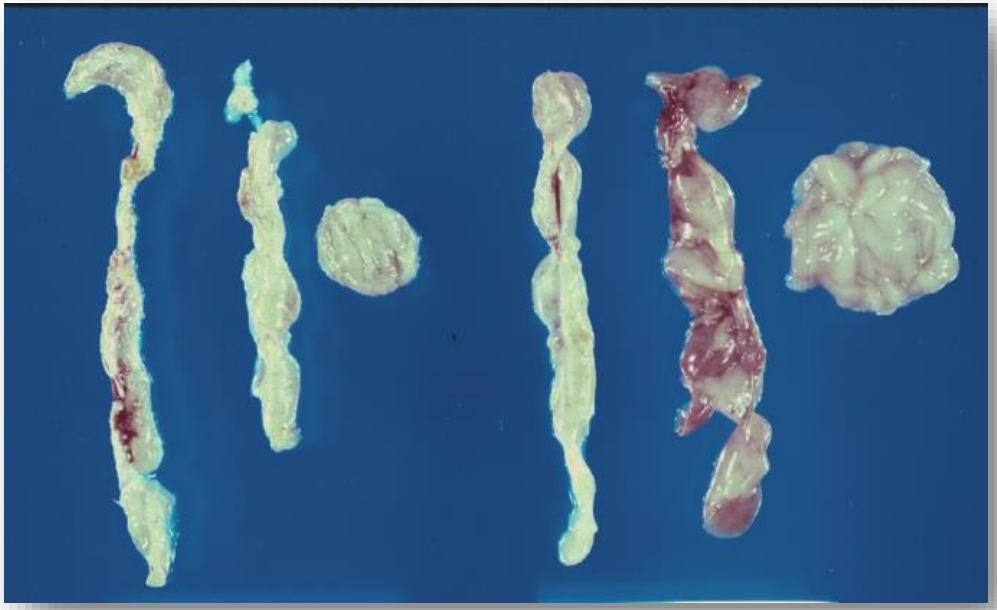

Broilers: Cases by Enteric Viruses Detected
No. Cases
80
60
40
20
0
N=258 Cases
Astrovirus
Rotavirus
Reovirus
AstroRota
AstroReo
RotaReo
AstroRotaReo
Virus

Viral Enteritis in Broilers
Bursa and Thymus Atrophy





Marek's Disease Immunosuppression



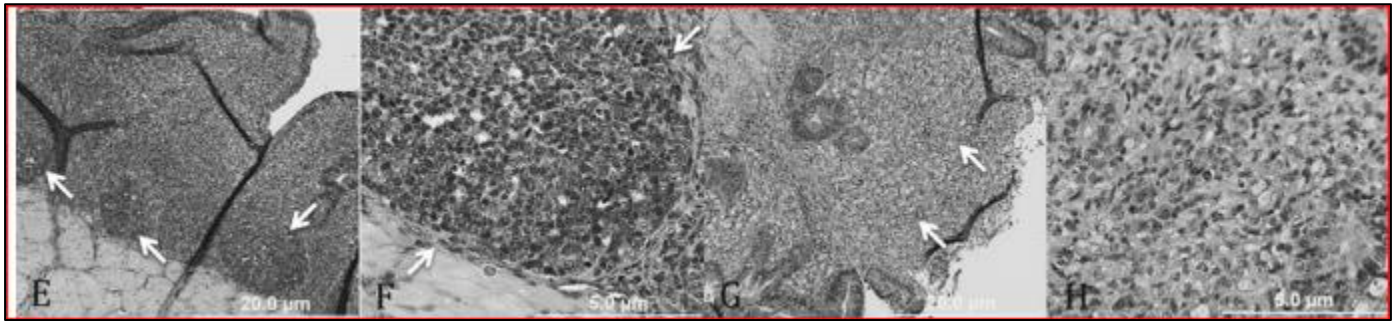
Marek's Disease Control

- Occurs at a young age
- Difficult to confirm
- Assume - if problems exist in Marek's tumors or clinical disease

Acute Marek's Disease and Immunosuppression

Acute Marek's disease infection causes necrosis and depletion of the **bursa of Fabricius, thymus, and cecal tonsils**

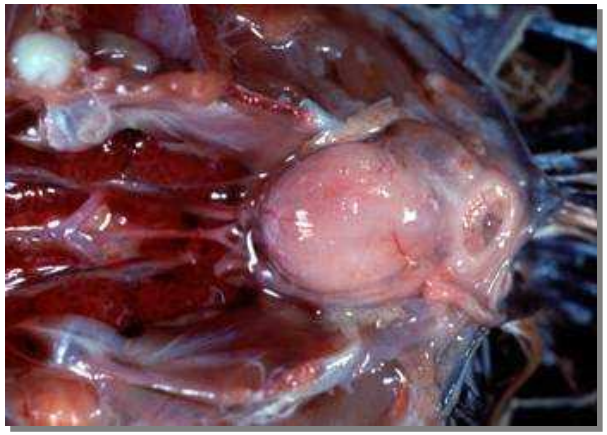
Cecal Tonsil:

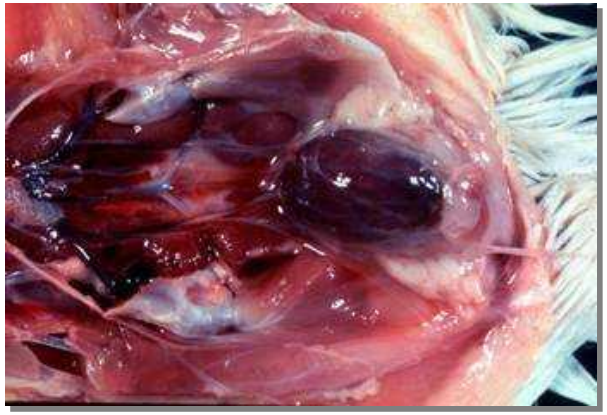


Heidari et al. Avian Diseases 58:262-270, 2014

Impact: Permissive environment for respiratory virus persistence and shed: Bronchitis and Newcastle

Infectious Bursal Disease – Classical

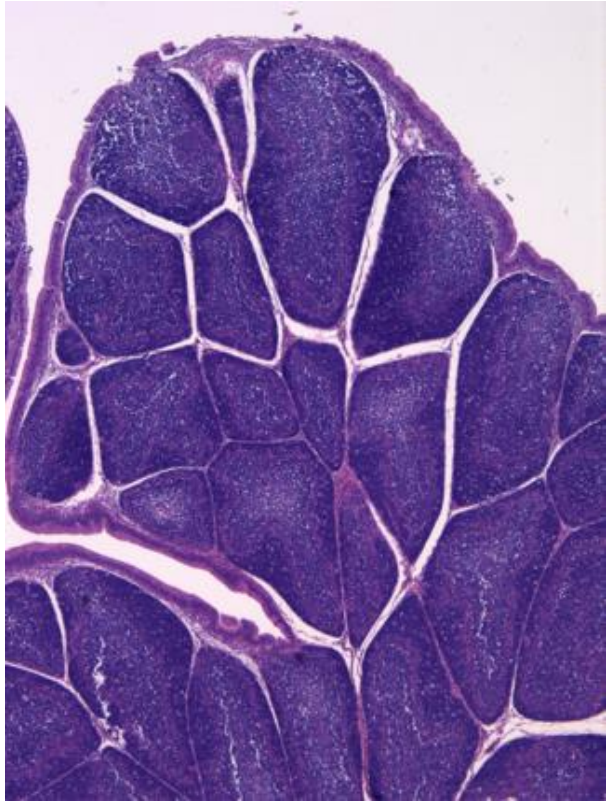




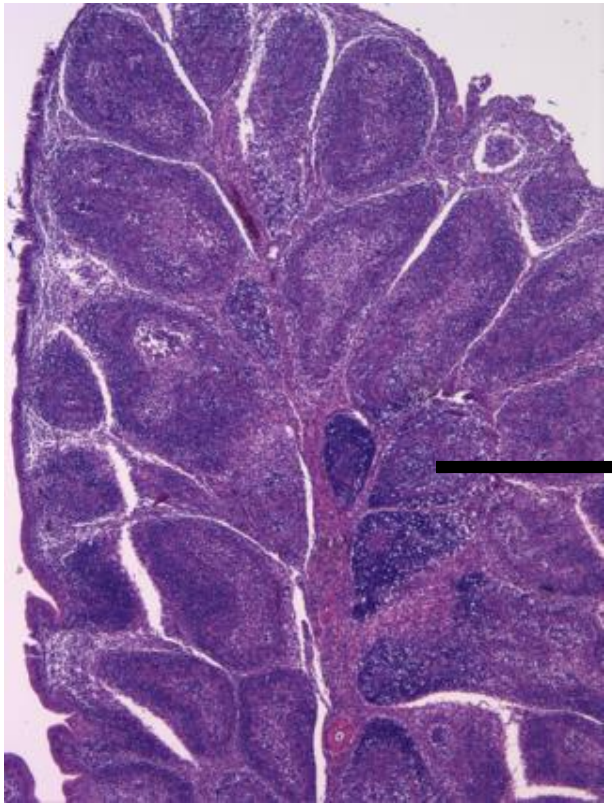
Variant Bursal Disease Virus

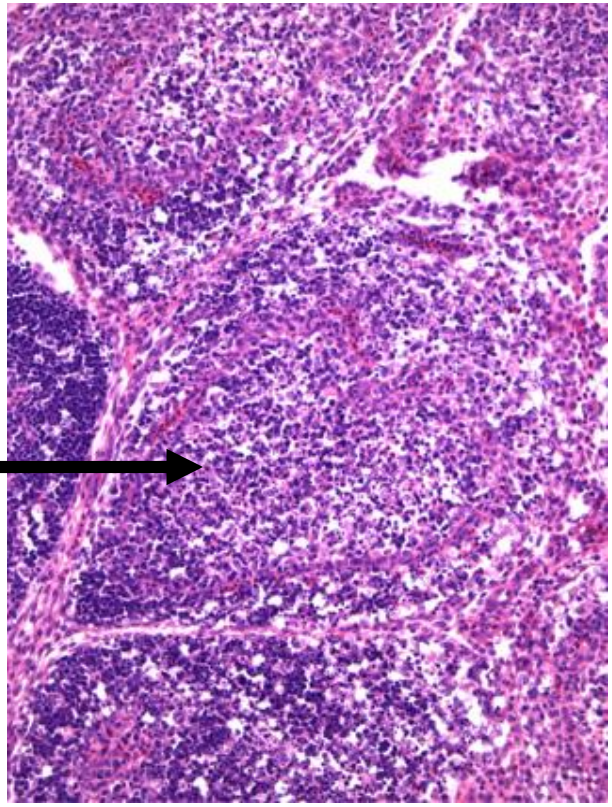
No breeder vaccination | Breeder vaccination | Unchallenged control

Bursa
Acute Bursitis (Acute Gumboro)



Normal





Necrosis (acute)

Acute Bursal Disease: Necrosis

The bird is susceptible to IBD at this age

- Maternal antibody diminished, or
- Variant challenge virus attacks through existing immunity, or
- Massive challenge virus overwhelms existing immunity

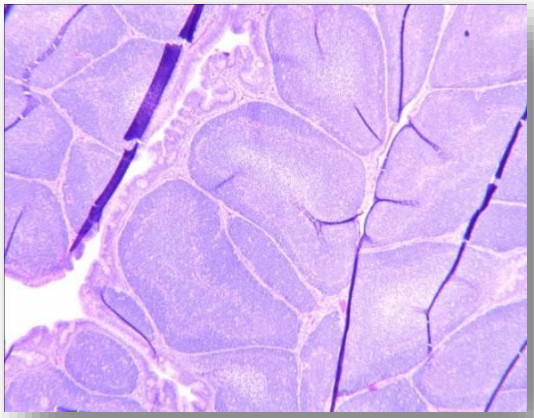
Bursa contains abundant virus

Good for virus isolation or detection by PCR

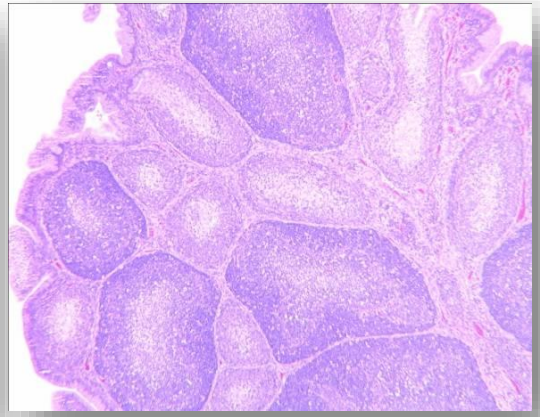
Acute bursal disease marks the onset of transient or possible permanent immunosuppression.

Post-necrotizing Bursitis Follicular Repopulation/Restitution

Grade 2

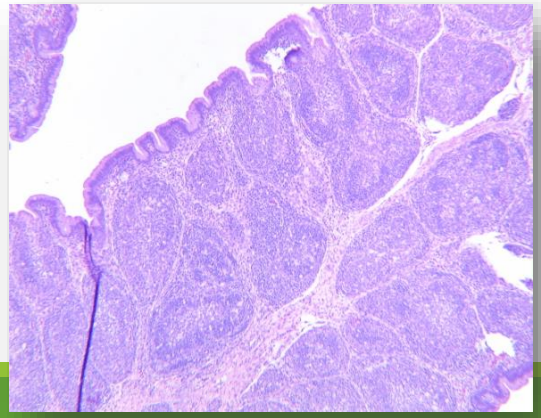


Grade 2.5 Large Follicle

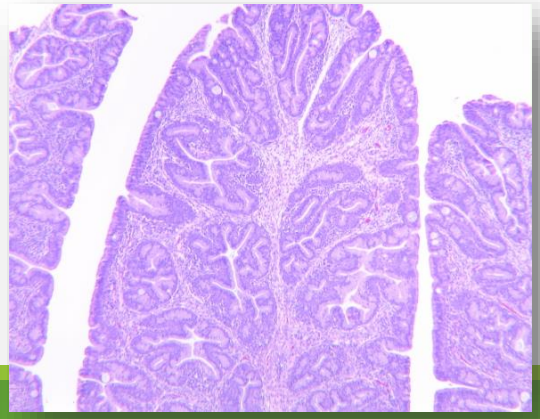


Grade 3

Grade 3.5



Grade 4

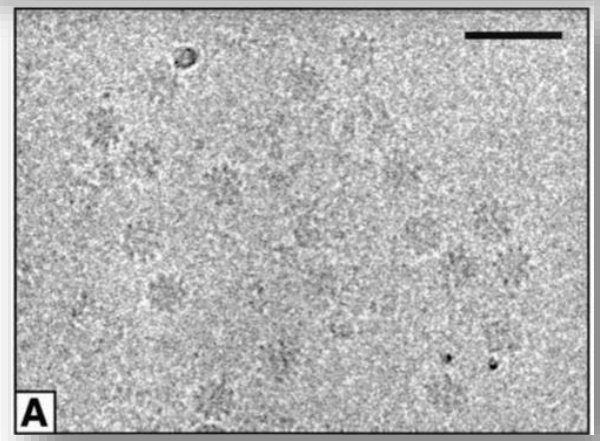


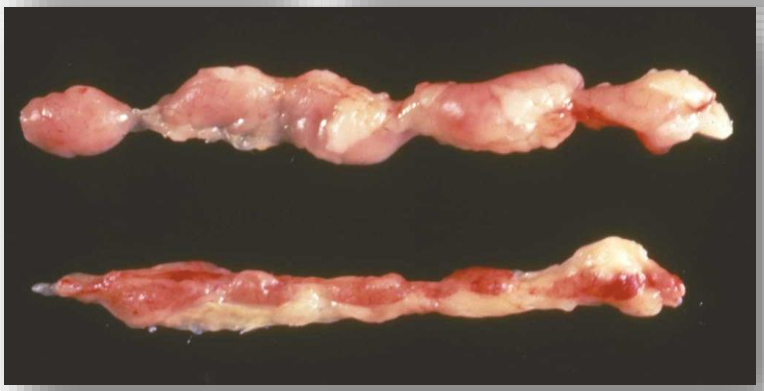
Bursa Grading: Broiler Case Study
Early Bursal Disease Challenge

	Age Days			
Flock	**14**	**21**	**25**	**28**
A	1 1 1	1 1 1	1 1	3.5 3.5
B	1 1 1	1 1 1	3.5 3.5	3 3.5 3.5
C	1 1	1 1	N 3.5	3 3.5
D	1 1 1	3 3 3	3 3 3	3.5 3.5 3.5
E	1 1 1	N 3 3	3.5 3.5 3.5	3.5 3.5 3.5
F	1 1 1	N 1 1	N N 1	N 3.5 3.5
G	N 1	3 4 3.5	3.5 3.5 3.5	3.5 3.5
H	N	3 3	3.5	3.5
I	N N	3.5 3.5 3.5	3.5 3.5 3.5	3.5 3.5
J	N	3.5	4	3.5

1= Normal | **2=Mild Depletion** | **3=Moderate** | **3.5 - 4= Necrosis/Marked~ Severe**

Chicken Infectious Anemia

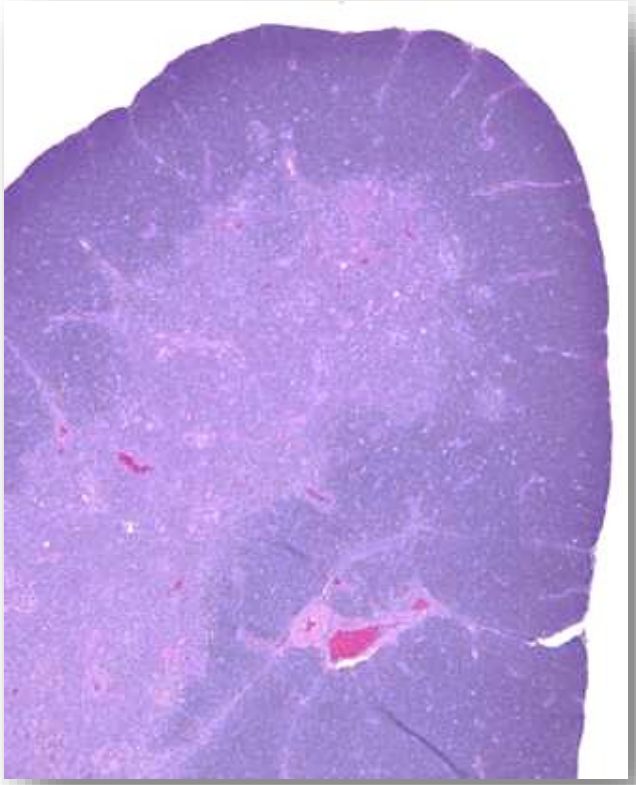




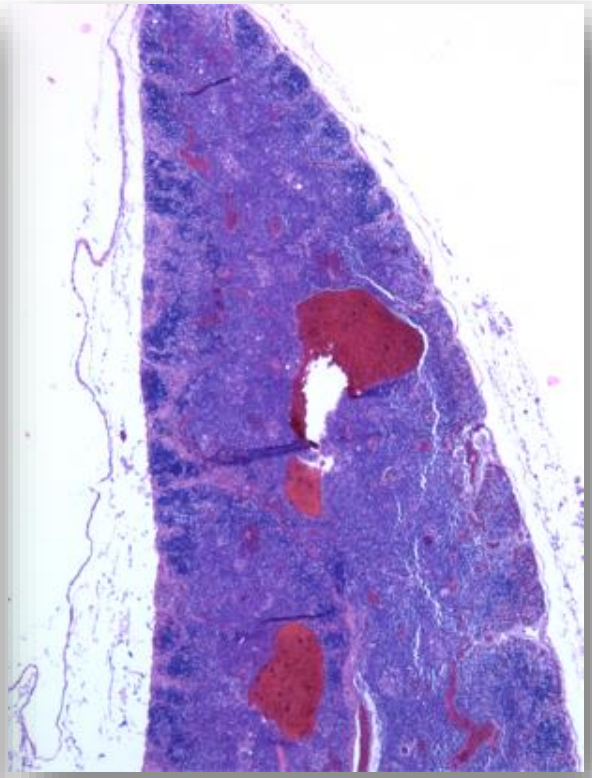
Crowther et al, J Virol. 2003 77: 13036–13041

AAAP Slide Set

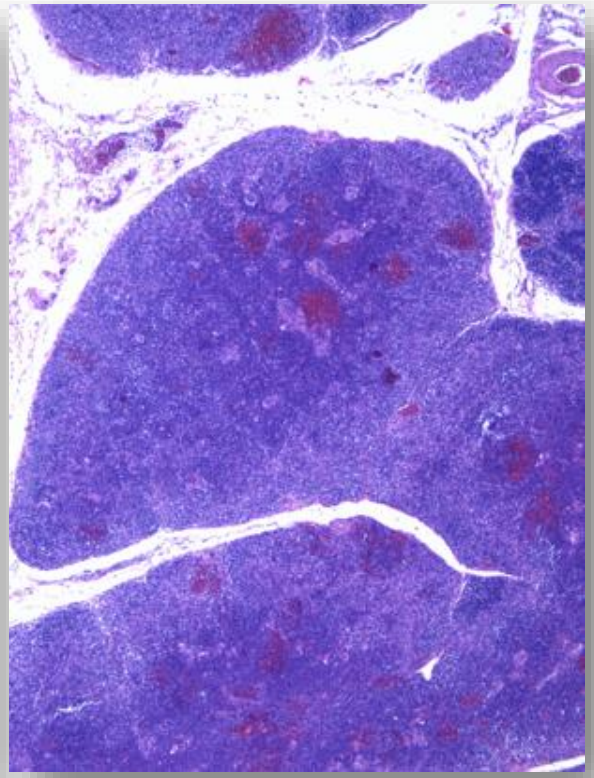
Thymus
Grade 4 Lymphocyte depletion (CAV)



Normal



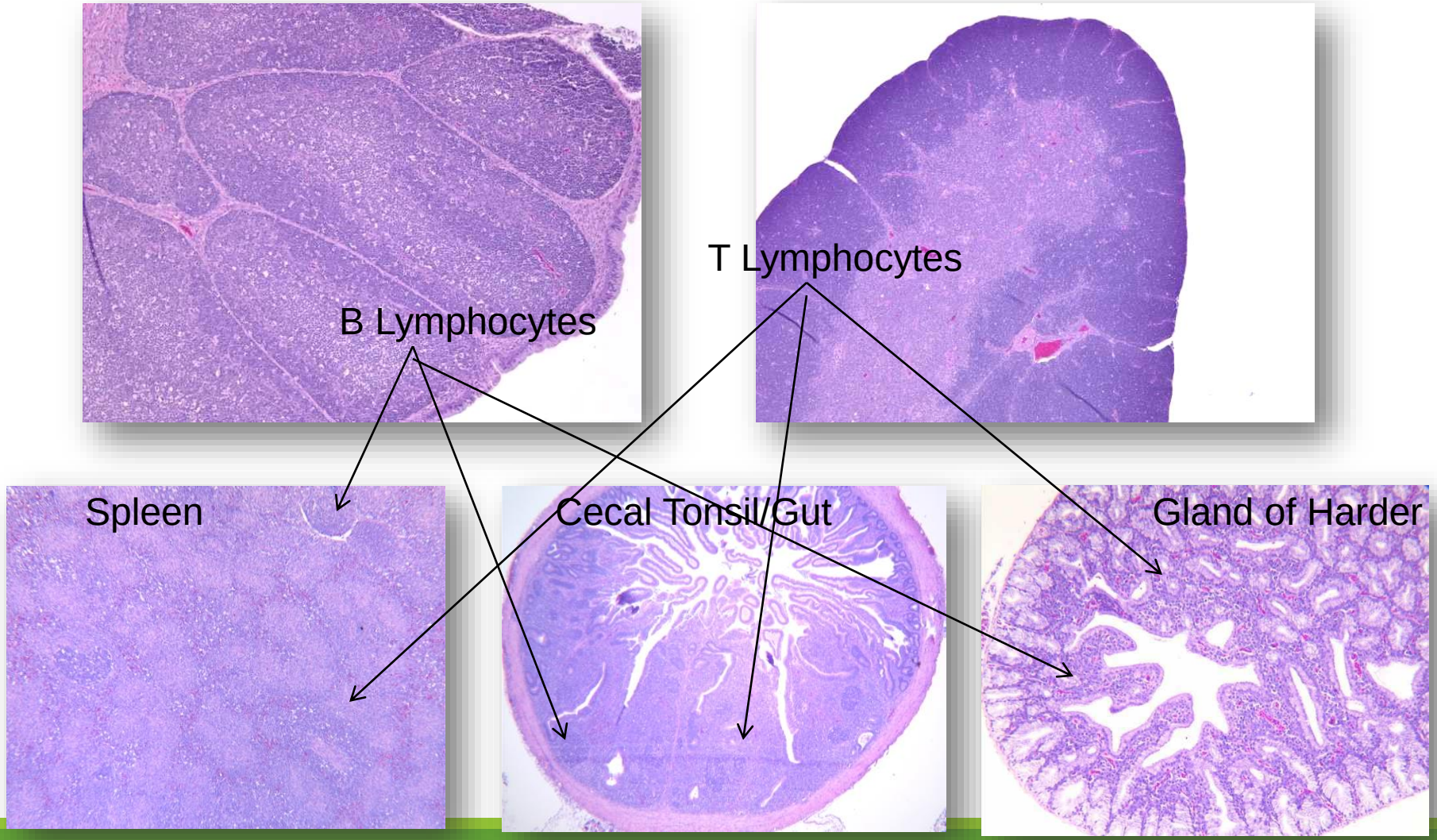
Grade 4



Grade 4

Bursa and Thymus: First 14 Days

Primary Lymphoid Organs Seed Secondary Organs



Diagnostic Laboratory Perspective

Atrophy of the bursa and thymus are routinely observed in broiler chickens submitted to diagnostic laboratory

Principle diagnoses

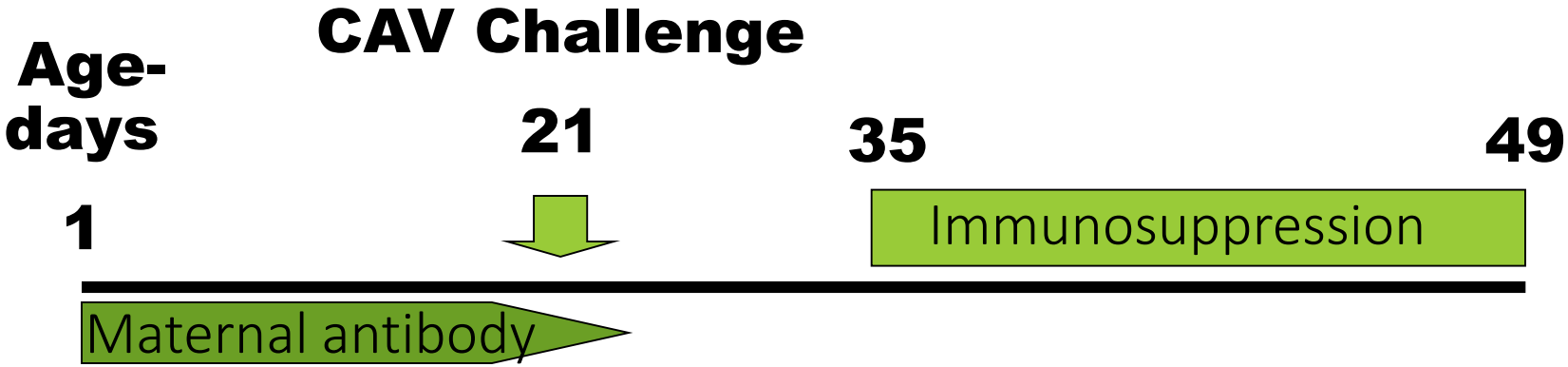
- Infectious bronchitis, vaccine strains isolated
- Coccidiosis, especially *Eimeria maxima*
- Gangrenous dermatitis

Bursal atrophy is primarily associated with infectious bursal disease

Thymus atrophy is primarily associated with chicken infectious anemia (PCR positive)

- Also possible Marek's

1993: CAV Infection& Thymus Atrophy after Depleted Maternal Immunity



No anemia observed

Lymphocyte and macrophage suppression

- T-cell growth factor, interferon, and transformation
- Macrophage FC receptor expression, interleukin-1, phagocytosis and bactericidal activity

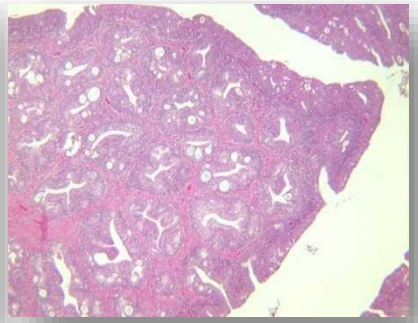
McConnell, Adair & McNulty (Avian Dis 37:366-374, 1993)

Immunosuppression Markers in Field Cases: Bursa and Thymus Histopathology Scores

Bursa

1

2



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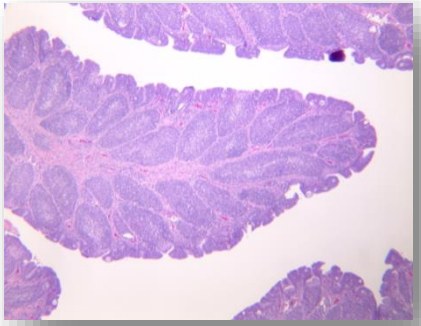
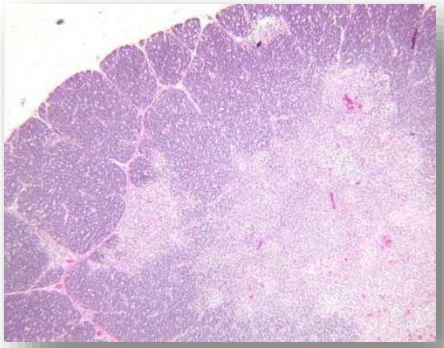
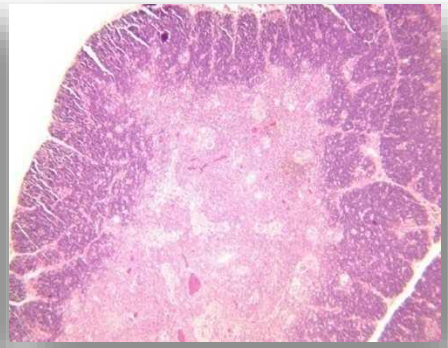
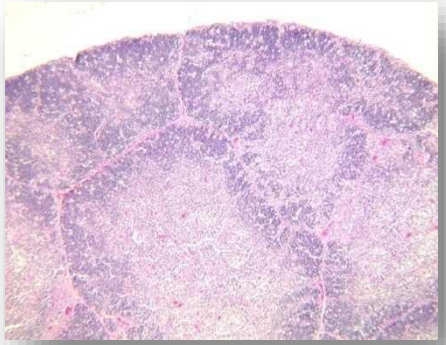


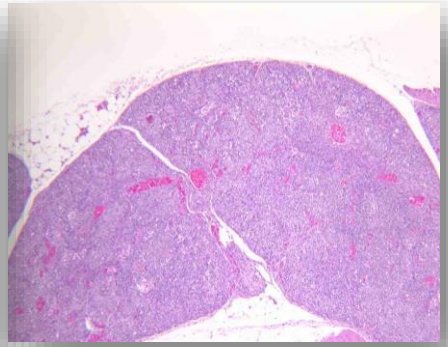
4

Thymus









Summary of 6-year Study

CAV infection was widespread

Thymus atrophy associated with CAV infection

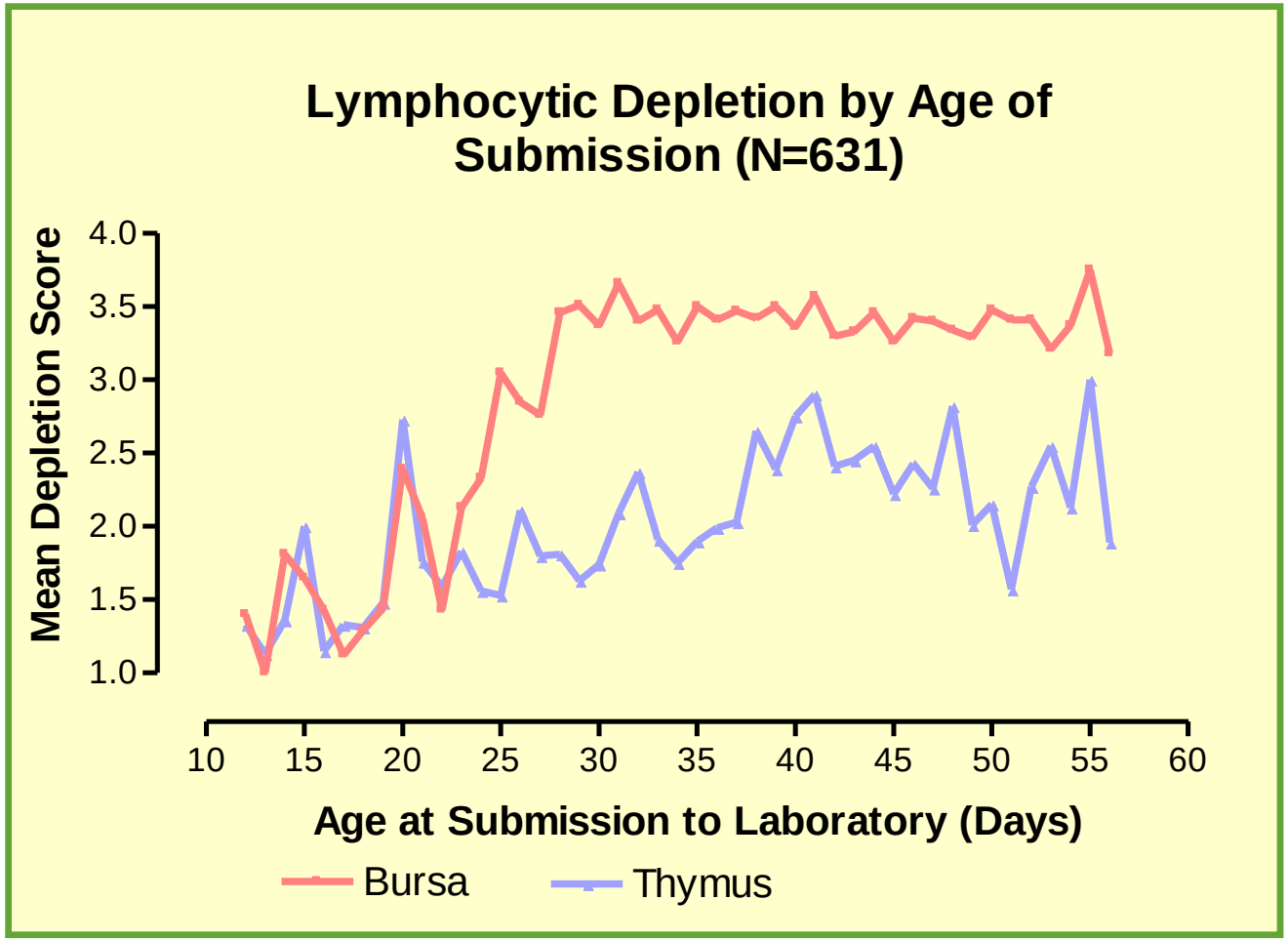
CAV, thymus atrophy, and bursa atrophy were more prevalent in chickens with clinical disease

- Respiratory
- Gangrenous Dermatitis
- Coccidiosis

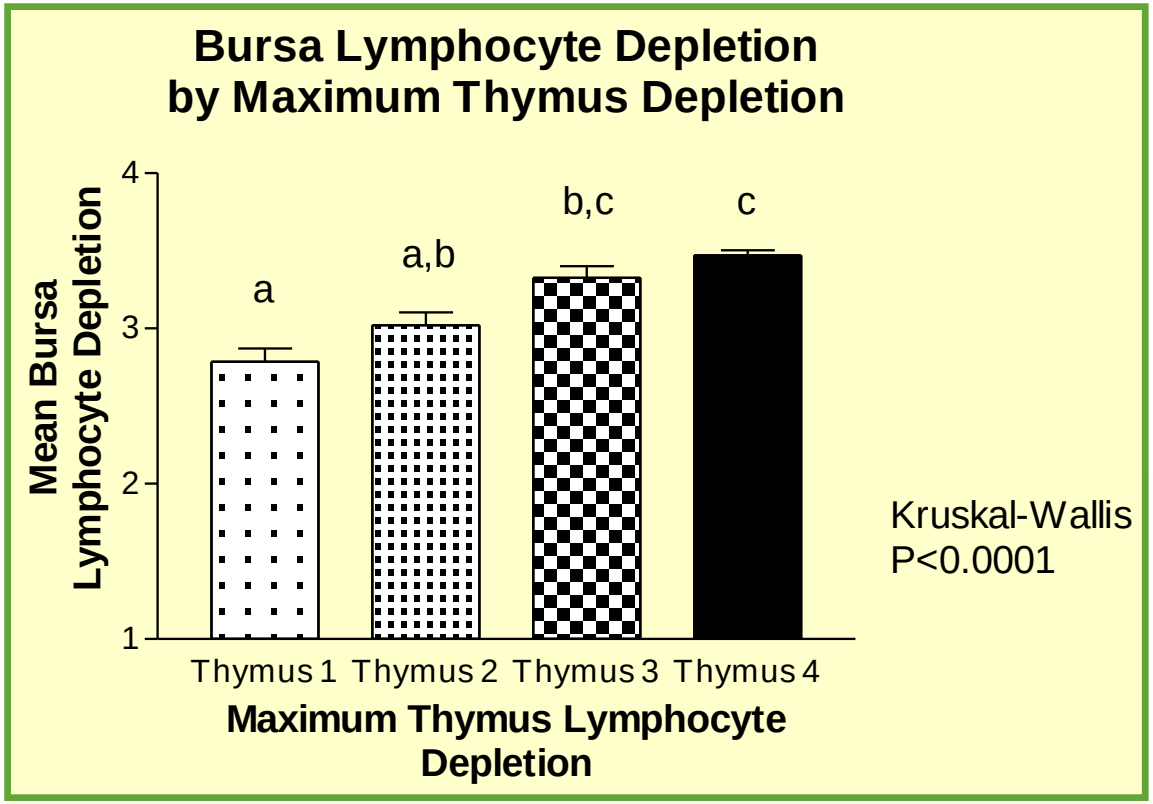
Laboratory findings correlated with economic losses.

Hagood et al. Avian Dis 44:803-808. 2000.

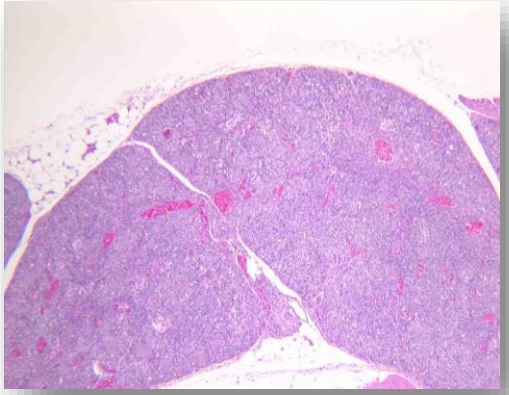
Alabama Broilers

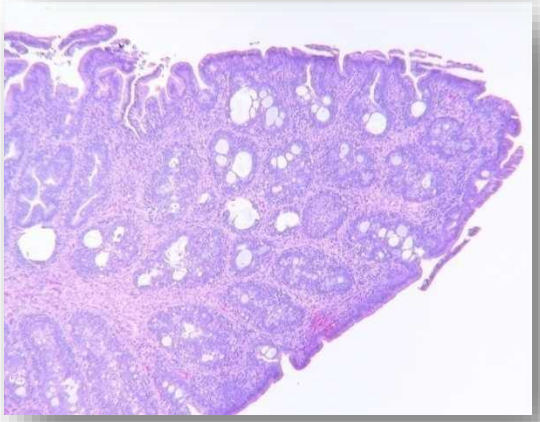


Thymus and Bursa Lymphocyte Depletion

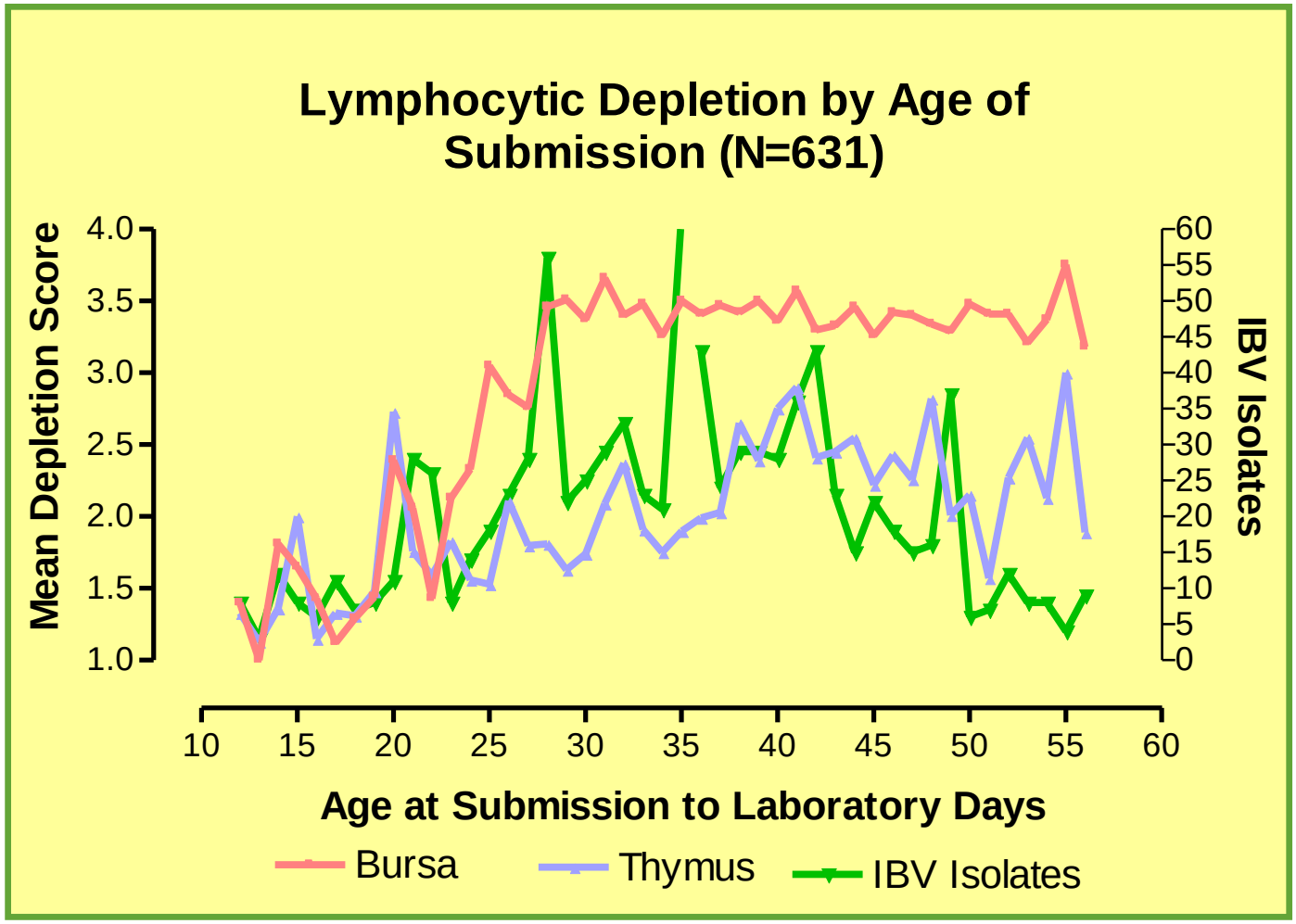


Kruskal-Wallis
P<0.0001

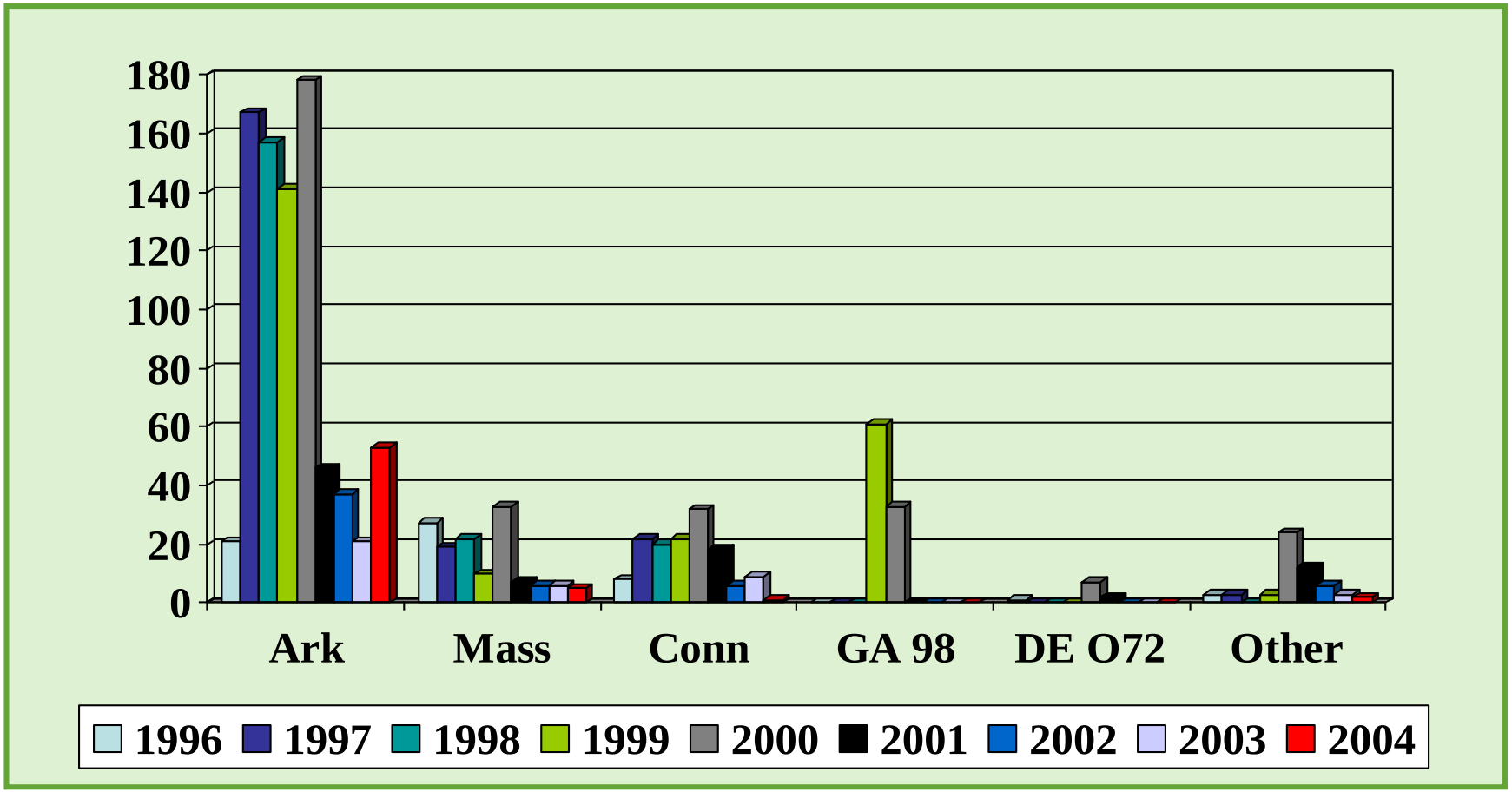




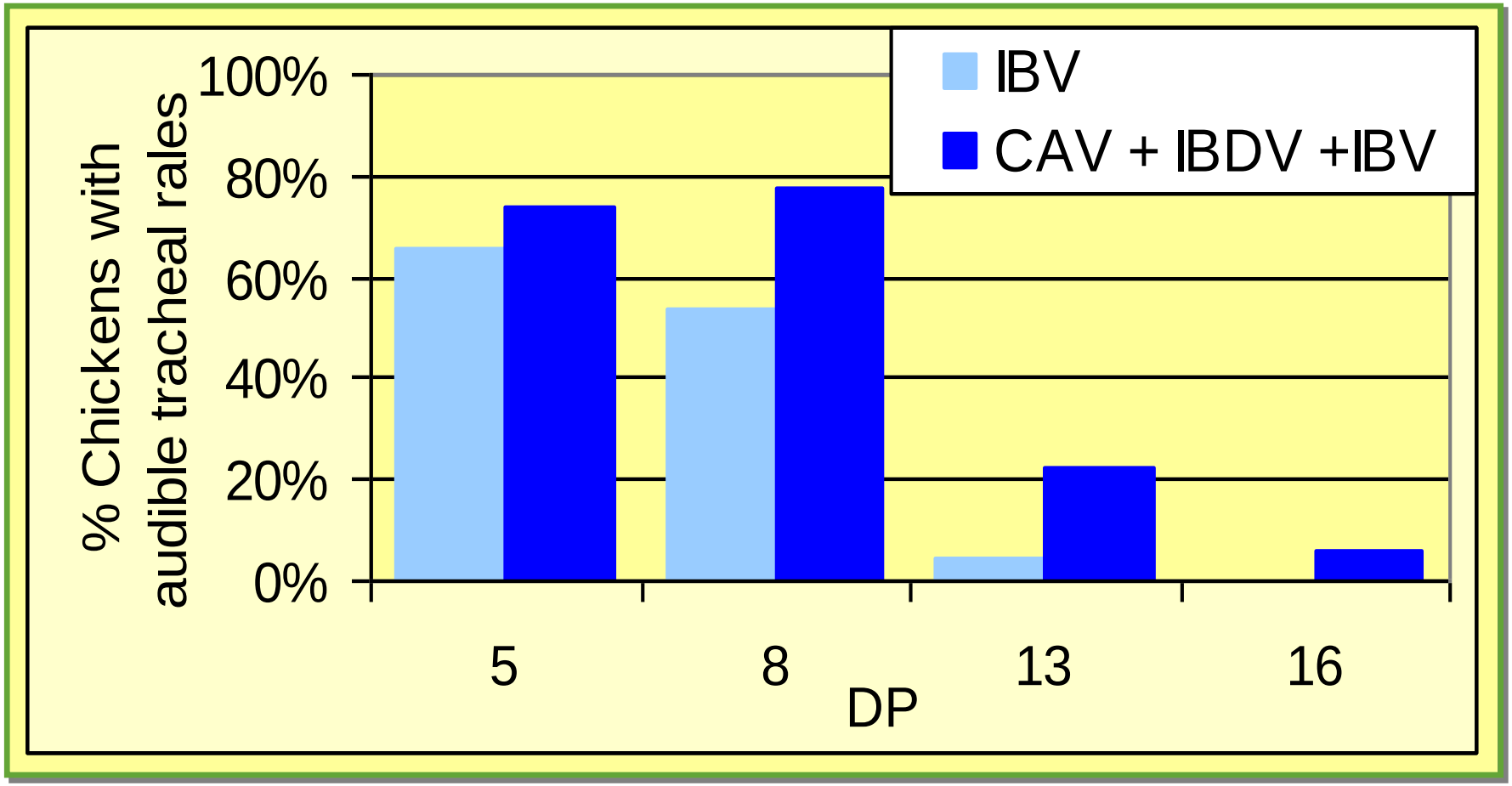
Alabama Broilers



Alabama Broilers and Broiler Sentinels
IBV Isolations

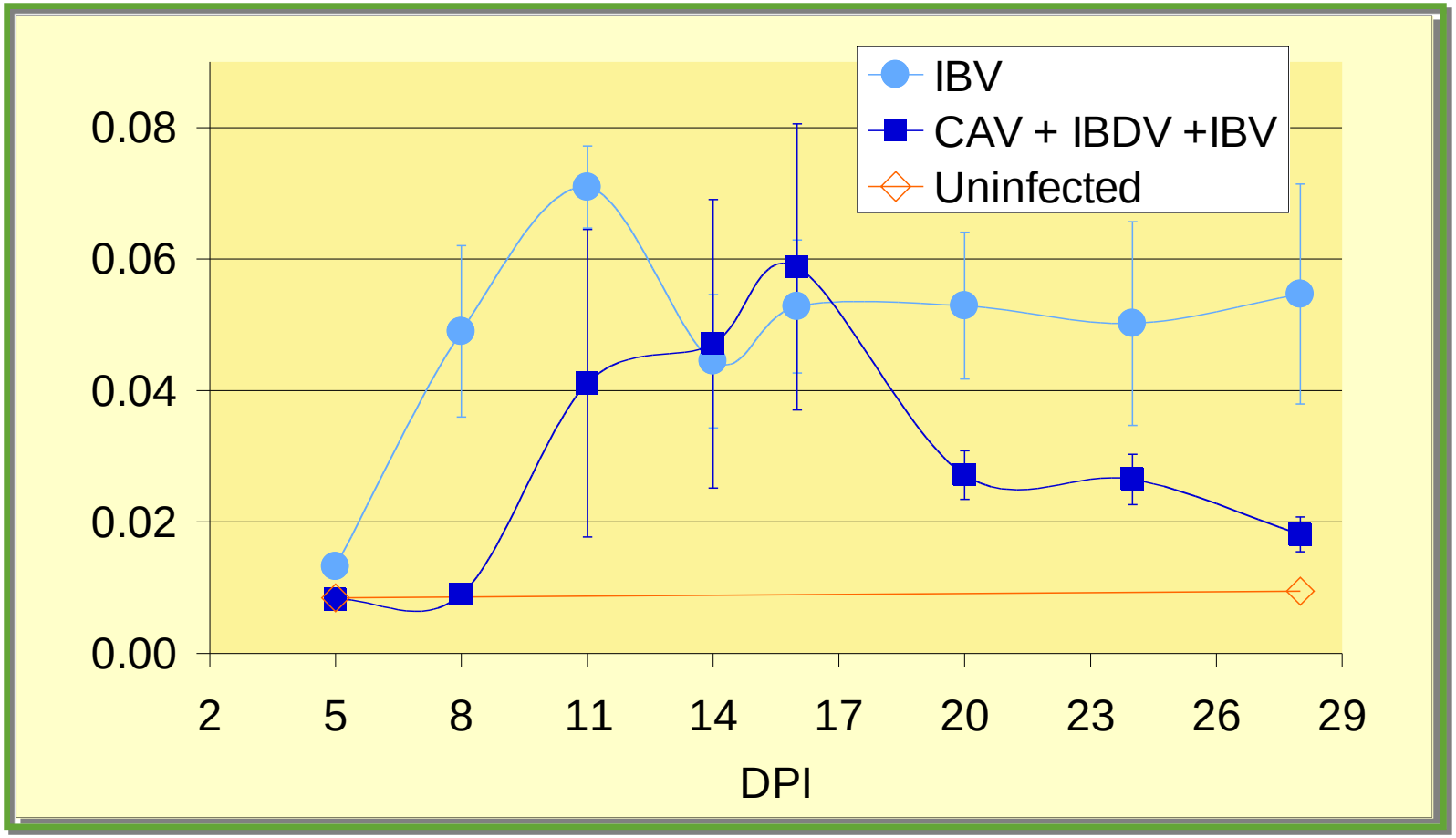


Clinical Signs: Tracheal Rales



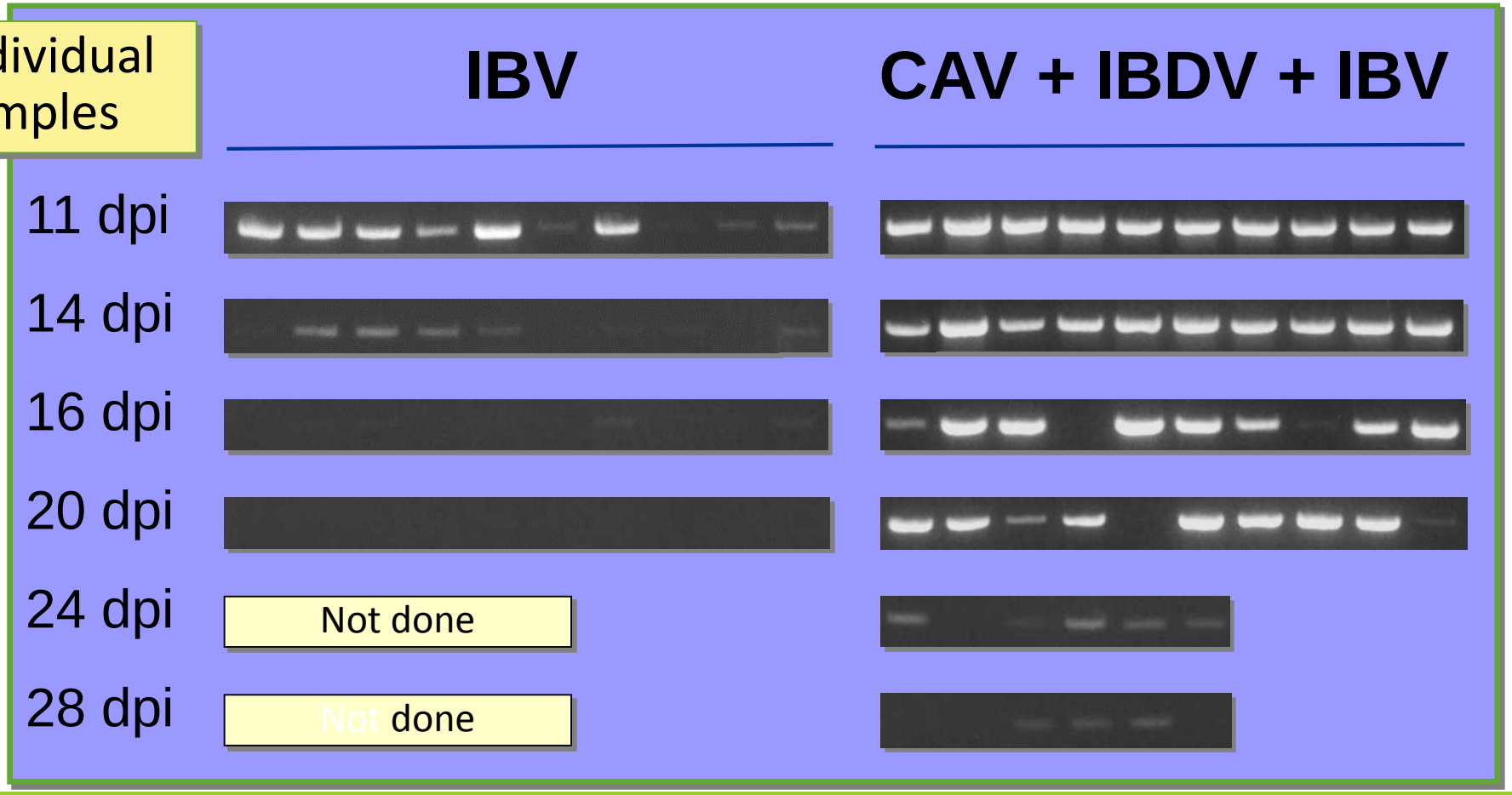
Toro, et al. 2006 Avian Pathology 35:455-64

Anti-IBV IgA in Tears: ELISA



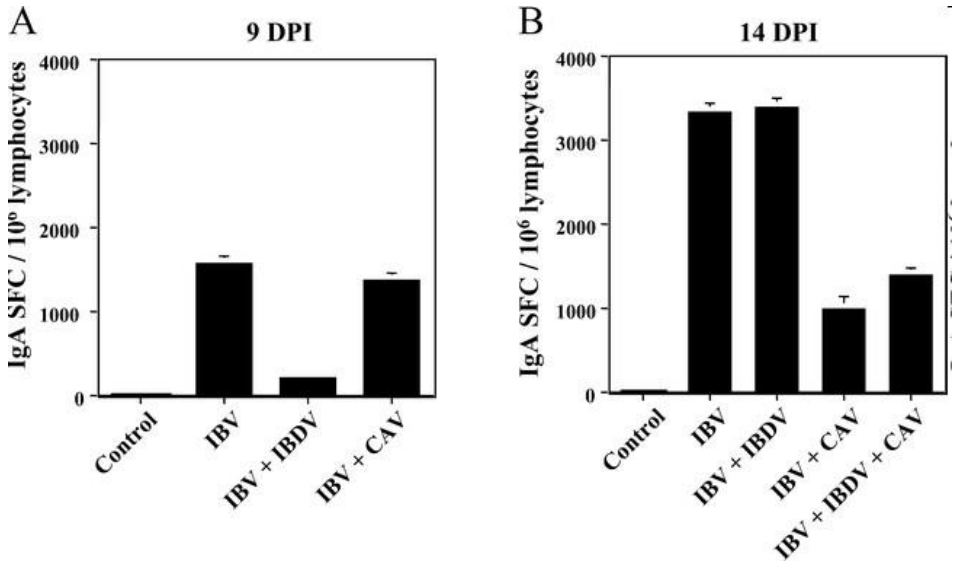
Toro, et al. 2006 Avian Pathology 35:455-64

Infectious Bronchitis Tears: RT-PCR Ark Field Strain



Toro, et al. 2006 Avian Pathology 35:455-64

Interaction of Infectious Bronchitis Virus, Infectious Bursal Dis., and Chicken Infectious Anemia: **Harderian Gland IBV-specific IgA response**



Van Ginkel *et al. Avian Diseases:* Vol. 52, No. 4, pp. 608–617.

Gumboro and CAV, alone and in combination, reduce the number of IBV-specific IgA lymphocytes in the Harderian Gland

Gumboro and CAV infection influence the selection of IBV vaccine subpopulations

Table 2. *Ranking of each subpopulation based on incidence (high to low) in immunocompetent and immunodeficient (IBDV infected, CAV infected, CAV + IBDV infected) chickens in the first passage of Experiments 1 and 2.*

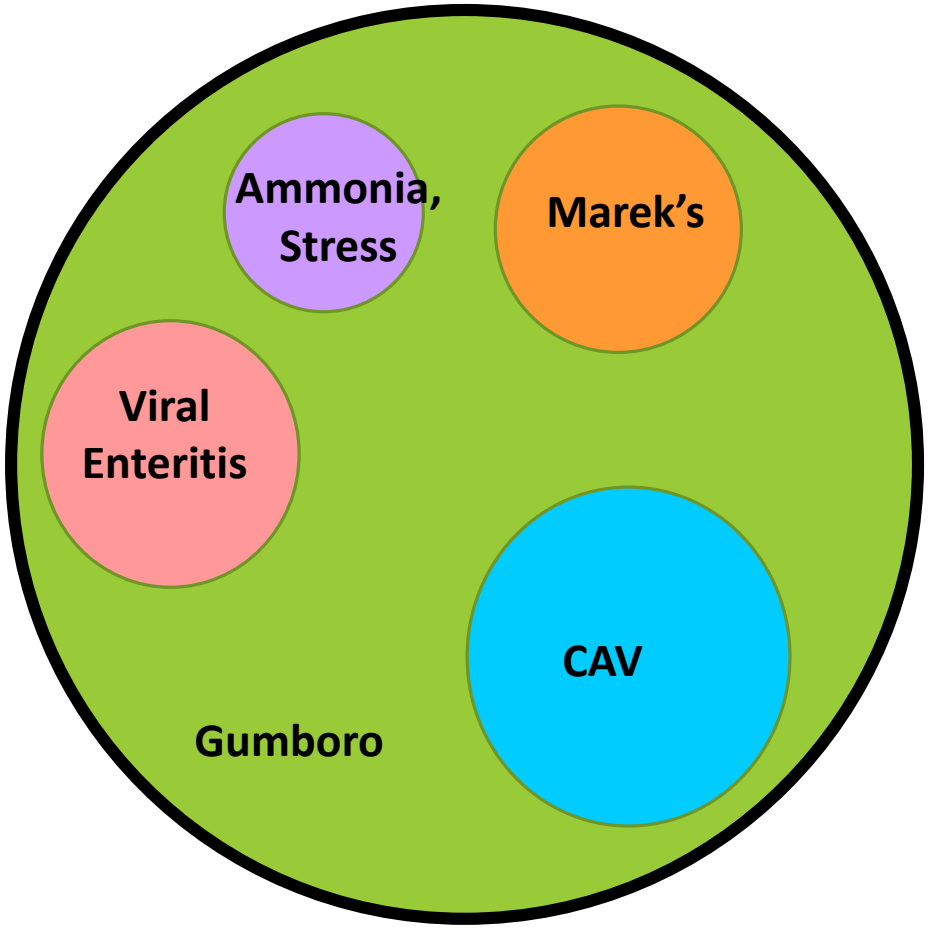
Group	Experiment 1	Experiment 2
Immunocompetent	C1[a] > C4 > C5	C4 > C1
IBDV	C1 = C4 = C2 > C5	C4 > C2 > C1
CAV	C1 = C4 > C2 = C5	C4 > C1 > C2
CAV + IBDV	C4 > C5 > C1 = Vx[b]	C4 = C1 > C5 > C3 = C2

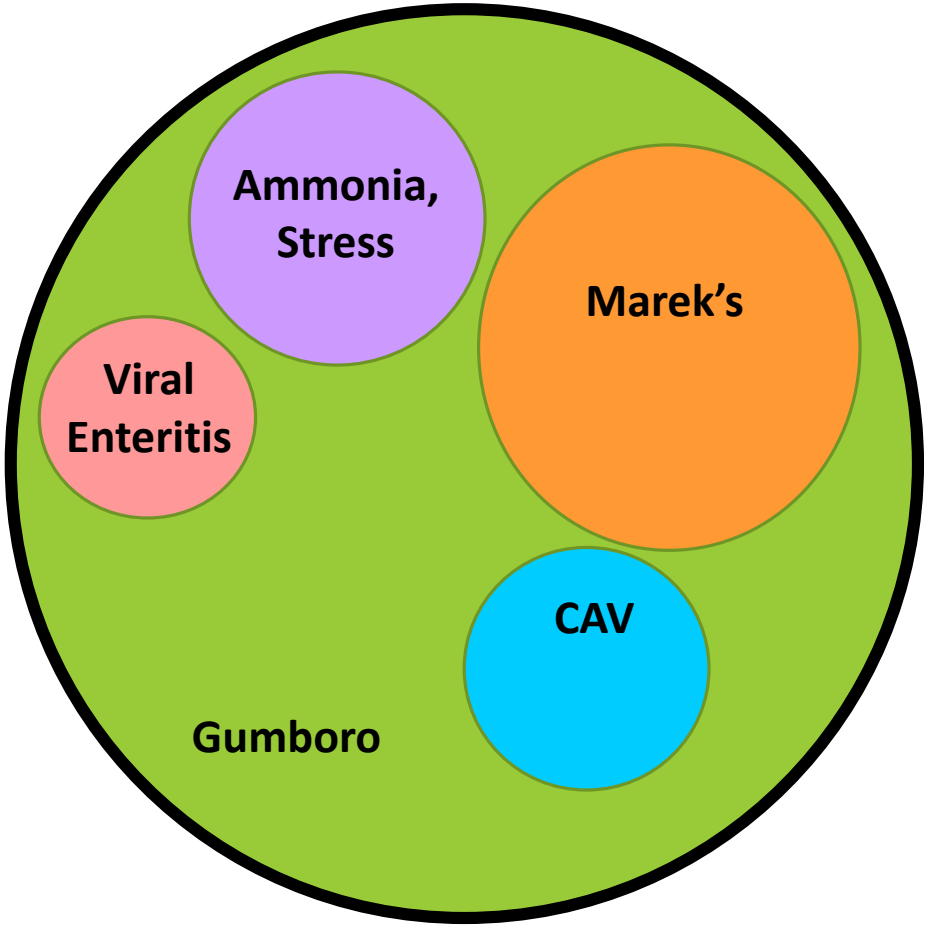
[a]Selected subpopulations, designated C1 to C5. [b]Vaccine major population.

Gallardo et al. Avian Pathology 41:5,451-458, 2012

Immunosuppression could change the anticipated performance of an infectious bronchitis vaccine through permissive replication of virus subpopulations.

Working model: Subpopulations at-risk

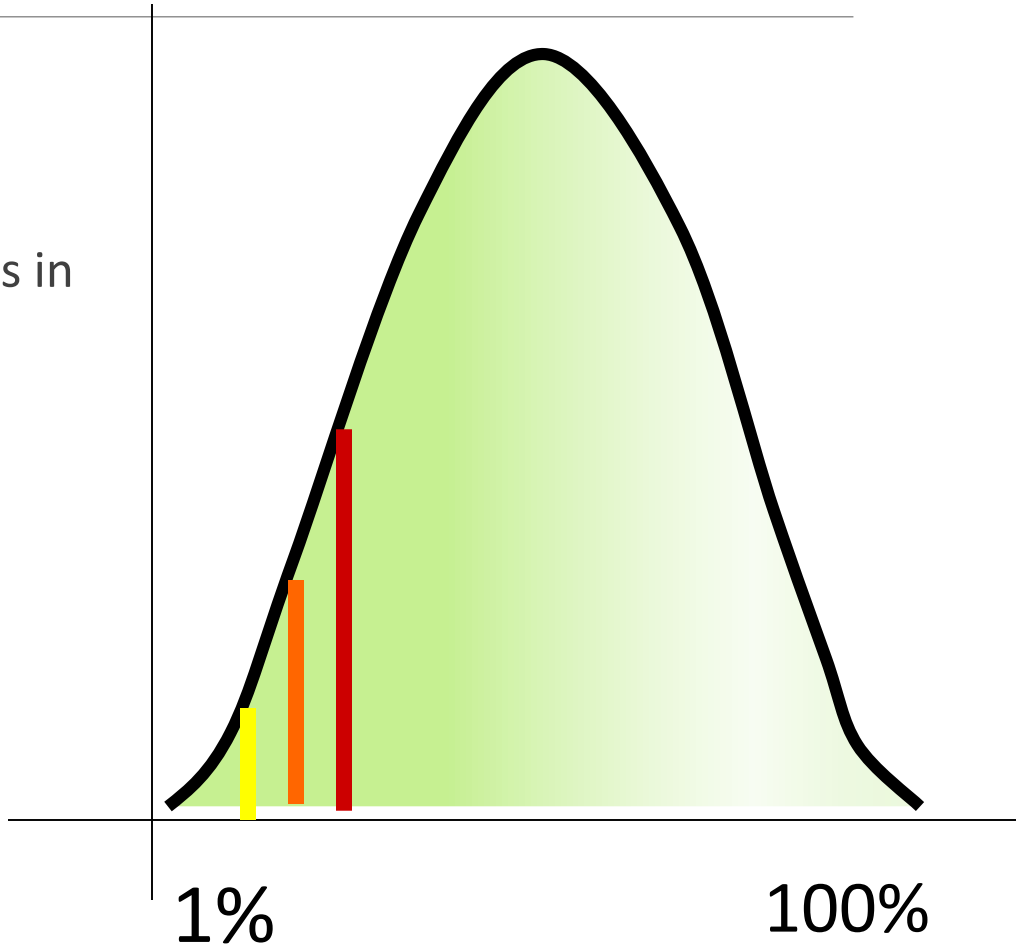




Immunosuppression – Erosion of Health and Productivity

A variable percentage of the flock is affected

Goal – Minimize the number of birds in the subpopulation



Recommendations

Conduct mortality surveys paying attention to bursa and thymus

Histopathology surveys to assess bursa and thymus health

- Evidence of viral enteritis at 10-14 days

Monitor the bursal disease vaccination program

- Necropsy, histopathology, and define challenge strains

Monitor thymus for atrophy

- CAV
- Marek's disease

Virus isolation/Molecular detection, and serology to understand respiratory challenge

- Typing of challenge viruses to define epidemiology

Thank You

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II Seminario Internacional Avicola Merial