Diagnosis of Immunosuppressive Diseases of Commercial Chickens

FREDERIC J. HOERR

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Recognizing Immunosuppression

Poor/harsh vaccination responses

Exaggerated morbidity/mortality

Early stress, later problems
- Runting stunting syndrome

Early exposure to immunosuppressive diseases
- Bursal disease
- Chicken infectious anemia
- Marek's disease
- Newcastle
- Reovirus

Diseases associated with immunosuppression
- Inclusion body hepatitis, possible respiratory disease

Differential Diagnosis

Highest priority

Enteric viruses

Ammonia

Infectious bursal disease

Chicken infectious anemia

Marek's disease

Also Important

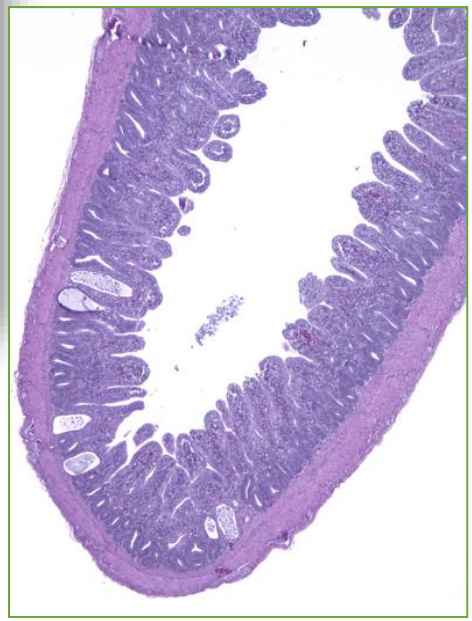
Hatch, transportation, environmental stress

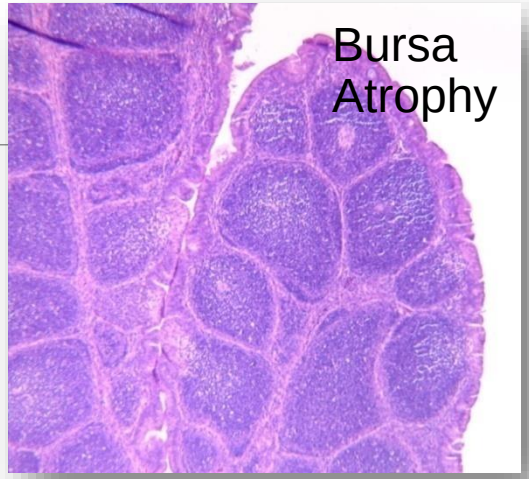
Mycotoxins and Nutrition

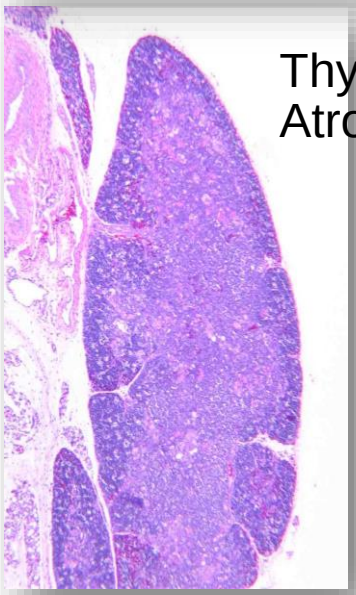
Other disease stress

- Newcastle
- Reovirus

Broiler Runting Stunting Syndrome







Enteric viruses

Clinical signs

- 6-15+ days

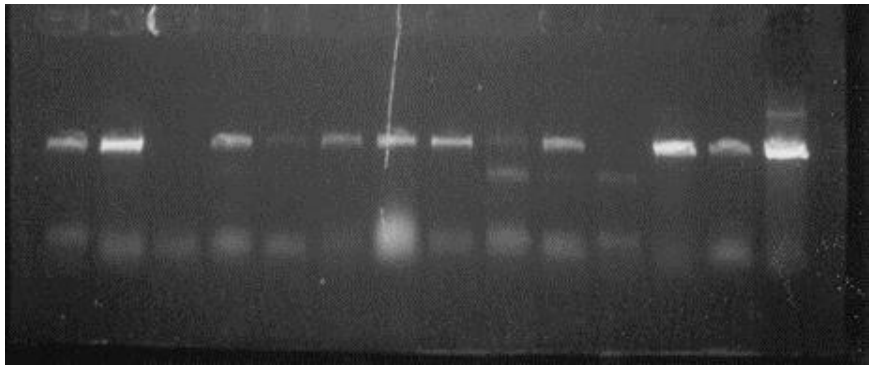
Histopathology

PCR

- Astrovirus, Rotavirus, Reovirus, Parvovirus

Virus isolation

- Reovirus – cell culture
- Others (SPF embryos)



Astrovirus PCR

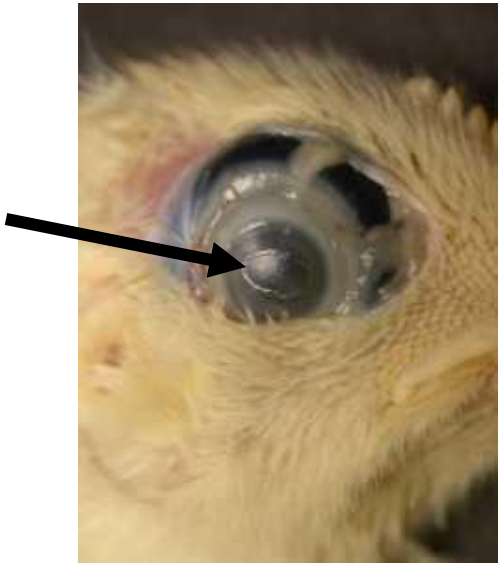
Ammonia

Clinical signs
- Photophobia
- Blindness

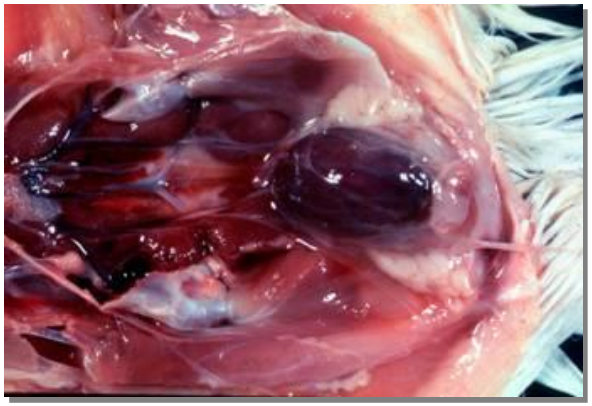
Flock inspection

Detection equipment

Histopathology
- Ulceration of cornea



Infectious Bursal Disease



Variant Bursal Disease Virus

No breeder vaccination | Breeder vaccination | Unchallenged control

Infectious Bursal Disease - Gumboro

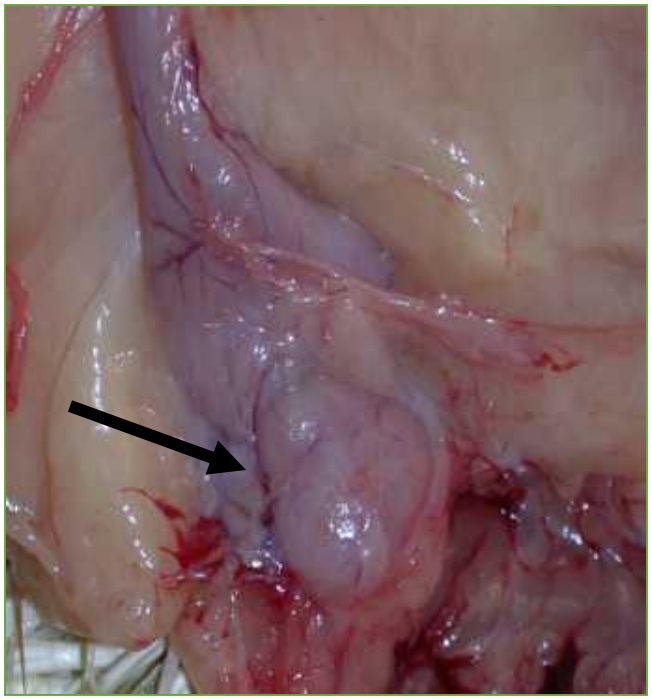
Clinical signs
- Flushing, fever, mortality 20-30 days

Pathology
- Swelling, hemorrhage of bursa - classical
- Atrophy of bursa – variants

Histopathology
- Acute infection
- Follicular restitution

Virus isolation (frozen tissue)

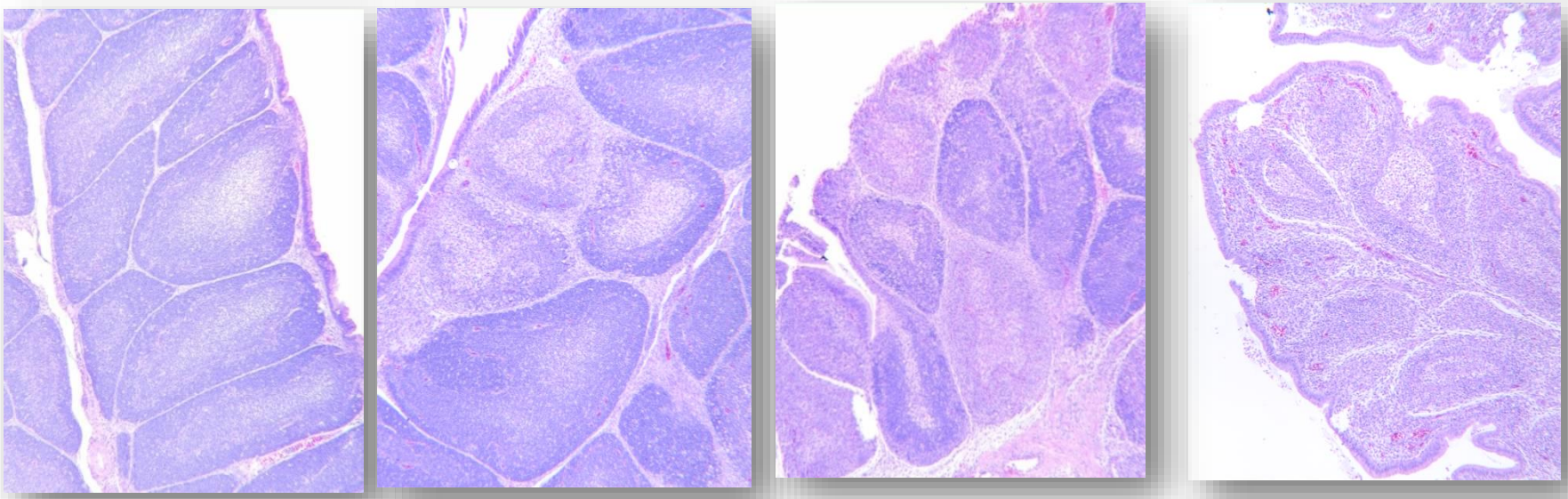
PCR
- Detection and typing using acute phase bursae (frozen) or FTA cards



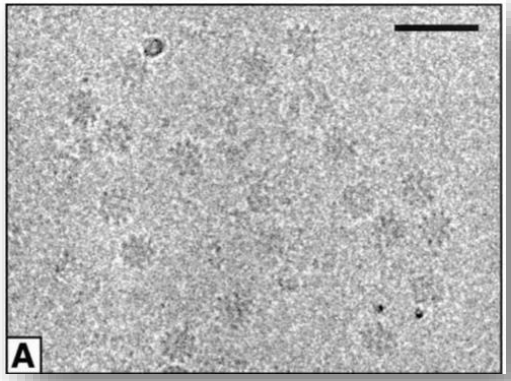
Bursal Disease Pathogenesis
Progression of Lesions

Grade 1 Normal

Rapid Acute Necrosis →



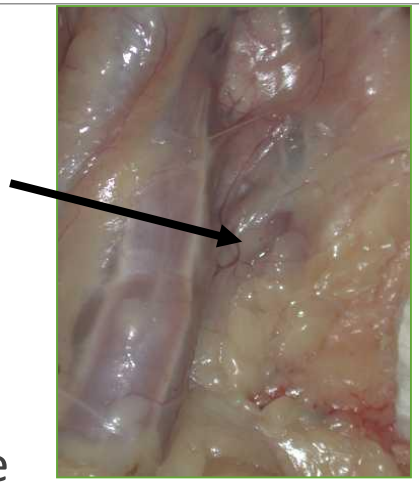
Chicken Infectious Anemia



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

AAAP Slide Set

Chicken infectious anemia



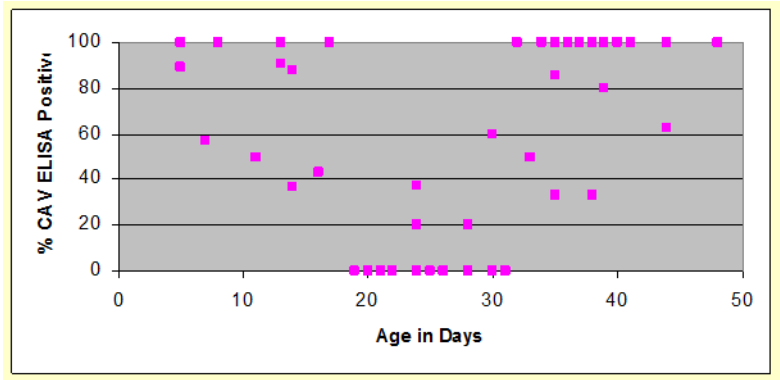
Clinical signs
- Blue wing and anemia in chicks

Pathology
- Thymus atrophy at any age

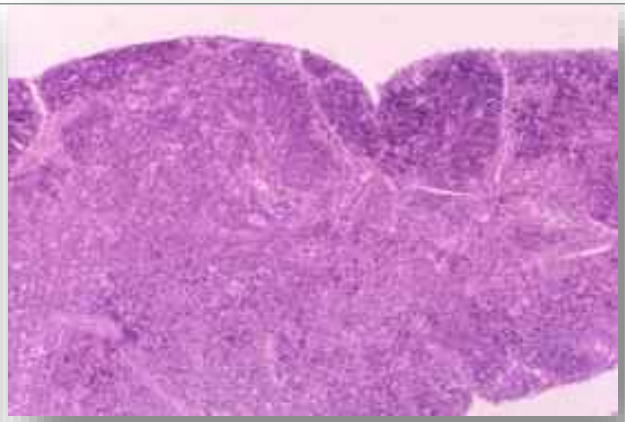
Histopathology
- Thymus lymphocyte depletion – severe

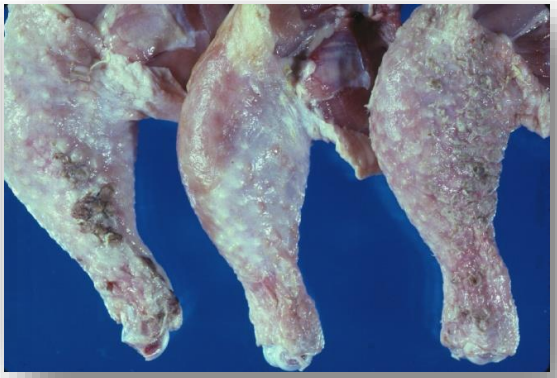
PCR
- Virus typing not essential
- Virus isolation difficult

Serology



Marek’s Disease





Marek' Disease: Broilers or Young Breeders & Layers

HISTORY AND EPIDEMIOLOGY

Age of birds affected

Date first observed

Breeder flock

Hatchery source

Farm history

NECROPSY

Examine multiple birds

Record the incidence and severity of lesions

Examine skin, viscera, and nerves

Broilers or Young Breeders & Layers

HISTOPATHOLOGY & FTA CARDS

Skin lesions with 1 cm margin

Nerves from each chicken,
- Vagus, brachial plexus, and sciatic
- Select enlarged nerves if possible

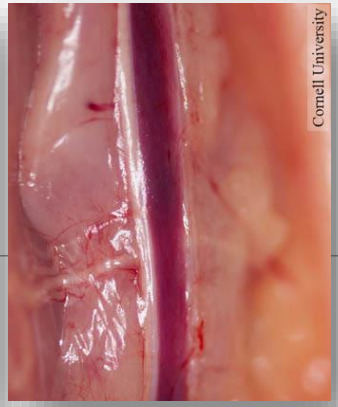
Tumors

One **eye** from each affected chicken

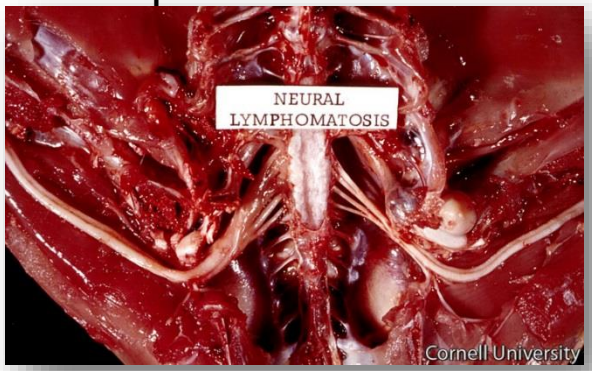
Spleen, liver, kidney, gonad, brain, and proventriculus from each chicken

FTA Cards for PCR
- Enlarged feather follicles and tumors

Vagus nerve



Pelvic plexus and sciatic



Hatch and First-Week Stress

Hatch
- Uneven hatch
- Excess time in hatcher
- Insufficient water loss during incubation
- Dehydration and energy depletion
- Chick processing
- Formalin
- Exhausted chick problems

Transport
- Time, temperature

Placement
- Physical handling, thermoneutrality, food and water

Immunosuppressive Mycotoxins

Aflatoxin

Trichothecenes (T-2, DAS, others)

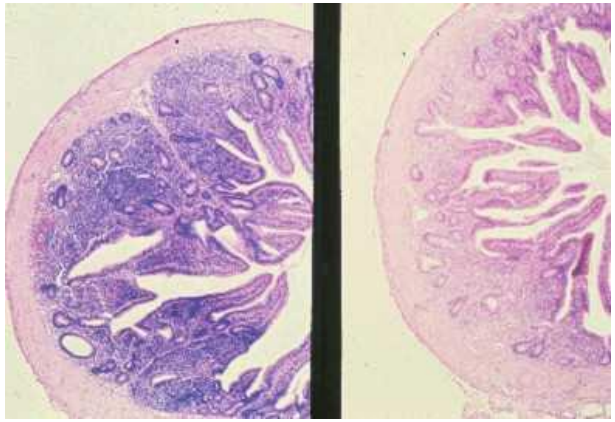
Fumonisins

Ochratoxin

Citrinin

Sterigmatocystin

Cyclopiazonic acid



T-2 Toxin- Depletion of Cecal Tonsil

Disease interactions: Coccidiosis, Marek's disease, Salmonellosis

Mycotoxin Diagnostic Challenge

Appropriate feed samples are required

Transient, intermittent presence in feed

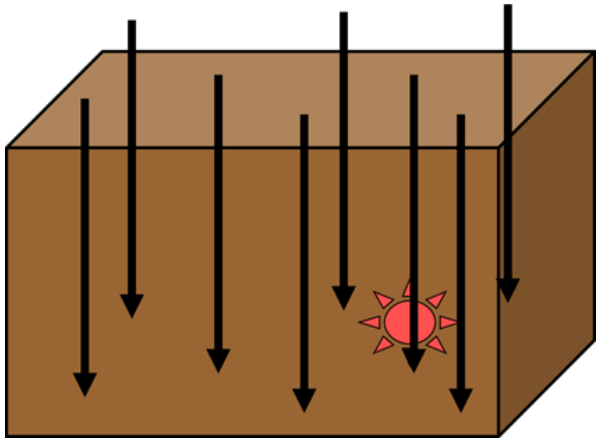
Limited laboratory capability for comprehensive testing

Chromatography

- HPLC, GC, GC-Mass Spectroscopy

Rapid immunodiagnostic tests for individual ingredients

- Feeds are more complex



Hot spot in feed.

Nutrition

Feeding a developing gut and the immune system

- First 20 days critical

Vitamin E

- Labile but essential to immune system

Disease places nutritional demand to support inflammation and tissue repair

- At expense of growth

Concurrent Disease Stress

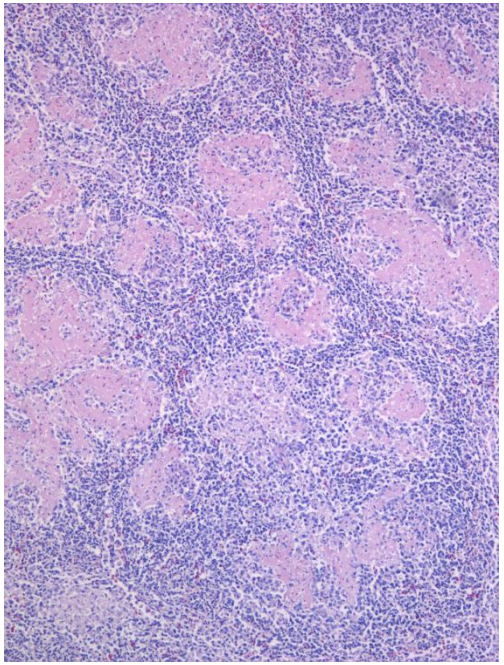
Interfere with economic expectations of Gumboro vaccine program

- Runting stunting syndrome
- Chicken anemia
- Transmissible viral proventriculitis
- Marek's disease

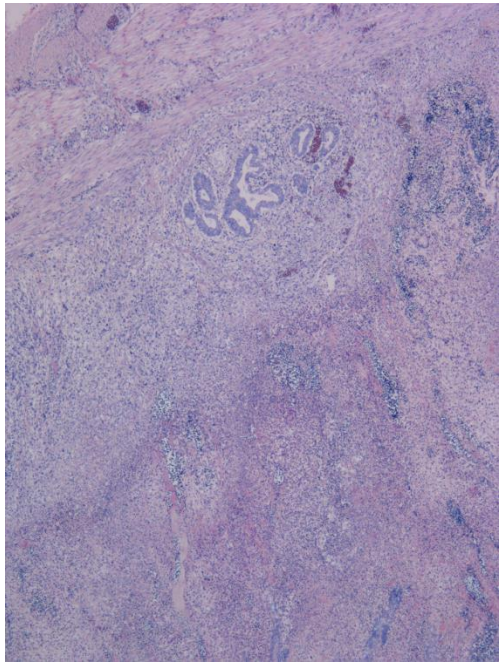
Acute infection may be immunosuppressive

- Reovirus
- Newcastle

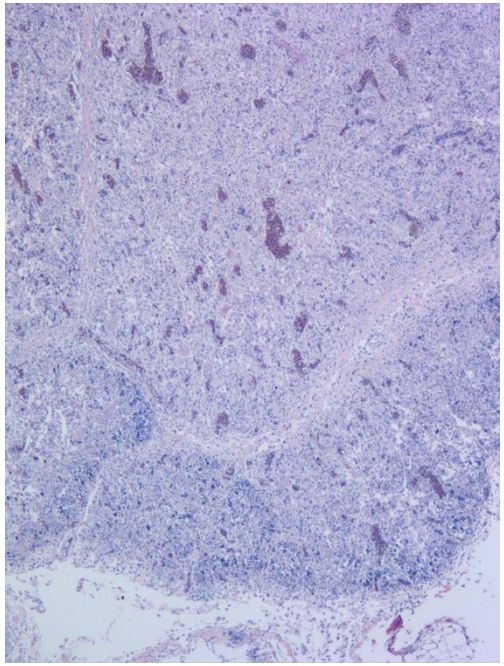
Newcastle Disease - Lymphocyte Necrosis and Depletion



Spleen



Cecal tonsil



Thymus

Monitoring Immunosuppression Direct

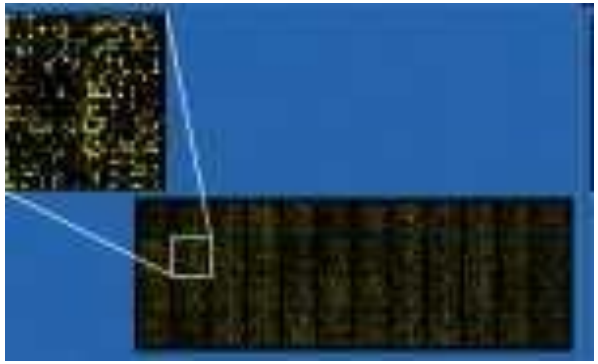
Heterophil-lymphocyte ratio – stress

Interleukin-2

Whole blood lymphocyte stimulation assay – T-cells

Blood monocytes functional responses

cDNA Microarrays of genes that control immunity and inflammation



Not Practical

Monitoring Immunosuppression - Indirect

Performance

Hatchery quality assurance

Record of clinical disease

Medication cost

Regular necropsy with lesion database

Serology

Histopathology

Agent detection and characterization

Practical Application

Consider immunosuppression aspects of management, nutrition, and disease

At necropsy, examine the **bursa and thymus** - standard procedure

Monitoring major immunosuppressive diseases and apply it consistently

- Bursa and thymus (Gumboro and Chicken infectious anemia)
- Intestine (viral enteritis)
- Spleen, nerve, eye (Marek's)
- Value of data collected over time

Determine how the information is used

Monitoring Gumboro Disease Program 2

Examine flocks at age intervals – depends on the program

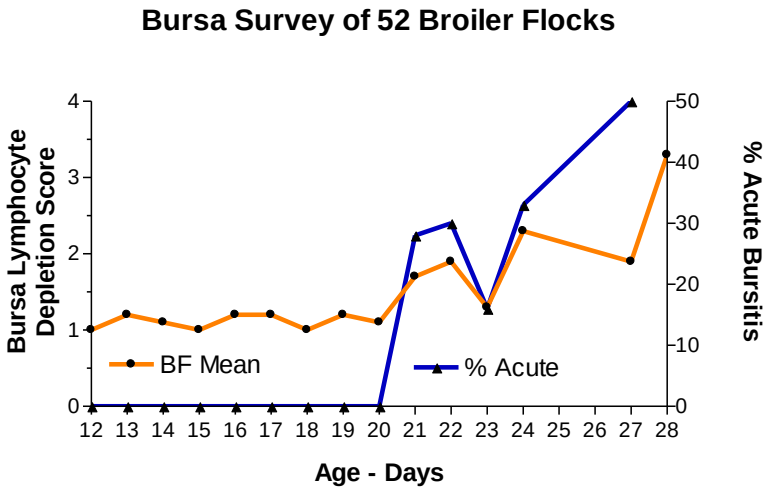
- 14, 21, 24/25, 28, 32, 35 days
- 18, 21, 25, 28, 32
- 21, 28, 35

Establish historical pattern

- Detect change in pattern
- Evaluate program changes

Bursa size

Histopathology - formalin



Freeze ½ bursa for virus isolation or molecular detection and characterization

Monitoring Gumboro Disease Program 2 - Modified

Additional immune system tissues for histopathology

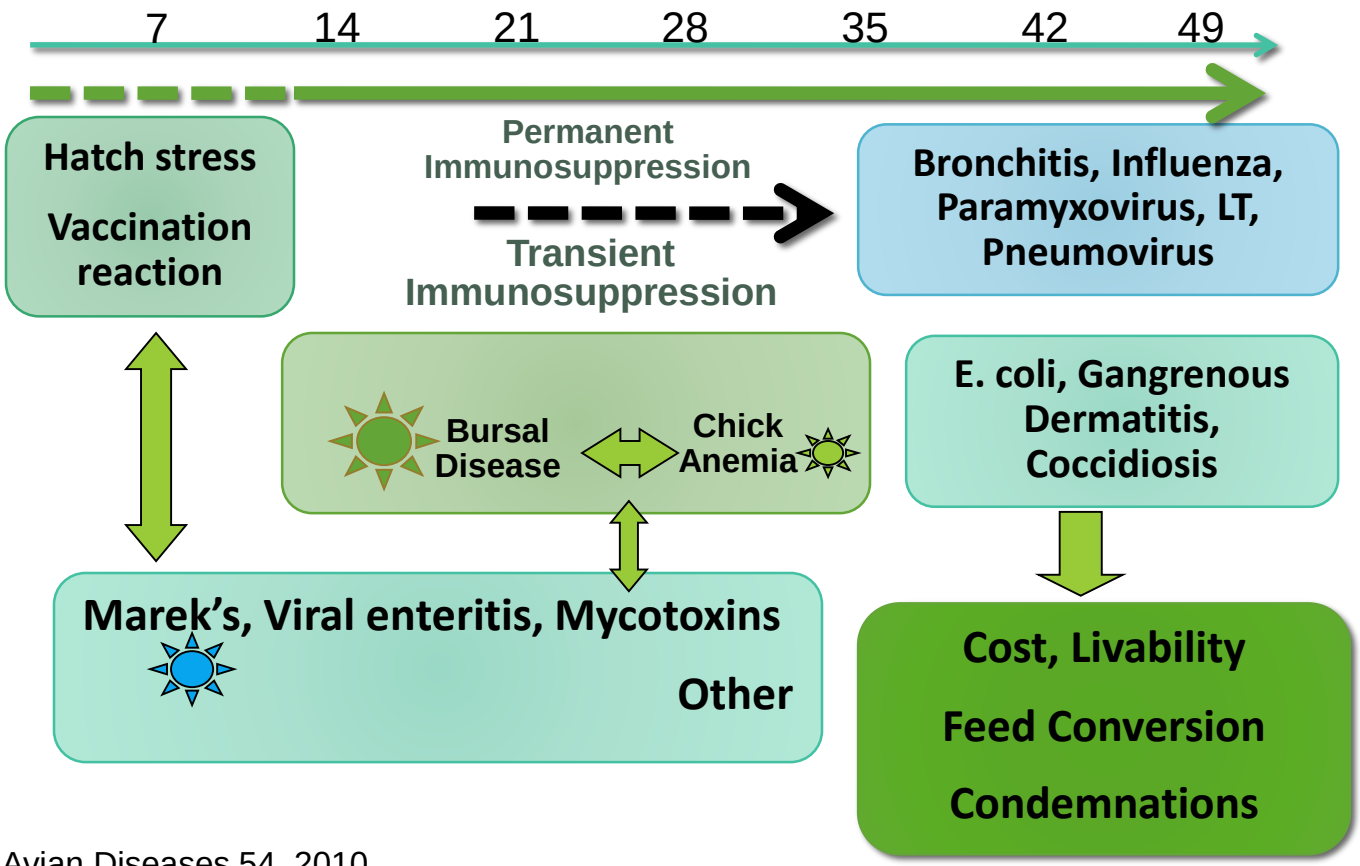
- Thymus, spleen

Other

- Liver
- Proventriculus, intestine
- Other depending on type of problem

Goal: identify chicken anemia, enteric virus, proventriculitis, nonspecific digestive conditions

Immunosuppressive Interactions in Broilers



Hoerr, Avian Diseases 54, 2010

Summary

Recognize the signs and syndromes immunosuppression

Highest priority immunosuppressive diseases

- Enteric viruses, ammonia, infectious bursal disease, chicken infectious anemia, Marek's disease

Also important

- Hatch, transportation, environmental stress; nutrition and mycotoxins; other disease stress

Monitor for immunosuppression and contributing factors

Thank You

fred.hoerr@gmail.com
www.vetdx.com

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