Current Topics In Broiler Pathology

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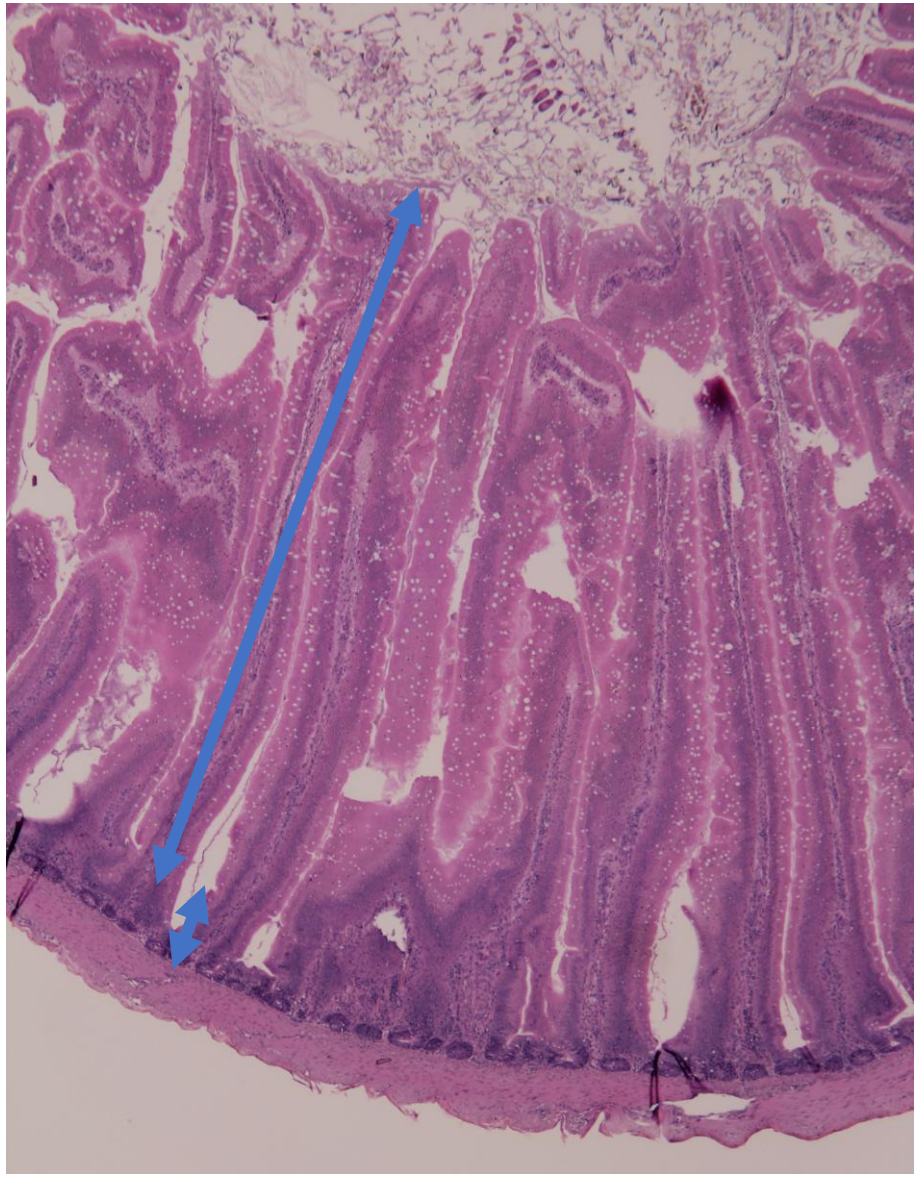
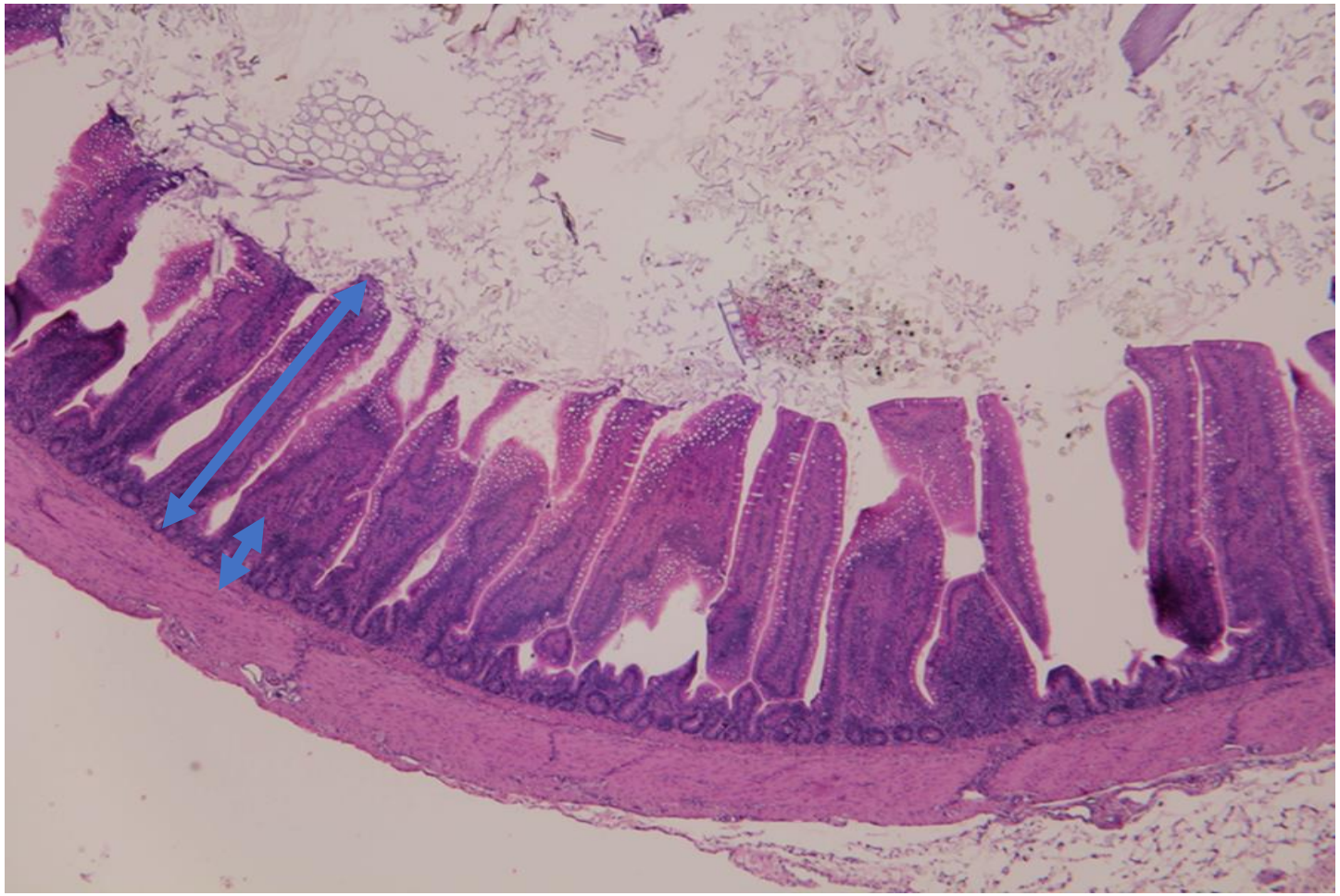
February 22, 2018

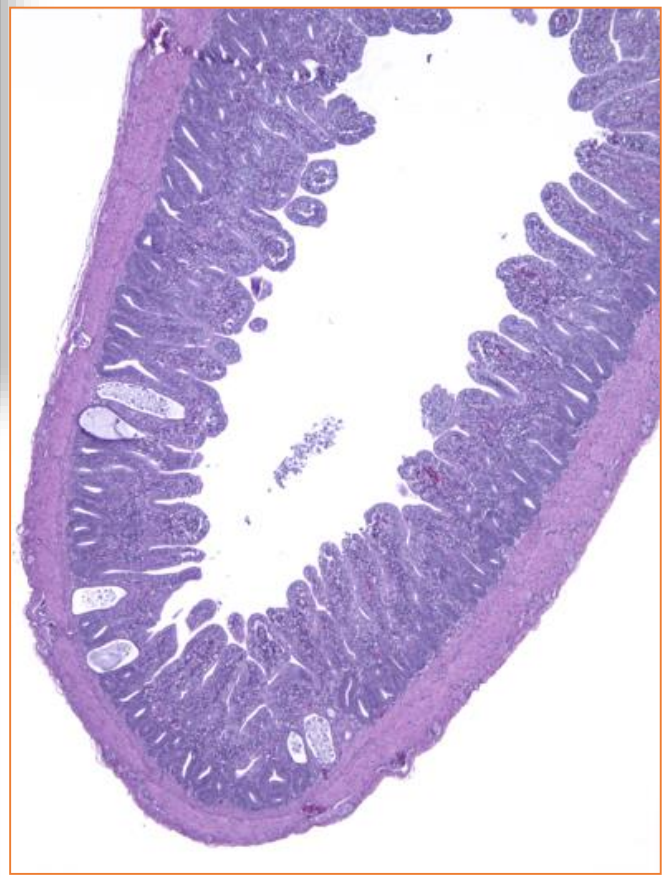
Normal duodenum and midgut

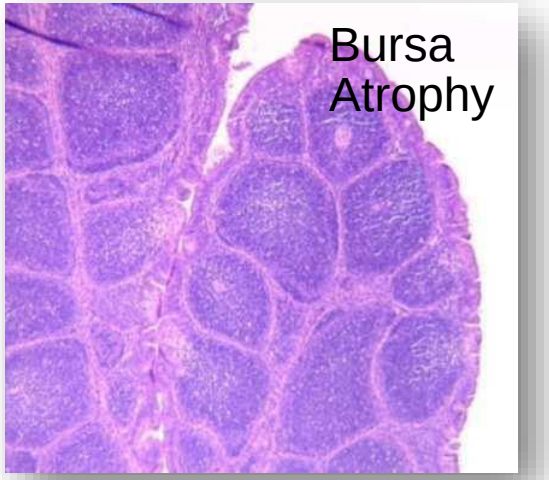


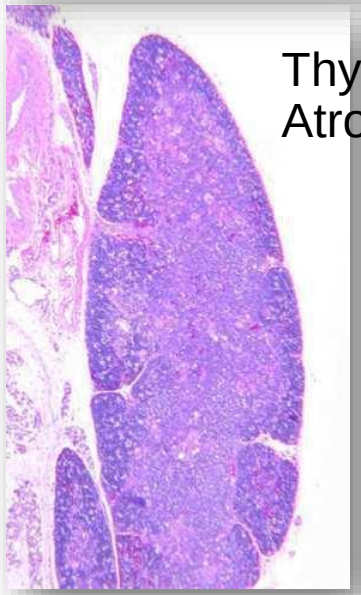


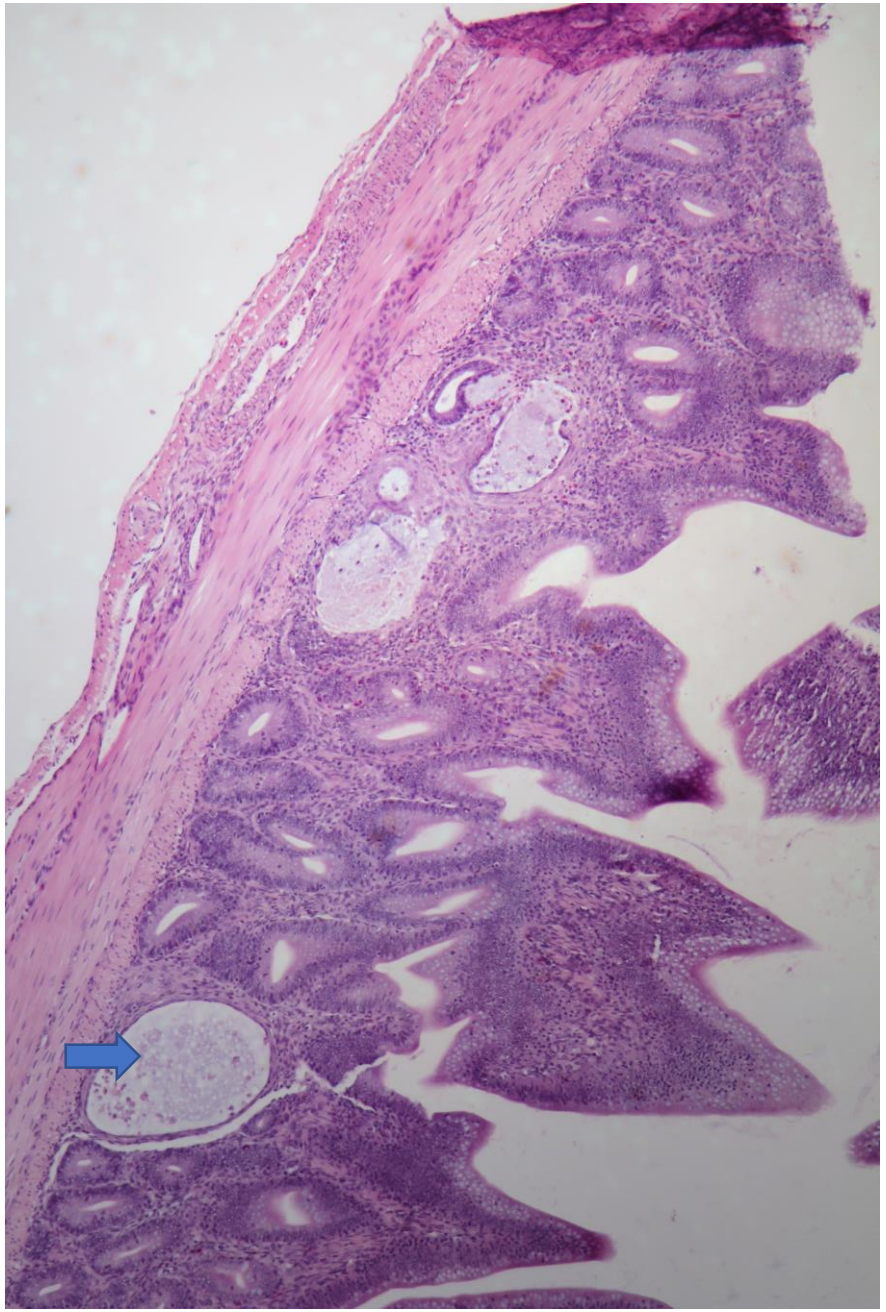
Broiler Viral Enteritis
“Runting Stunting Syndrome”

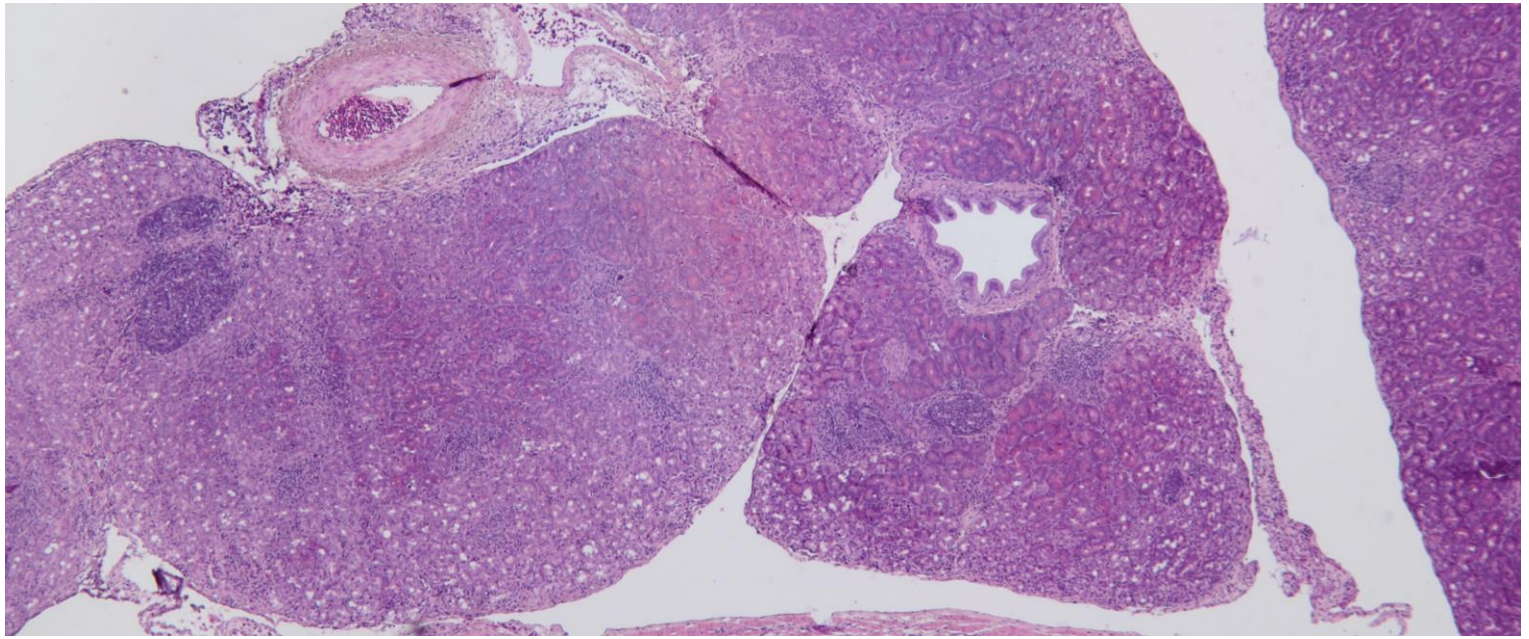
06.1029





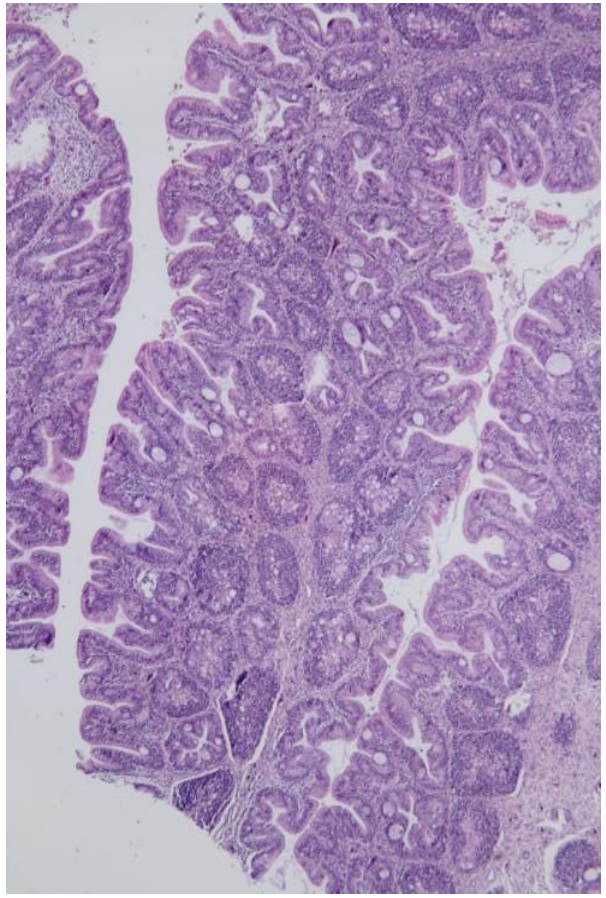


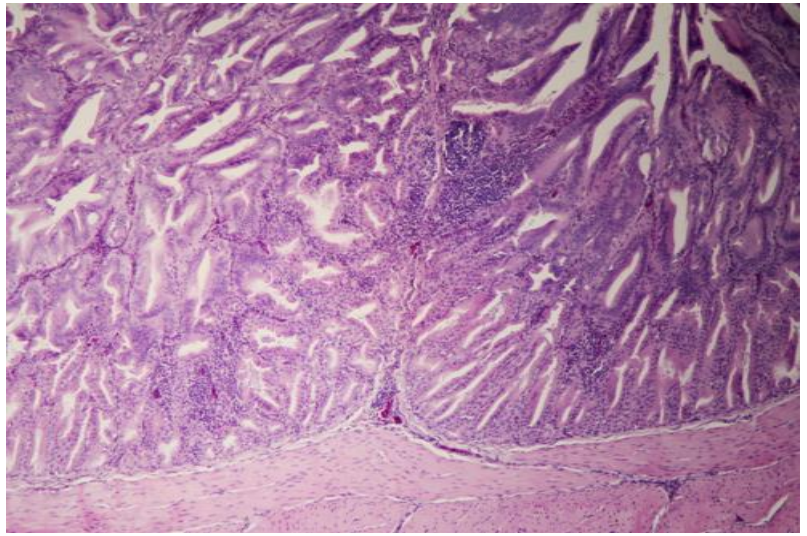


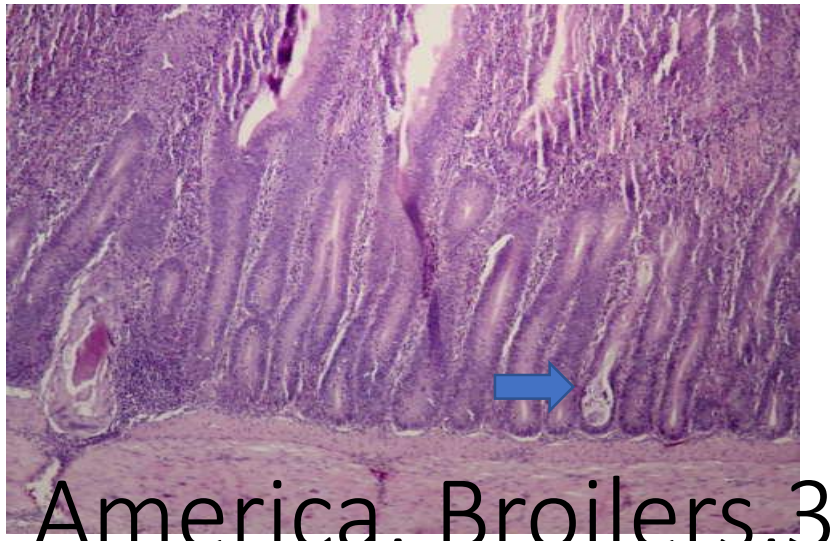


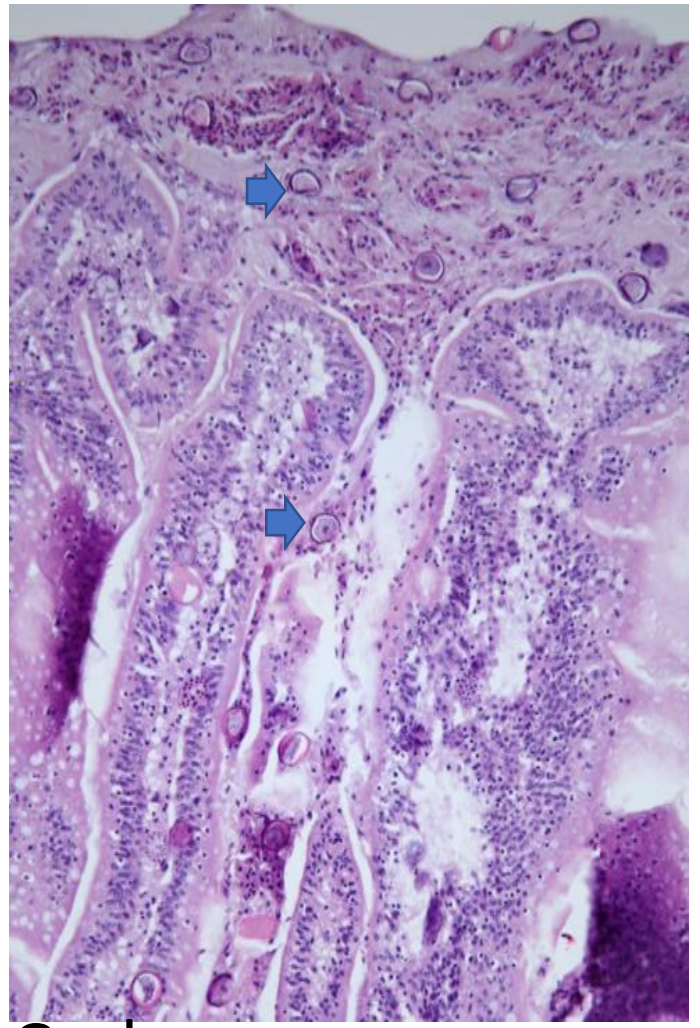
Central America, Broilers, 18 days, Viral Enteritis

Differential: astro, rota, reo, parvo, corona, others, confirmed by PCR



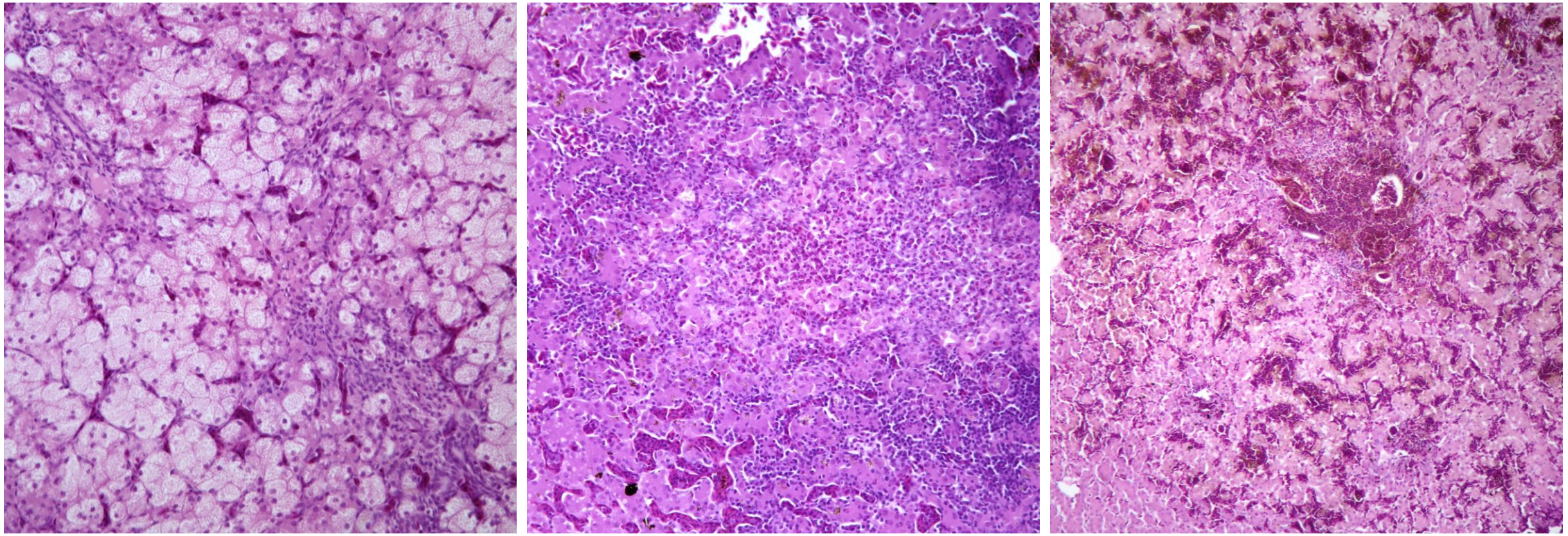






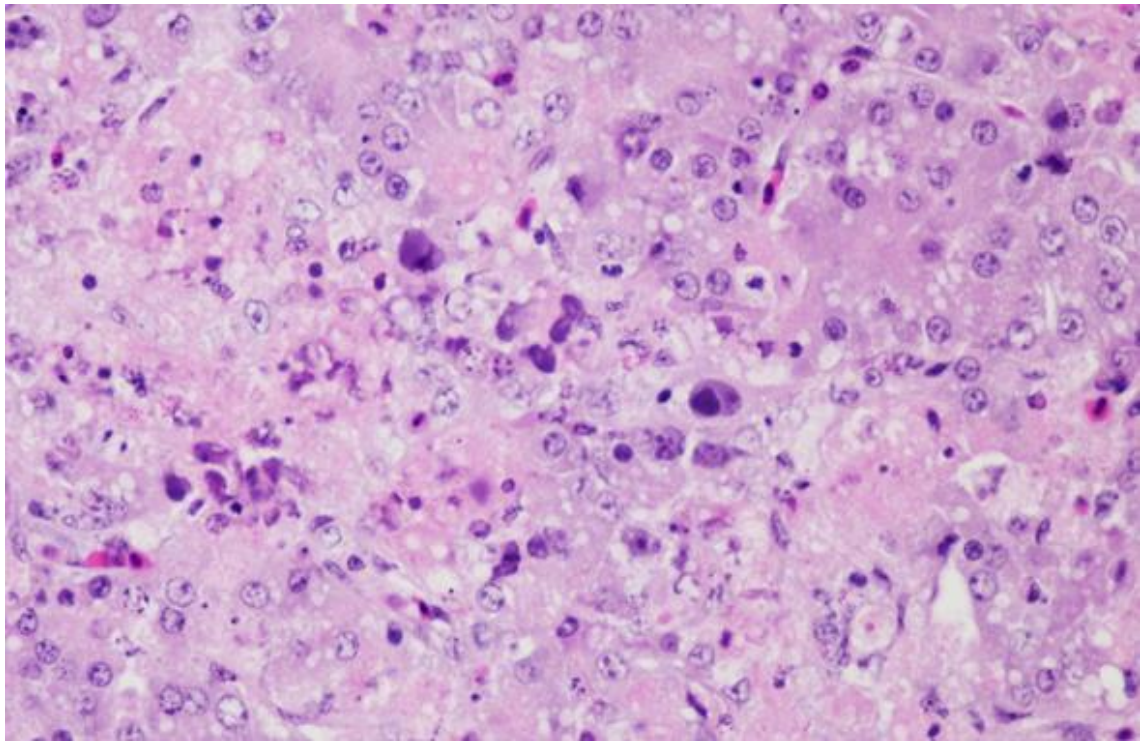
Central America, Broilers,30 days

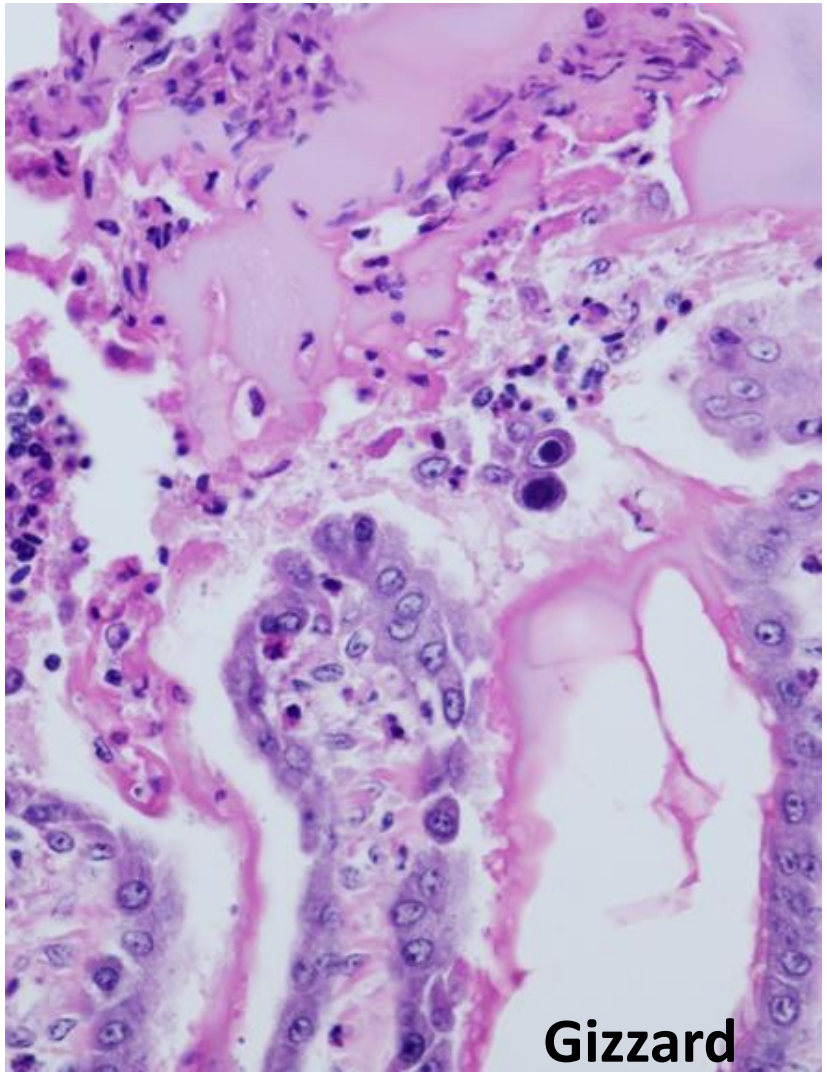
Sequelae to bursal disease, viral enteritis, acute transmissible viral proventriculitis, *Eimeria maxima*



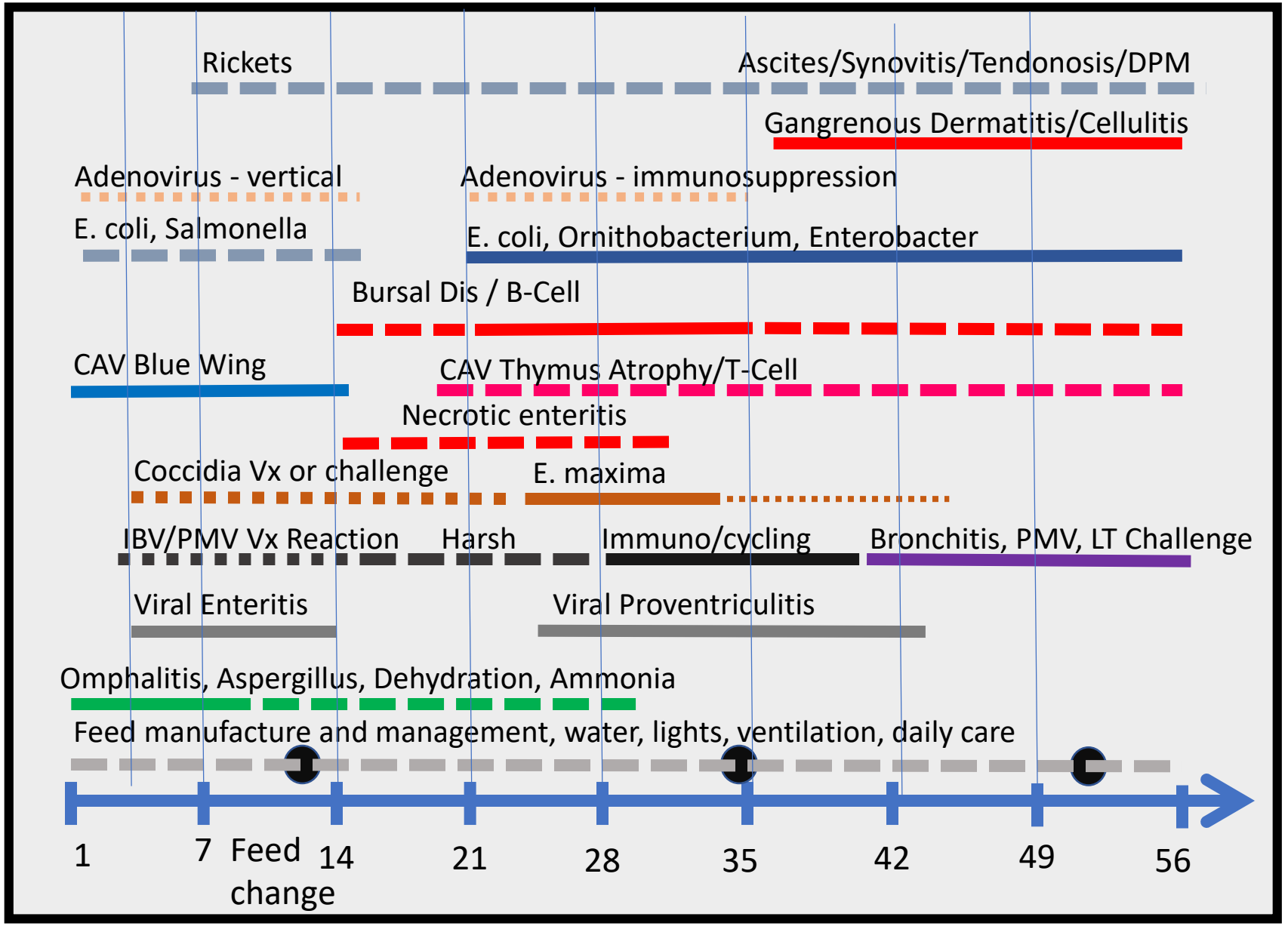
Central America, 12 Days, Broilers
Hepatotoxicity (possible mycotoxins)

Asia, broilers, 7 days; inclusion body hepatitis, adenovirus



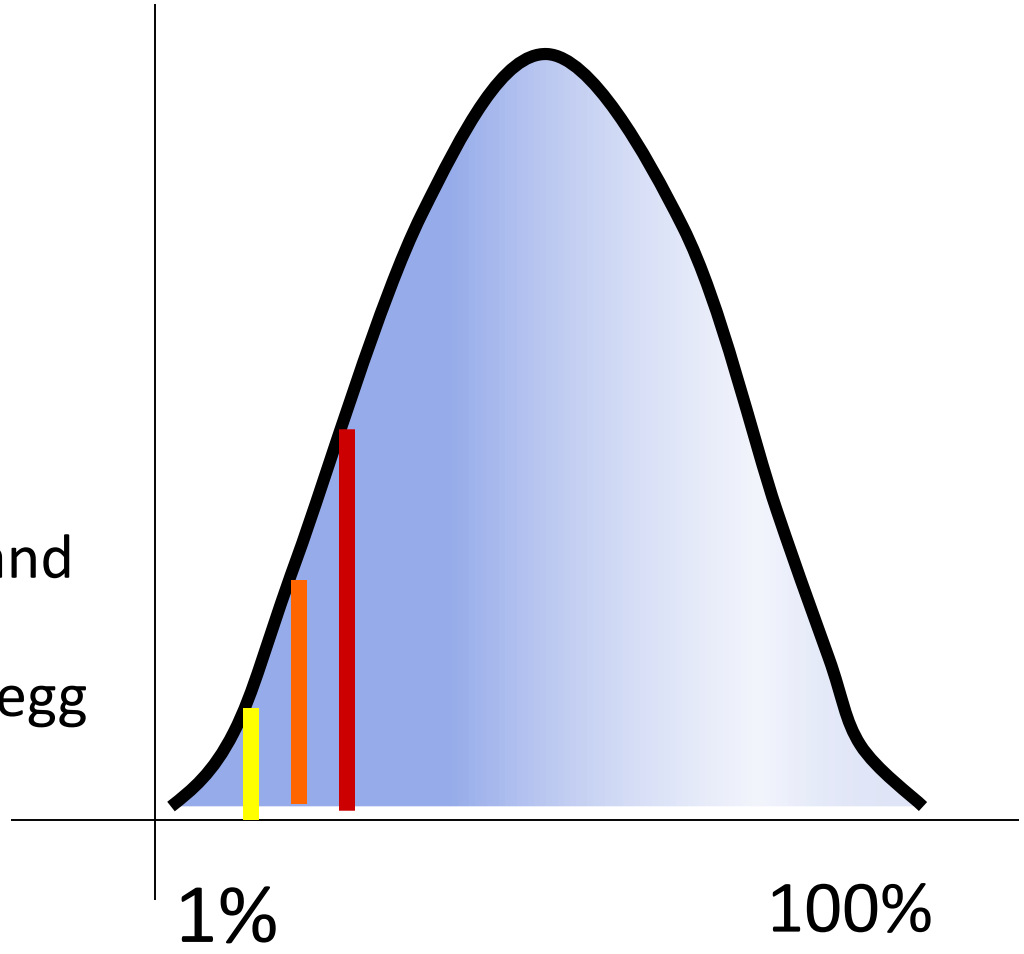


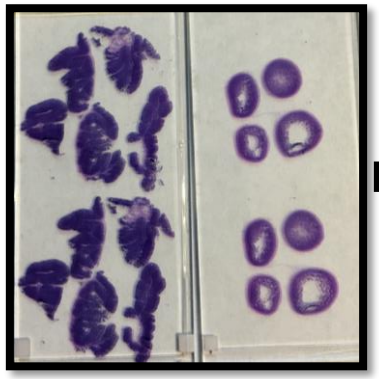
Anticipated Broiler Health Challenges by Age

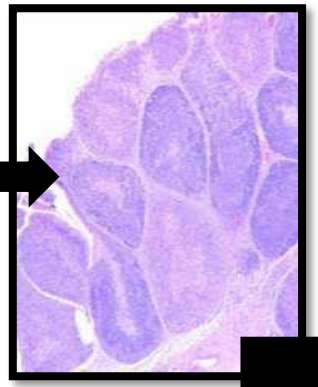


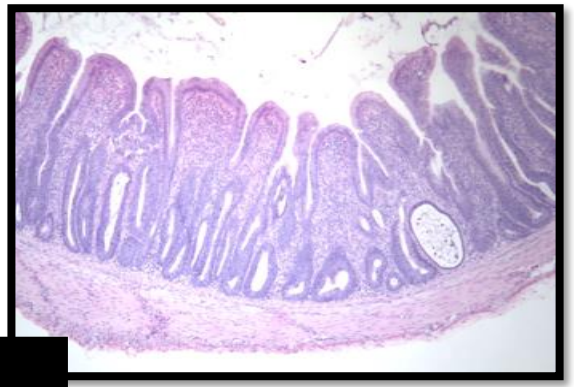
Poultry Diagnostics

- Traditional – Morbidity and Mortality
  - Diagnosis
  - Identification of major disease(s)
- Diagnostics integrated with production.
  - Disease erodes genetic potential and leads to nutrient wastage and partitioning away from growth or egg production
  - Onset, duration, and severity

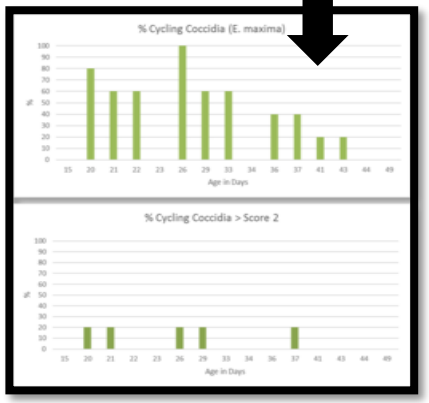


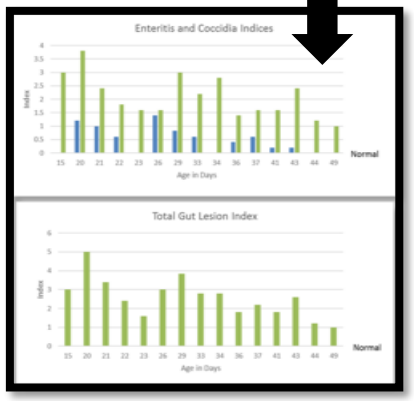






Organ	1	2	3	4	5	6	Mean	Comment	1	2	3	4	5	6	Mean	Comment	1	2	3	4	5	6	Mean	Comment	1	2	3	4	5	6	Mean	Comment	1	2	3	4	5	6	Mean	Comment
Bursa score	1	1	1	1	1		1		1	1	1	1	1		1		1	1	1	1	1		1		4	4	4	4	3.5		3.9	Acute	1	1	1	1	1		1	
Mid Intestine																		m		m	m																			
Coccidia	1	1	1	1			1		2	4	2	1	2		2.2		1	4	1	2	2		2		1	2	2	1	2		1.6		1	1	1	1	1		1	
Villus atr	1	1	1	1			1		1	3	1	2	1		1.6		1	3	1	1	1		1.4		1	2	1	1	1		1.2		1	1	1	1	2		1.2	
Crypt HP	2	2	2	2			2		3	3	2	3	2		2.6		2	2	1	2	2		1.8		2	1	1	2	1		1.4		1	2	1	1	2		1.4	
LP/GALT	1	1	1	1			1		1	1	1	2	1		1.2		1	1	1	1	1		1		2	1	1	1	1		1.2		1	1	1	1	1		1	
Bacteria/dysbact	1	1	1	1			1		1	1	1	1	1		1		2	1	1	1	1		1.2		1	1	1	1	1		1		1	1	1	1	1		1	
cysts	1	3	2	1			1.75		1	1	1	3	1		1.4		1	1	1	1	1		1		1	1	1	1	1		1		1	1	1	1	1		1	
other	2	2	2	3			2.25		2	2	2	2	2		2		2	2	2	2	2		2		2	2	2	2	2		2		2	2	2	2	2		2	
Bursa mean score							1								1								1								3.9								1	
Coccidia Index							0								1.2								1								0.6								0	
Enteritis Index							3								3.8								2.4								1.8								1.6	
Total Gut Lesion Index							3								5								3.4								2.4								1.6	





Basic Methodology of Toxicologic Pathology

Viral enteritis to 30+ days with 5 species of coccidia challenge; dysbacteriosis

- Broilers 15 to 34 days – Bursa, duodenum, pancreas, midgut, cecum

Broilers 15 to 34 days – Bursa, Duodenum, pancreas, midgut, cecum

Organ	1	2	3	4	5	Mean	Comment	1	2	3	4	5	Mean	Comment	1	2	3	4	5	Mean	Comment	1	2	3	4	5	Mean	Comment	1	2	3	4	5	Mean	Comment	1	2	3	4	5	Mean	Comment
Bursa score	1	1	1	1		1		1	1	1	1	1	1		4	4	4	4	4	4	acute	1	1	1	1	1	1		1	1	1	1	1	1		1	4	1	1	4	2.2	cryptosporidium	1	1	1	1	1	1	
Mid Intestine			a	a						a								a	a			b																					a		a	?	a		
Coccidia	1	2	2	3	1	1.8		1	1	2	1	1	1.2		1	1	1	2	2	1.4		2	1	1	1	1	1.2		1	1	1	1	1	1		1	1	1	1	1	1		2	3	2	2		2.25	
Villus atr	1	1	1	1	1	1		1	1	1	1	1	1		1	1	1	1	1	1		1	1	1	1	1	1		1	1	1	1	1	1		1	1	1	1	1	1		1	1	1	1		1	
Crypt HP	2	2	2	2	2	2		1	2	1	2	2	1.6		2	2	2	2	2	2		1	1	1	2	1	1.2		1	2	1	1	1	1.2		3	2	2	3	3	2.6		2	2	2	3		2.25	
LP/GALT	1	2	2	1	1	1.4		1	1	2	1	2	1.4		2	1	1	1	1	1.2		1	1	1	1	1	1		2	2	1	1	1	1.4		2	1	1	2	1	1.4		2	1	2	1		1.5	
Bacteria/dysbact	1	1	2	1	1	1.2		1	1	1	1	1	1		1	1	1	1	1	1		1	1	1	1	1	1		1	1	3	1	1	1.4		1	1	3	2	1	1.4		1	1	1	1		1	
cysts	1	1	1	1	3	1.4		1	1	2	1	2	1.4		1	2	1	2	1	1.4		1	1	1	1	1	1		2	4	1	1	1	1.8		3	1	3	2	1	2		1	1	1	1		1	
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Pancreas																																																	
Lymphocytic HP	1	1	1	1	1	1		1	1	1	1	1	1		1	1	1	2	1	1.2		1	1	1	1	1	1		1	1	1	1	2	1.2		1	1	1	1	1	1		2	1	1	4		2	
Other	1	1	1	1	1	1		1	1	1	1	1	1		1	1	1	1	1	1		1	1	1	1	1	1		1	1	1	1	1	1		1	1	1	1	1	1		1	1	1	1		1	
Mid Intestine	m		m	m		m									m			m	m				m											m								m	m		m	m		
Coccidia	3	2	4	4		3.25		2	4	2	2	1	2.2		2	1	2	3	2	2		1	2	1	1	1	1.2		1	1	1	1	1	1		1	1	1	1	2	1.2		2	2	1	2	2	1.8	
Villus atr	1	1	2	3		1.75		2	2	1	2	2	1.8		1	1	2	3	2	1.8		1	1	2	1	1	1.2		2	1	2	1	1	1.4		2	1	2	1	2	1.6		1	1	2	2	1	1.4	
Crypt HP	2	2	3	3		2.5		2	2	3	2	2	2.2		2	3	2	2	2	2.2		3	1	1	3	2	2		1	1	1	1	1	1		2	2	2	1	2	1.8		3	3	1	2	1	2	
LP/GALT	1	2	2	2		1.75		2	2	1	1	11	3.4		1	1	1	1	1	1		1	1	1	1	1	1		2	2	2	2	2	2		1	1	1	2	1	1.2		1	1	1	2	1	1.2	
Bacteria/dysbact	1	1	3	1		1.5		2	1	1	1	1	1.2		1	1	1	1	1	1		1	1	1	1	1	1		1	1	1	2	1	1.2		1	1	1	1	1	1		1	1	1	1	1	1	
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Cecum																						1																									
Coccidia	1	1	1	1		1		1	1	1	1	1	1		1	1	1	1	1	1		1	1	1	1	1	1		1	1	1	1		1		1	1	1	1	1	1		1	1	1	1	1	1	
LP/GALT	1	1	1	1		1		1	1	1	2	1	1.2		1	1	1	1	1	1		1	1	1	1	1	1		1	1	1	1		1		1	2	1	1		1.25		1	1	1	1	1	1	
Bacteria/dysbact	1	1	1	1		1		2	2	2	1	1	1.6		2	1	2	1	2	1.6		1	1	2	2	2	1.6		1	1	1	1		1		1	1	2	2		1.5		2	1	1	2	1	1.4	
Other	1	2	1	1		1.25		1	2	2	1	2	1.6		2	1	2	2	3	2		2	1	2	2	1	1.6		1	1	2	1		1.25		3	2	2	3		2.5		3	1	2	2	2	2	

Slides	4							4							4							4							4							4						
Organ	1	2	3	4	5	Mean	Comment	1	2	3	4	5	Mean	Comment	1	2	3	4	5	Mean	Comment	1	2	3	4	5	Mean	Comment	1	2	3	4	5	6	Mean	Comment
Bursa score	1	4	3.5	3.5		3	acute & recovery; cryptosporidium	1	4	1	1	2	1.8	acute	3.5	3.5	3.5	4		3.625	acute & recovery	3	3	3.5	3	3.5	3.2	recovery	3	3	3	3	2.5	2.9	recovery	3.5	3.5	3	3.5			3.375	recovery
Mid Intestine	a	a	a,b	a	a			b	a		a	a,b			b		a						b	b		b	b			a,b		b	a					b	b			
Coccidia	3	2	2	2	2	2.2		2	2	1	2	2	1.8		2	1	2	1		1.5		1	2	2	2	2	1.8		2	1	2	2	1	1.6		1	1	1	2	2		1.4	
Villus atr	1	1	1	1	1	1		1	1	1	1	1	1		1	1	2	1		1.25		1	1	1	1	1	1		1	1	1	1	1	1		1	1	1	1	1		1	
Crypt HP	3	2	2	3	2	2.4		1	1	2	1	3	1.6		2	2	3	2		2.25		1	1	2	2	1	1.4		2	3	2	2	2	2.2		2	3	3	2	2		2.4	
LP/GALT	2	2	2	1	2	1.8		2	1	1	1	1	1.2		1	2	1	1		1.25		1	2	1	2	2	1.6		1	2	1	1	1	1.2		1	2	1	1	1		1.2	
Bacteria/dysbact	1	1	1	1	1	1		1	1	1	1	1	1		1	1	1	1		1		1	1	1	1	1	1		1	1	1	2	1	1.2		1	1	1	1	1		1	
cysts	1	1	2	2	2	1.6		2	1	1	1	3	1.6		1	2	2	1		1.5		1	1	2	2	1	1.4		1	3	2	1	1	1.6		1	1	1	1	1		1	
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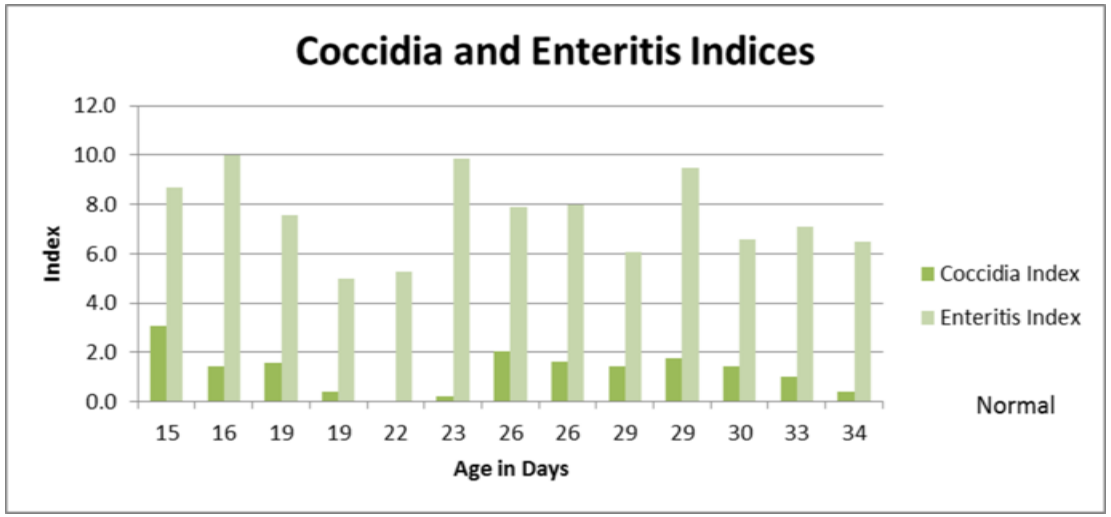
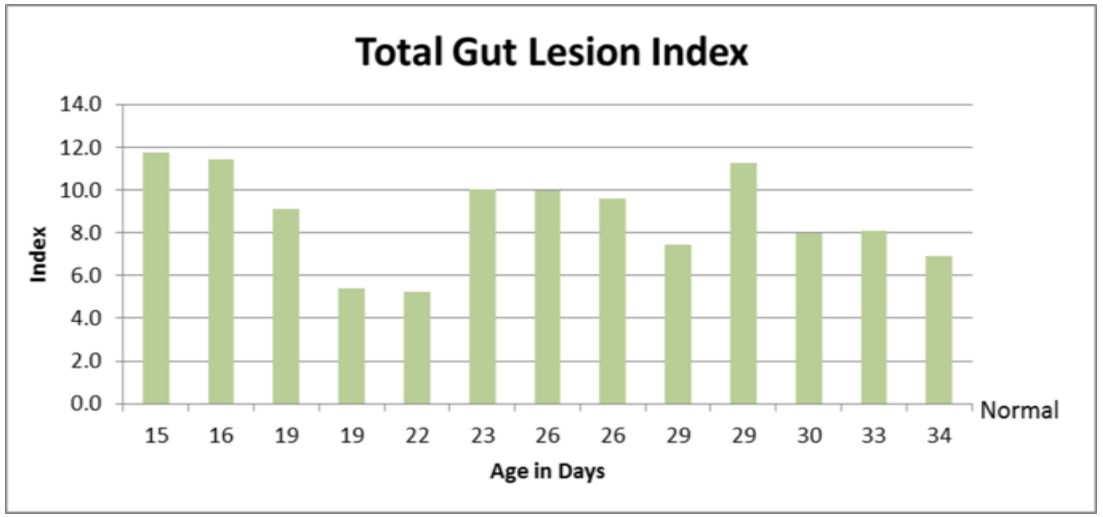
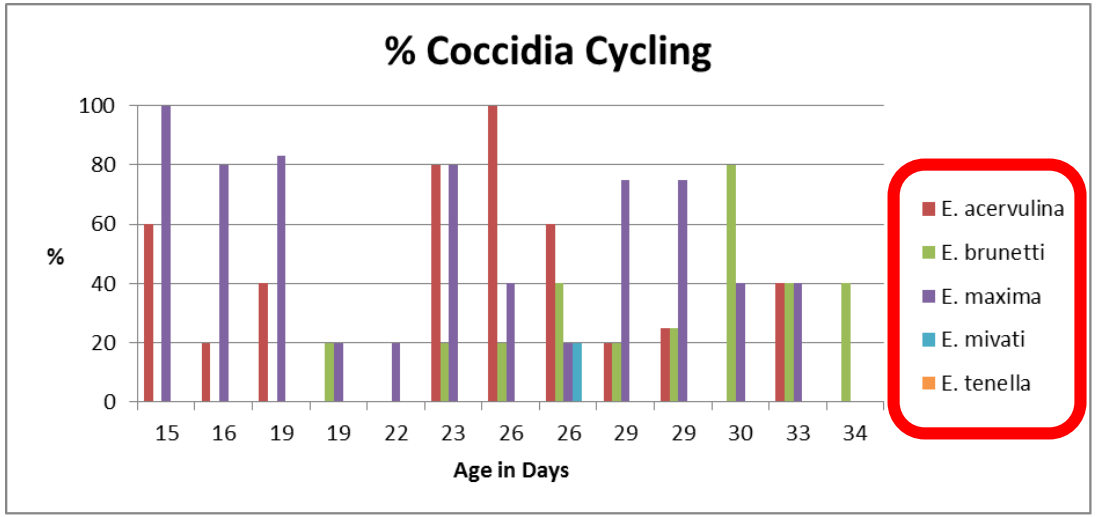
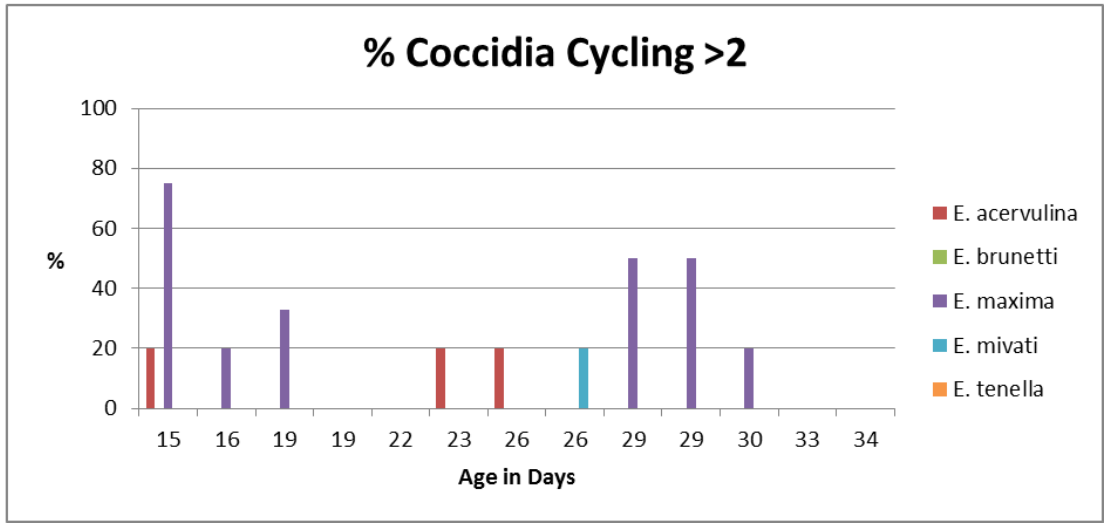
Pancreas																																											
Lymphocytic HP	1	1	1	1	1	1		2	2	1			1.6667		1	4	4	1		2.5		1	1				1		1	2				1.5		1	1	1	1	1	1	1	
Other	1	1	1	1	1	1		1	1	1			1		1	1	1	1		1		1	1				1		1	1				1		1	1	1	1	1	1	1	
Mid Intestine	m	m							mi		m				m	m	m					m				m						m	m										
Coccidia	2	2	1	1	1	1.4		1	3	1	1	2	1.6		2	3	3	1		2.25		3	1	1	1	2	1.6		1	2	1	2	1	1.4		1	1	1	1	1		1	
Villus atr	1	2	1	1	1	1.2		1	1	1	1	1	1		1	2	1	1		1.25		1	2	1	1	2	1.4		1	1	1	1	1	1		1	1	1	1	1		1	
Crypt HP	2	2	2	2		2		1	1	2	2	2	1.6		3	2	3	3		2.75		2	3	2	1	2	2		1	1	2	1	2	1.4		1	2	1	3	2		1.8	
LP/GALT	2	2	2	1	1	1.6		1	1	1	1	2	1.2		1	2	1	2		1.5		1	1	1	1	1	1		1	1	2	1	2	1.4		2	1	1	1	1		1.2	
Bacteria/dysbact	1	1	2	1	1	1.2		1	1	1	1	1	1		2	1	1	1		1.25		1	3	1	1	1	1.4		1	2	1	1	1	1.2		1	1	1	1	1		1	
cysts	1	2	1	1	1	1.2		1	1	1	1	1	1		1	1	1	2		1.25		1	1	1	1	1	1		1	1	1	1	1	1		1	1	1	1	1		1	
other	2	1	2	2	2	1.8		2	2	2	2	2	2		2	2	2	2		2		2	2	2	2	2	2		2	2	3	2	2	2.2		3	2	2	2	2		2.2	
Cecum																																											
Coccidia	1	1	1	1	1	1		1	1	1	1	1	1		1	1				1		1	1	1	1		1		1	1						1						1	
LP/GALT	2	2	1	1	1	1.4		1	1	1	1	1	1		2	1				1.5		2	1	1	1	1	1.2		2	1	1	2		1.5		2	1					1.5	
Bacteria/dysbact	1	1	1	1	1	1		2	2	2	1	2	1.8		1	1				1		1	1	2	1	2	1.4		1	2	1	1		1.25		2	1					1.5	
Other	2	1	2	1	2	1.6		2	2	1	1	2	1.6		1	1				1		2	2	2	1	1	1.6		1	1	2			1.25		2	1					1.5	

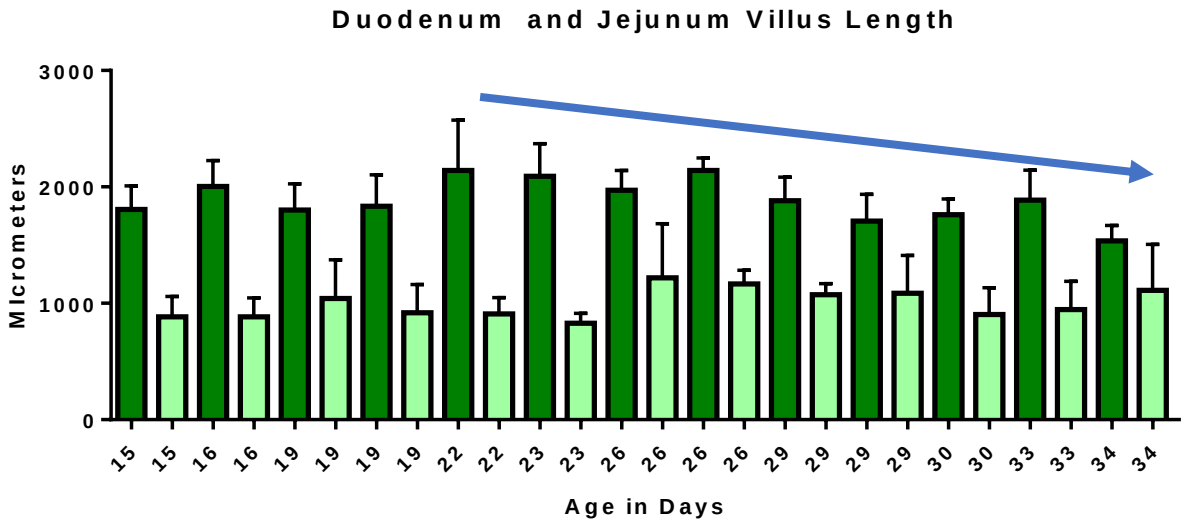
Veterinary Diagnostic Laboratory, LLC

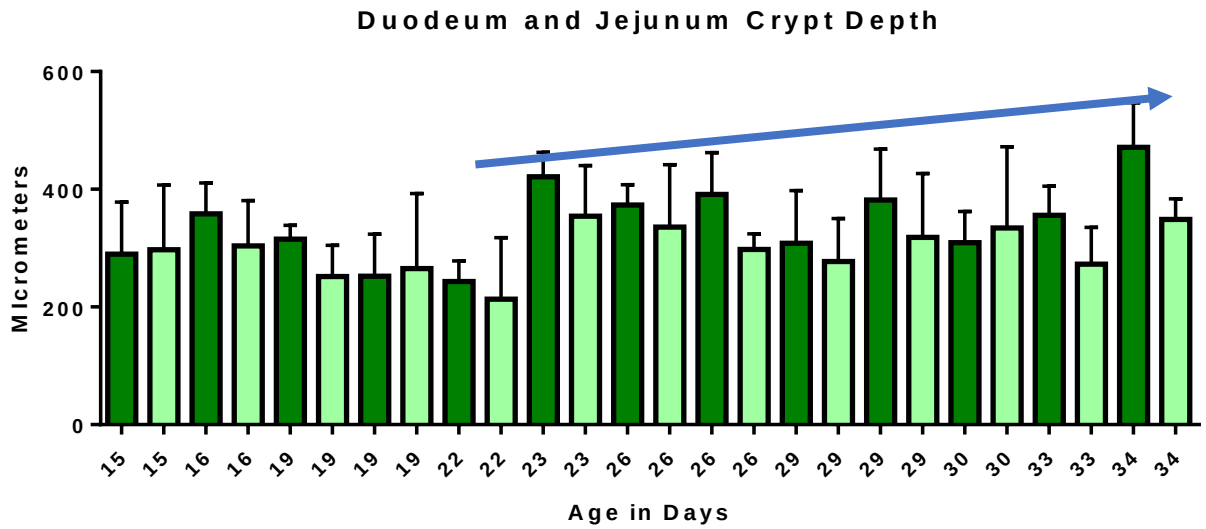

Coccidia and Enteritis Indices
Index
12.0
10.0
8.0
6.0
4.0
2.0
0.0
15 16 19 19 22 23 26 26 29 29 30 33 34
Age in Days
Coccidia Index
Enteritis Index
Normal

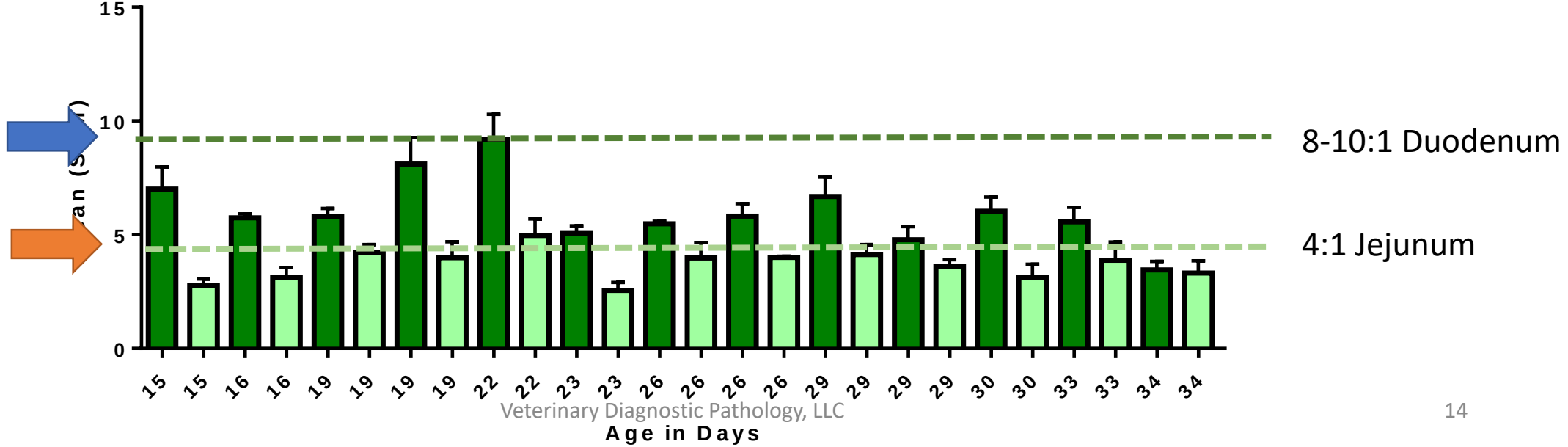

Total Gut Lesion Index
Index
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
15 16 19 19 22 23 26 26 29 29 30 33 34
Age in Days
Normal


% Coccidia Cycling
%
100
80
60
40
20
0
15 16 19 19 22 23 26 26 29 29 30 33 34
Age in Days
E. acervulina
E. brunetti
E. maxima
E. mivati
E. tenella


% Coccidia Cycling >2
%
100
80
60
40
20
0
15 16 19 19 22 23 26 26 29 29 30 33 34
Age in Days
E. acervulina
E. brunetti
E. maxima
E. mivati
E. tenella


Duodenum and Jejunum Villus Length
Micrometers
3000
2000
1000
0
15 15 16 16 19 19 19 19 22 22 23 23 26 26 26 26 29 29 29 29 30 30 33 33 34 34
Age in Days


Duodeum and Jejunum Crypt Depth
Micrometers
600
400
200
0
15 15 16 16 19 19 19 19 22 22 23 23 26 26 26 26 29 29 29 29 30 30 33 33 34 34
Age in Days


Duodenum and Jejunum V:C Ratio
15
10
5
0
15 15 16 16 19 19 19 19 22 22 23 23 26 26 26 26 29 29 29 29 30 30 33 33 34 34
Age in Days
8-10:1 Duodenum
4:1 Jejunum

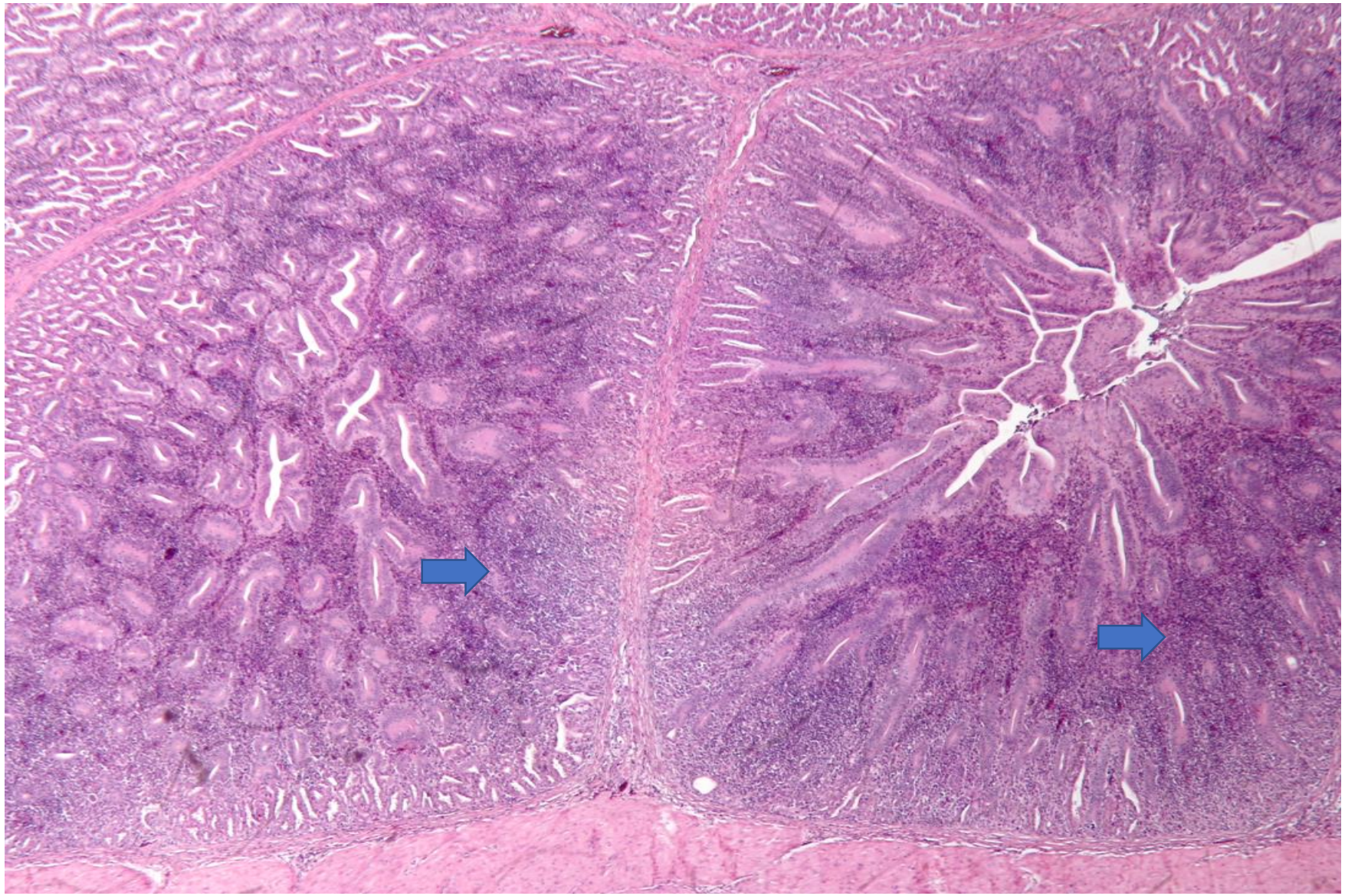
Recent field study, 9, 20, 30, 53 days of age, possibly 4 treatments (unknown),

Gut, proventriculus and immune system examined

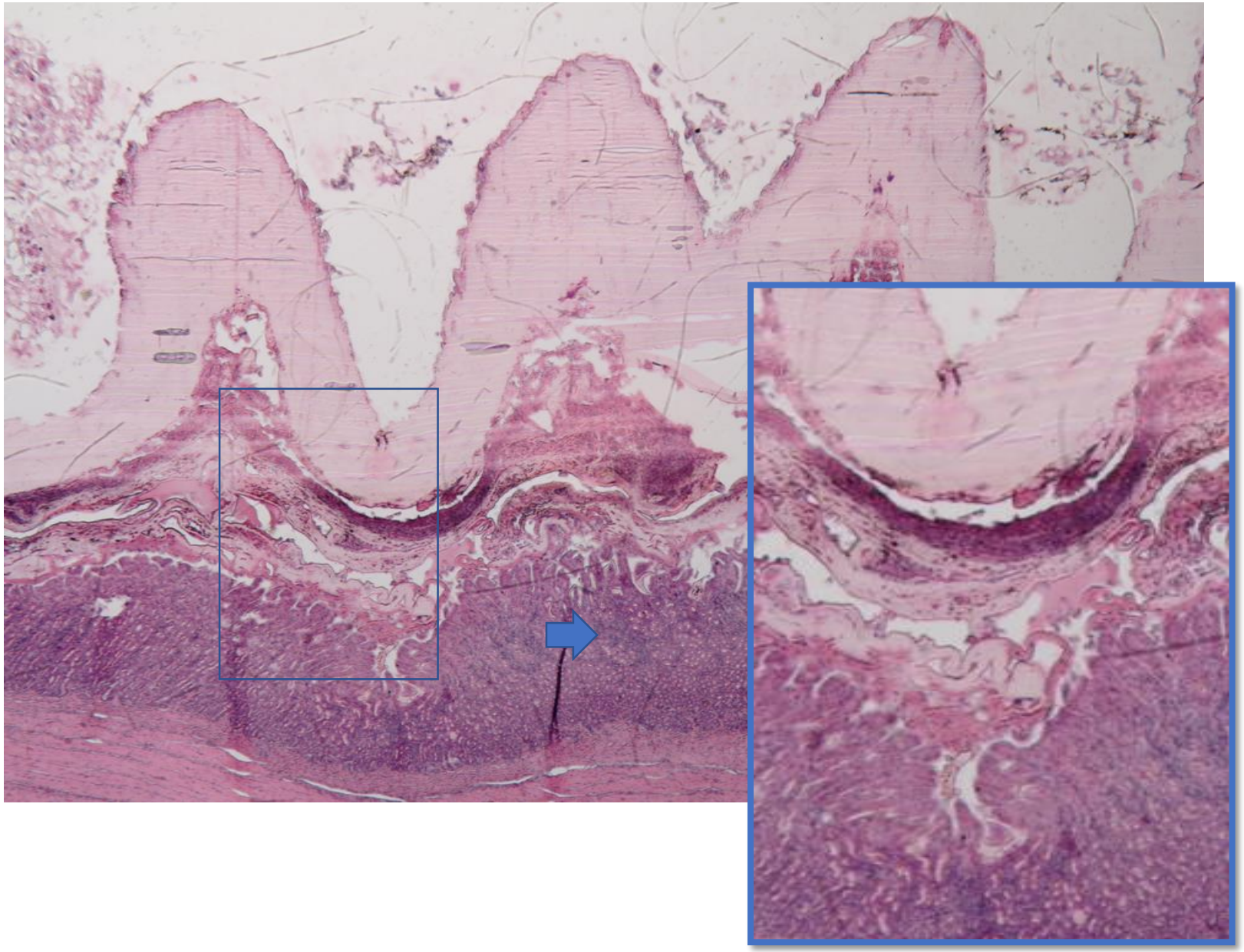
9 days, middle small intestine. The intestine has a subacute enteritis characterized by cystic dilated crypts (arrow) and mild crypt hyperplasia. Villus fixation is suboptimal for assessment.

30 days, proventriculus. The proventriculus glands have multifocal to confluent lymphohistiocytic inflammation (arrows) consistent with transmissible viral proventriculitis.

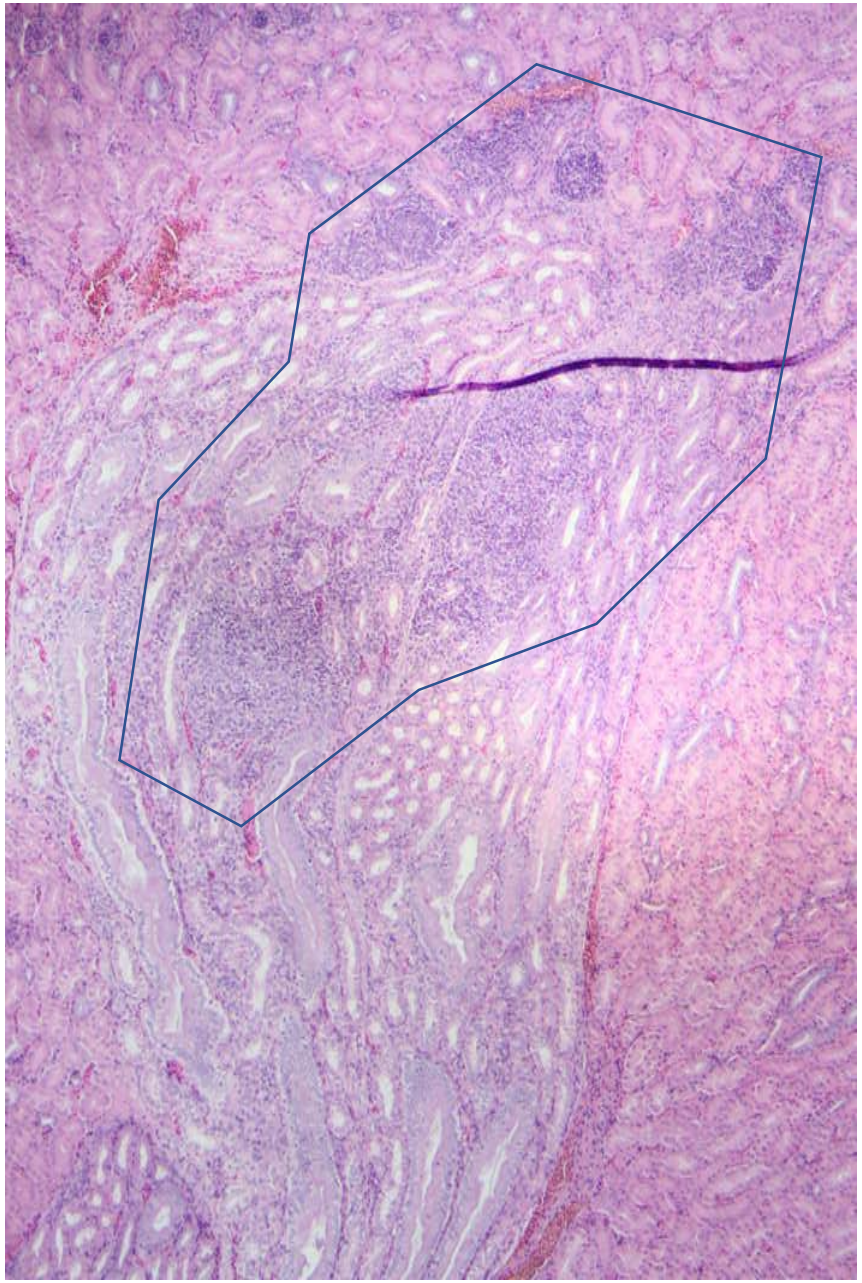
53 days, proventriculus. The proventriculus glands have severe lymphohistiocytic adenitis, consistent with transmissible viral proventriculitis.



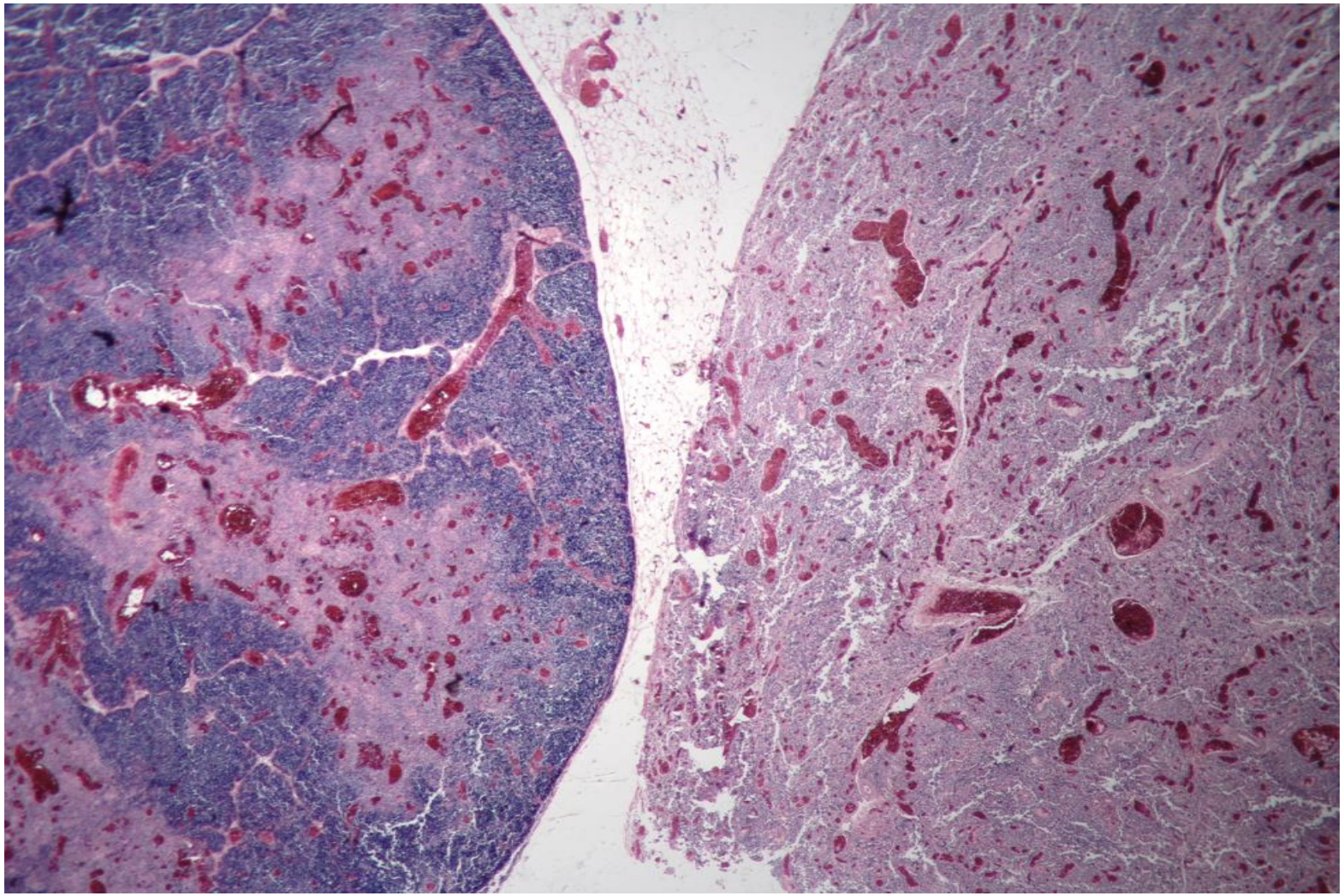
The gizzard has multifocal to confluent lymphocytic inflammation in the mucosa (arrows), accompanied by a coagulum of fibrin and inflammatory cells at the mucosal surface. The koilin layer has laminar dissociation and is separated from the mucosa.



53 days, multifocal to confluent lymphohistiocytic inflammation in the medullary cones. The differential diagnosis includes infectious bronchitis. This could be inflammation related to transmissible proventriculitis.

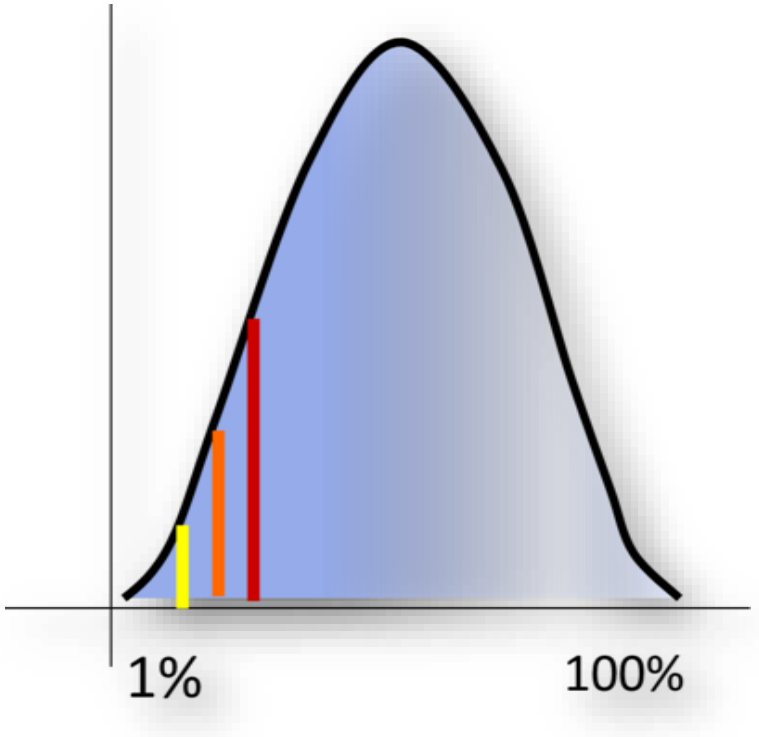


53 days, thymus. The thymus on the left is congested but the lymphocytic component is mildly depleted but within normal limits. The thymus on the left has severe, grade 5, lymphocytic depletion. The differential diagnosis includes chicken infectious anemia virus infection following decline of maternal immunity.

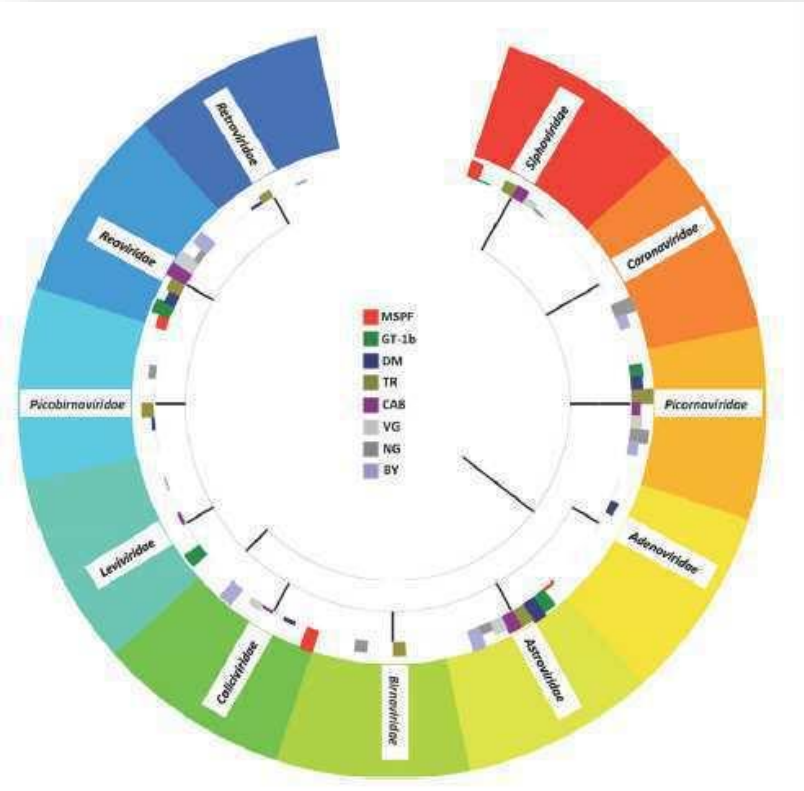


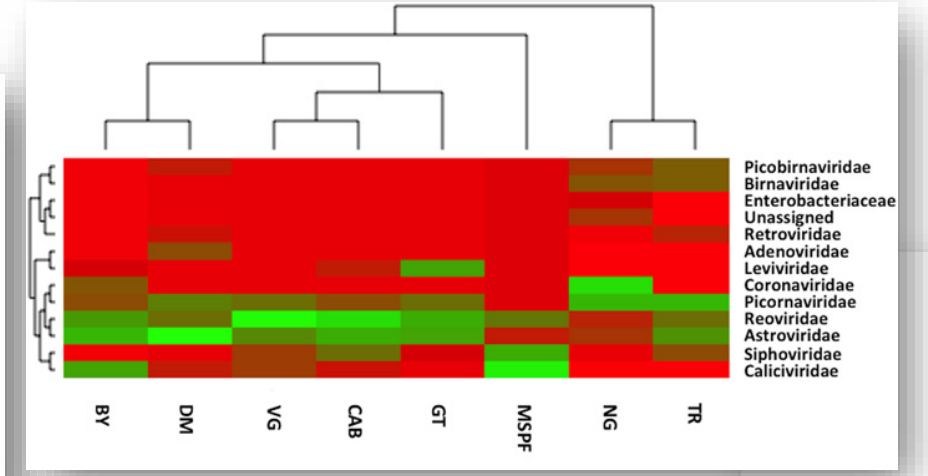
This case is typical of gut pathology in problematic broiler operations

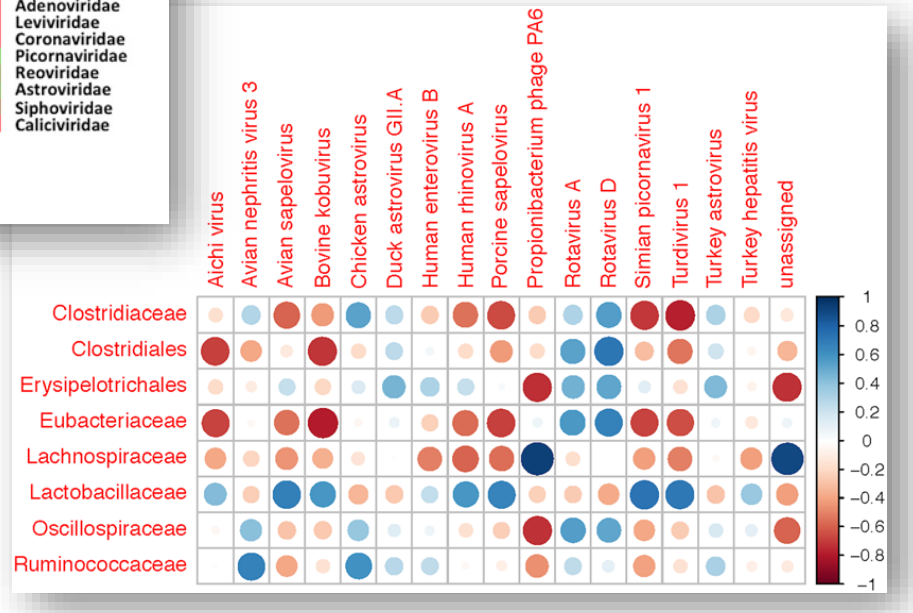
- Viral enteritis
  - Progressing to nonspecific enteritis and dysbacteriosis
  - Variable coccidiosis problems…in my experience
    - US: E. maxima
    - Europe: E. acervulina, minor species common
    - Asia, Latin America: very little coccidia
- Viral proventriculitis
  - Common in Americas and Asia
- Gizzard problems
  - Viral?
  - Toxins?
- Bursal disease and chicken anemia immune stress



Enteric Virome Metagenomic Analysis: SPF Sentinels on 6 broiler farms







Day JM, Oakley BB, Seal BS, Zsak L (2015) Comparative Analysis of the Intestinal Bacterial and RNA Viral Communities from Sentinel Birds Placed on Selected Broiler Chicken Farms. **PLoS ONE 10(1): e0117210. doi:10.1371/journal.** pone.0117210

Early Immunosuppression in Broilers

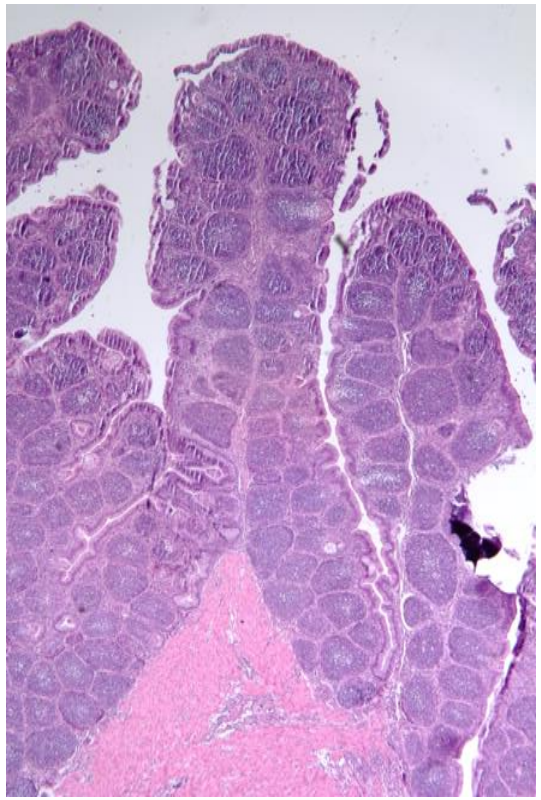
Possible causes: stress, viral enteritis, chicken anemia, Marek’s disease, viral arthritis reovirus strains, infectious bursal disease

Two complexes (US), 12 to 26 days of age, bursa & thymus surveyed

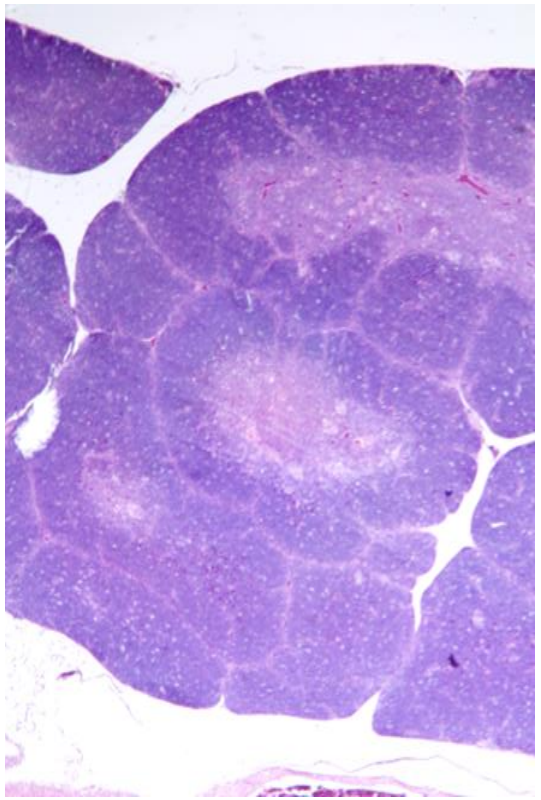
Age	Units	B1	B2	B3	B4	B5	B6	Mean	#Nec	Comment	T1	T2	T3	T4	T5	T6	T7	Mean	Comment
12	days	0	0	0	0	0		0	0	Within normal limits	0	0	0	0	0	0	0	0	Within normal limits
12	days	0	0	0	0	0		0	0	Within normal limits	0	2	0	0	0	0	0	0.286	Nonspecific depletion/stress
12	days	0	0	0	0	0	0	0	0	Within normal limits	0	1	0	0	0	0	2	0.429	Nonspecific depletion/stress
13	days	0	0	0	0	0	0	0	0	Within normal limits	0	0	0	0	0	0	0	0	Within normal limits
13	days	0	0	0	0	0	0	0	0	Within normal limits	0	0	0	0	1	1	0	0.286	Nonspecific depletion/stress
13	days	0	0	0	0	0	0	0	0	Within normal limits	0	0	0	1	0	1	0	0.286	Nonspecific depletion/stress
15	days	0	0	0	0	0	0	0	0	Within normal limits	1	1	1	1	2	0	0	0.857	Nonspecific depletion/stress
15	days	0	0	0	0	0		0	0	Within normal limits	0	0	0	0	0	0	0	0	Within normal limits
15	days	1	0	1	0	0		0.4	0	Nonspecific depletion/stress	0	0	0	0	0	0	0	0	Within normal limits
16	days	0	0	1	0	0		0.2	0	Nonspecific depletion/stress	0	2	0	0	0	0	0	0.286	Nonspecific depletion/stress
16	days	0	0	0	0	0	0	0	0	Within normal limits	0	0	0	0	0	0	0	0	Within normal limits
16	days	0	0	0	0	0		0	0	Within normal limits	0	0	0	0	0	0	0	0	Within normal limits
19	days	0	0	0	0	0		0	0	Within normal limits	3	3	3	3	0	0	0	1.714	Consistent w ith CAV
19	days	0	0	1	1	0		0.4	0	Nonspecific depletion/stress	3	3	0	5	5	3	3	3.143	Consistent w ith CAV
19	days	0	0	0	0	0		0	0	Within normal limits	0	0	0	0	0			0	Within normal limits
20	days	0	0	1	0	0	0	0.167	0	Nonspecific depletion/stress	2	2	1	0	0	0	0	0.714	Nonspecific depletion/stress
20	days	0	0	0	0	0		0	0	Within normal limits	0	0	2	2	1	1	1	1	Nonspecific depletion/stress
20	days	0	0	0	0	0	3	0.5	0	Nonspecific depletion/stress	0	0	0	0	0	0	3	0.429	Consistent w ith CAV
22	days	0	0	0	0	0	0	0	0	Within normal limits	1	1	1	0	1	0	0	0.571	Nonspecific depletion/stress
22	days	1	0	0	0	0	0	0.167	0	Nonspecific depletion/stress	3	3	1	2	2			2.2	Consistent w ith CAV
22	days	0	0	0	0	0	0	0	0	Within normal limits	1	1	1	1	0	0		0.667	Nonspecific depletion/stress
23	days	0	0	0	2	0	0	0.333	0	Nonspecific depletion/stress	1	1	0	0	1	1	0	0.571	Nonspecific depletion/stress
23	days	0	0	0	0	0	0	0	0	Within normal limits	1	1	0	1	1	1	0	0.714	Nonspecific depletion/stress
23	days	0	0	5	0	0	4	1.5	2	Acute bursitis/IBD	1	0	1	0	2	2	0	0.857	Nonspecific depletion/stress
26	days	0	0	0	0	0		0	0	Within normal limits	3	0	0	0	0	0		0.5	Consistent w ith CAV

Age	Units	B1	B2	B3	B4	B5	B6	Mean	#Nec	Comment	T1	T2	T3	T4	T5	T6	T7	Mean	Comment
12	days	0	0	1	0	1	0	0.333	0	Nonspecific depletion/stress	0	0	1	1	1	1	0	0.571	Nonspecific depletion/stress
12	days	2	0	0	0	1	0	0.5	0	Nonspecific depletion/stress	0	0	3	3	3	1	1	1.571	Consistent w ith CAV
12	days	0	0	0	0	0		0	0	Within normal limits	3	3	1	1	1	2	1	1.714	Consistent w ith CAV
13	days	0	0	4	0	0		0.8	0	Within normal limits	0	0	5	5	1	0	0	1.571	Consistent w ith CAV
13	days	0	0	0	0	0	0	0	0	Within normal limits	1	0	1	1	0	0	1	0.571	Nonspecific depletion/stress
13	days	0	0	0	0	1	0	0.167	0	Nonspecific depletion/stress	1	0	0	0	0	1	1	0.429	Nonspecific depletion/stress
15	days	0	0	0	0	0	0	0	0	Within normal limits	0	0	0	0	0	0	0	0	Within normal limits
15	days	0	0	0	0	0	0	0	0	Within normal limits	0	0	0	0	0	0	0	0	Within normal limits
15	days	0	2	0	0	0		0.4	0	Nonspecific depletion/stress	1	1	1	0	0	0		0.5	Nonspecific depletion/stress
16	days	0	0	0	0	0	0	0	0	Within normal limits	1	0	0	0	0	1	1	0.429	Nonspecific depletion/stress
16	days	2	0	0	0	0	0	0.333	0	Nonspecific depletion/stress	0	2	2	2	2	3	0	1.571	Consistent w ith CAV
16	days	0	0	0	0	0	1	0.167	0	Nonspecific depletion/stress	0	0	0	0	5	5	5	2.143	Consistent w ith CAV
19	days	0	0	0	0	0	0	0	0	Within normal limits	0	0	0	3	3	1	0	1	Consistent w ith CAV
19	days	0	4	0	0	0	0	0.667	0	Nonspecific depletion/stress	0	0	0	0				0	Within normal limits
19	days	1	0	0	1	0	0	0.333	0	Nonspecific depletion/stress	0	0	0	4	4	4	0	1.714	Consistent w ith CAV
20	days	0	0	0	0	0		0	0	Within normal limits	0	0	2	0	0	0	0	0.286	Nonspecific depletion/stress
20	days	0	0	0	0	0	0	0	0	Within normal limits	0	0	0	0	0	0	0	0	Within normal limits
20	days	0	0	0	0	0	2	0.333	0	Nonspecific depletion/stress	0	0	0	0	0	0	0	0	Within normal limits
22	days	0	0	0	0	1	0	0.167	0	Nonspecific depletion/stress	0	0	2	0	0	0	0	0.286	Nonspecific depletion/stress
22	days	0	0	0	0	0	0	0	0	Within normal limits	0	0	0	0	0	0	0	0	Within normal limits
22	days	0	0	0	2	0		0.4	0	Nonspecific depletion/stress	3	3	1	0	0	2	2	1.571	Consistent w ith CAV
23	days	0	0	0	0	0		0	0	Within normal limits	0	0	0	0	0	0	0	0	Within normal limits
23	days	0	0	0	0	0	0	0	0	Within normal limits	0	0	1	1	1	2	2	1	Nonspecific depletion/stress
23	days	1	0	0	0	0	0	0.167	0	Nonspecific depletion/stress	1	0	0	0	0	0	0	0.143	Nonspecific depletion/stress
26	days	0	0	0	0	0		0	0	Within normal limits	0	0	0	2	0	0	0	0.286	Nonspecific depletion/stress

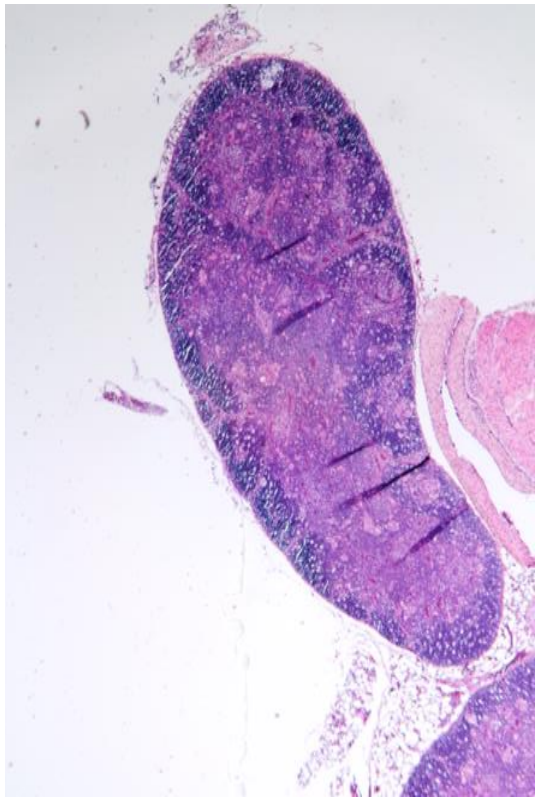
Bursa score 0, normal



Bursa score 4



Thymus Score 0, normal

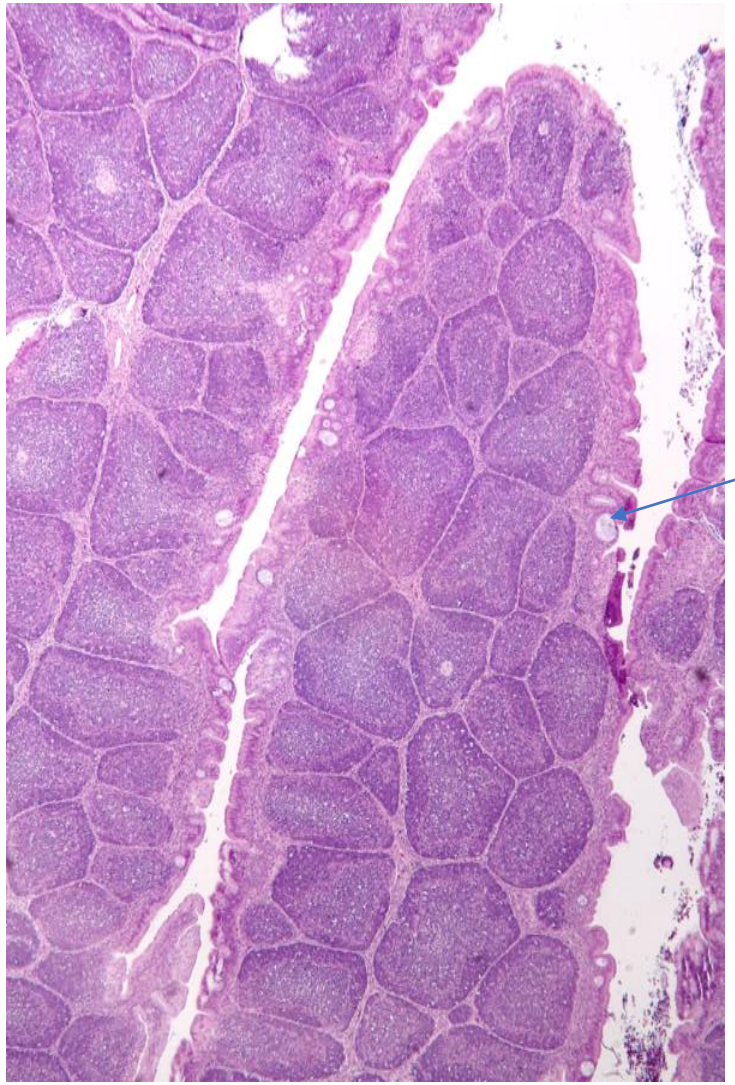


Thymus score 4

13 days, bursa and thymus depletion

Bursa, nonspecific depletion, 15 days

Score 0, within normal limits

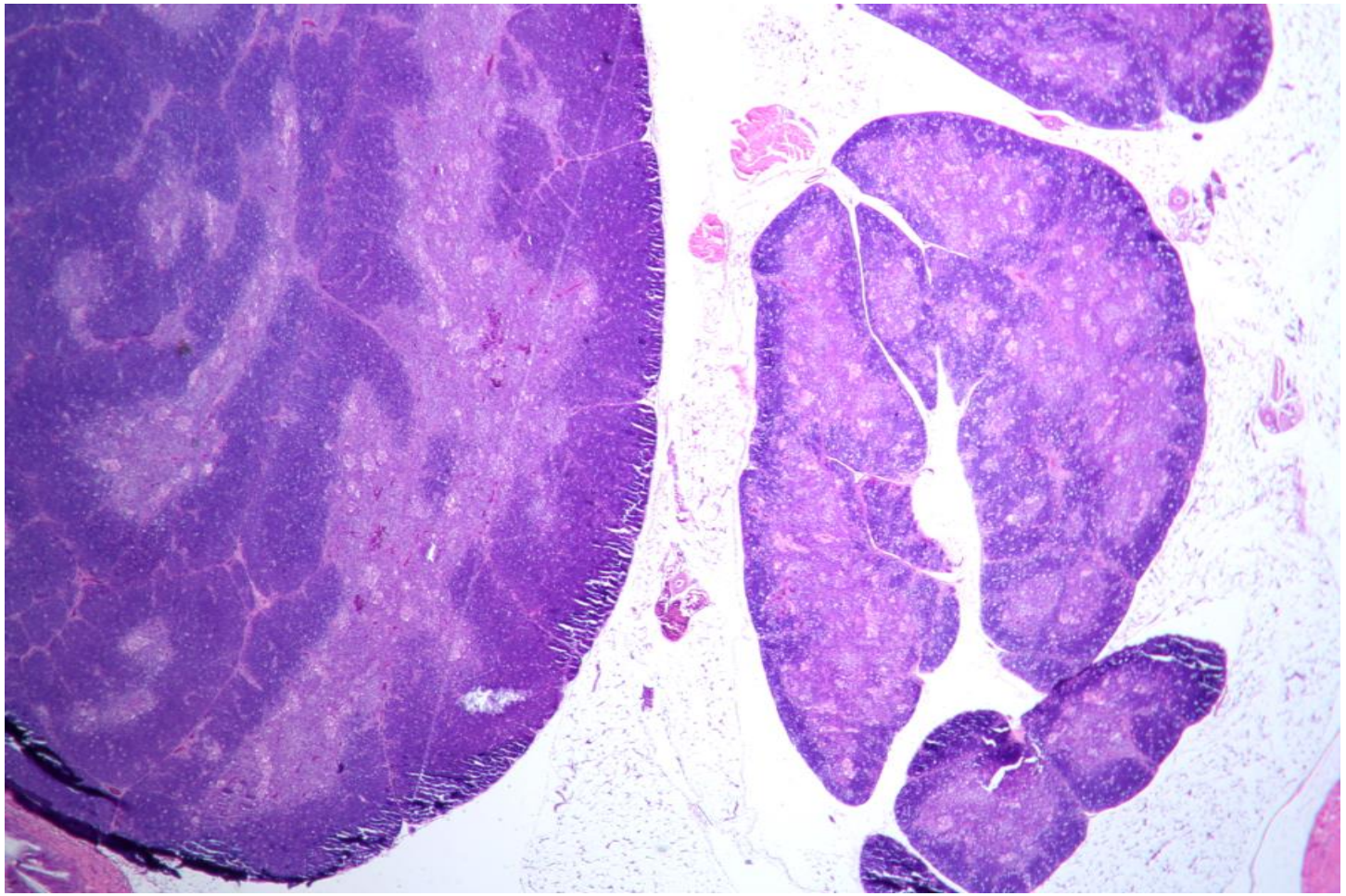


Score 1, minimal nonspecific depletion

Mucosal cysts, suggestive of RSS

16 days, thymus, depletion, CAV suspect (& Marek's)

Score 0, normal



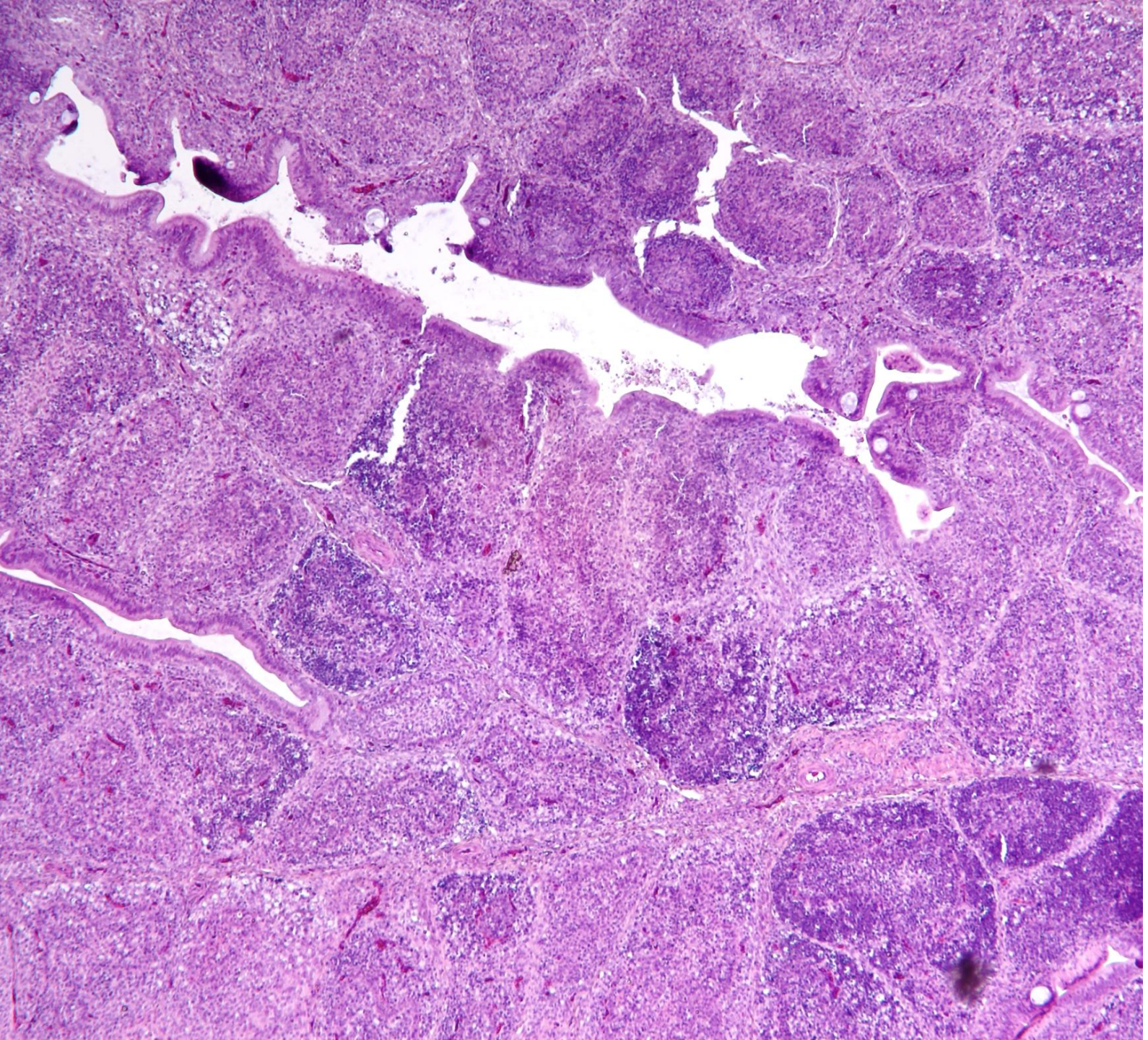
Score 5, severe, CAV candidate

Bursa nonspecific depletion, 20 days

Possible causes: stress, viral enteritis

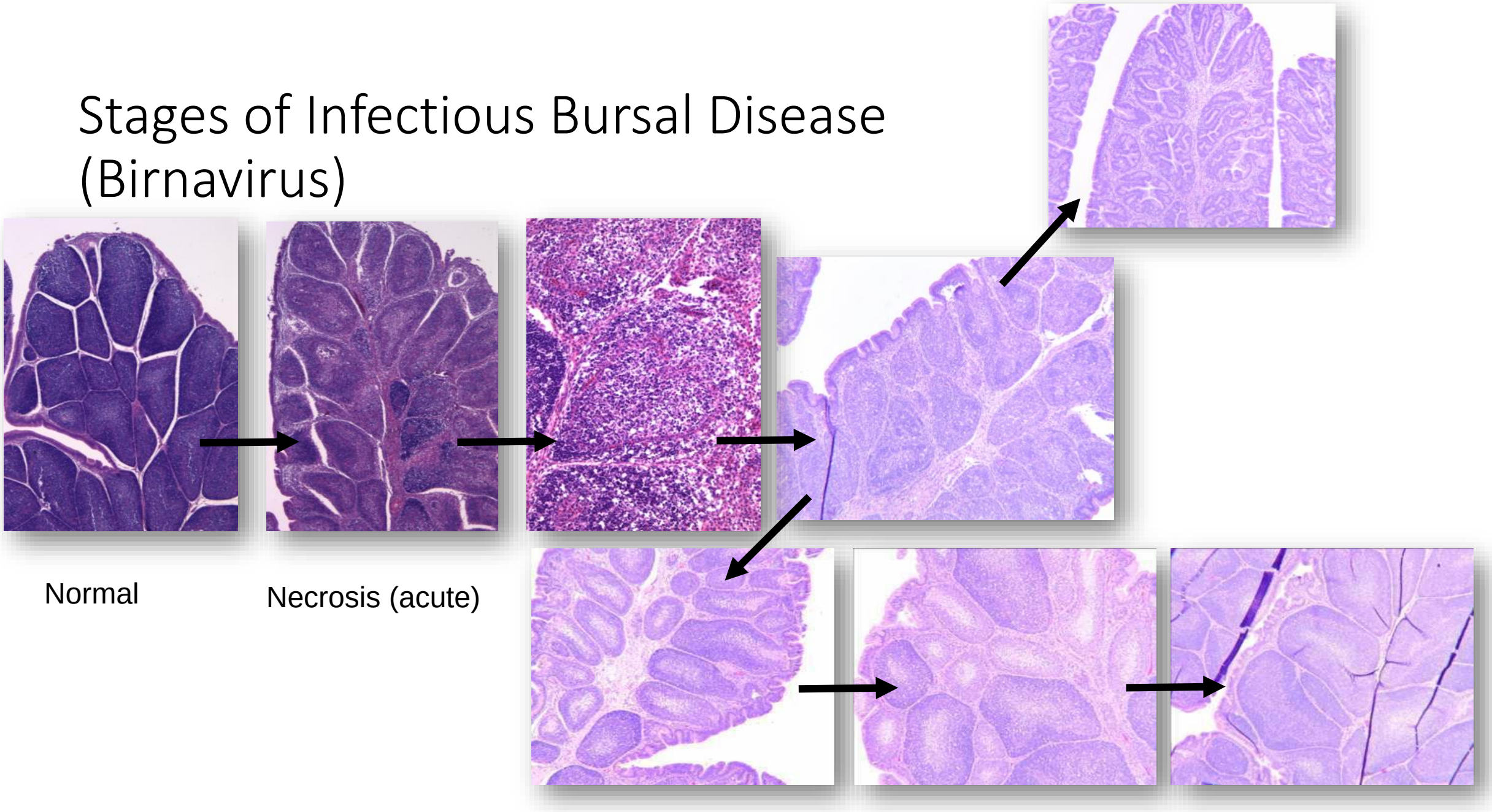
Score 0 within normal limits

Score 3



Bursa, 23 days, acute necrotizing bursitis – acute bursal disease

Stages of Infectious Bursal Disease (Birnavirus)

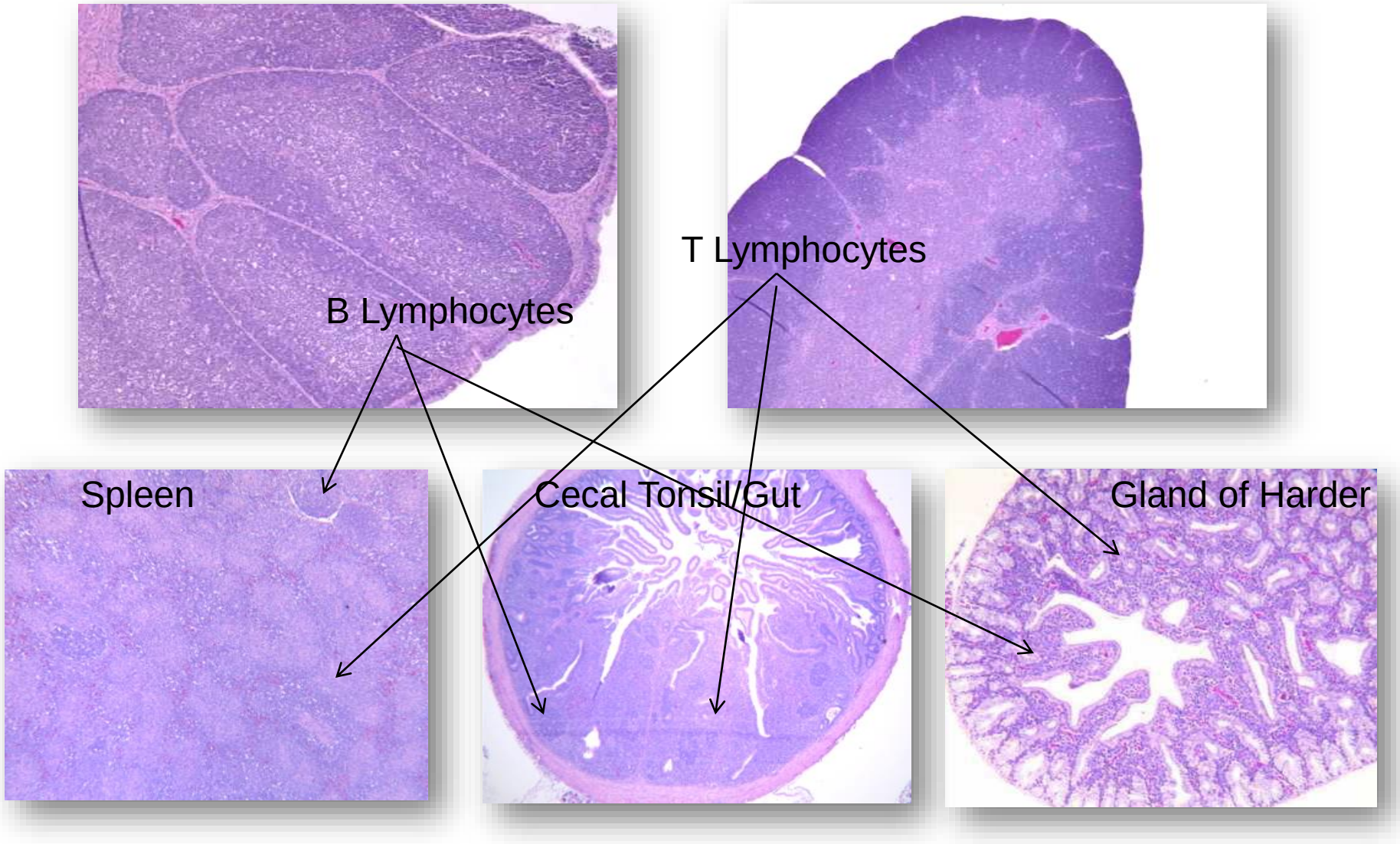


Normal

Necrosis (acute)

Bursa and Thymus: First 14 Days

Primary Lymphoid Organs Seed Secondary Organs



Bursa Survey: 6 flocks – Influence of early Gumboro on spleen germinal centers (B-cell centers)

Age	Units	B1	B2	B3	B4	B5	B6	Mean	Virus Detect	#Nec	Comment
14	days	1	1	1	1	1	1	1		0	Within normal limits
21	days										Tissue not available
29	days	3.5	3.5	3.5	3.5	2	2	3	2	0	Recovery IBD
34	days	3	3	3	3.5	3	1	2.75	2	0	Recovery IBD
41	days	3	3	3	3	3	1	2.6667	2	0	Recovery IBD
14	days	1	1	1	1	1		1			Within normal limits
21	days	1	1	1	1	1		1			Within normal limits
28	days	4	4	1	4	4		3.4	1	4	Acute bursitis/IBD
33	days	3.5	3.5	3.5	3	3.5		3.4	2	0	Recovery IBD
41	days	3	3	3	3	3		3	2	0	Recovery IBD
41	days	3	3	3	3	3		3	2	0	Recovery IBD
14	days	1	1	1	1	1		1			Within normal limits
21	days	4	4	3.5	1	1		2.7	1	3	Acute bursitis/IBD
28	days	4	3.5	4	3	3		3.5	2	0	Recovery IBD
33	days	3	3	3	3	3		3	2	0	Recovery IBD
41	days	2.5	3	3	3.5	3		3	2	0	Recovery IBD

25.8

16.6

18.8

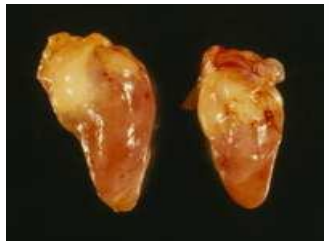
14	days	1	1	1	1	1		1			Within normal limits
22	days	1	1	1	1	1		1			Within normal limits
29	days	3	3	3.5	3.5	3.5		3.3	2	0	Recovery IBD
34	days	3	3	3.5	3	3		3.1	2	0	Recovery IBD
41	days	3	3	3	3	2.5		2.9	2	0	Recovery IBD
41	days	3	2.5	3	3	3		2.9	2	0	Recovery IBD
14	days	4	1	1	1	1		1.6	1	1	Acute bursitis/IBD
21	days	3	3.5	3.5	3.5	3.5		3.4	2	0	Recovery IBD
28	days	3.5	3.5	3.5	3.5	3.5		3.5	2	0	Recovery IBD
32	days	2.5	2.5	2.5	2.5	3		2.6	2	0	Recovery IBD
41	days	2.5	2.5	2	2	2.5		2.3	2	0	Recovery IBD
41	days	1	2.5	2.5	2.5	2.5		2.2	2	0	Recovery IBD
14	days	1	1	2	1	1		1.2	1	1	Acute bursitis/IBD
21	days	4	4	4	4	3.5		3.9	1	4	Acute bursitis/IBD
28	days	3	3	3	3	3		3	2	0	Recovery IBD
33	days	2.5	4	2.5	3	3		3	2	0	Recovery IBD
41	days	2.5	2.5	1	2.5	2.5		2.2	2	0	Recovery IBD
41	days	2.5	1	2.5	2.5	2.5		2.2	2	0	Recovery IBD

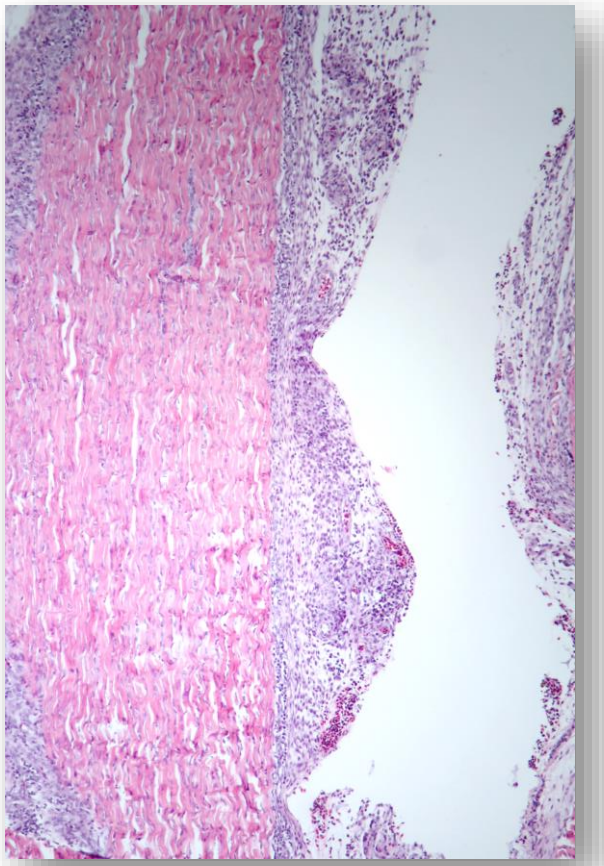
11.6

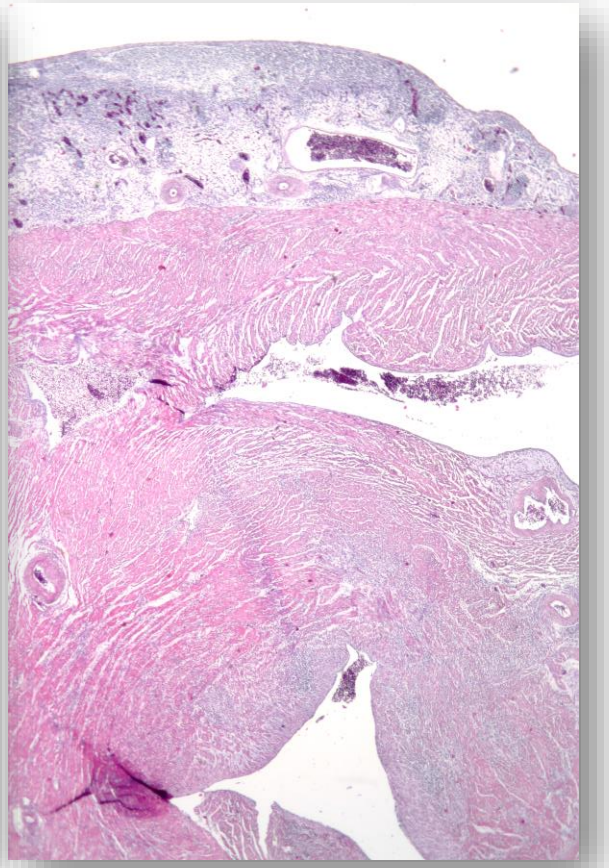
4.2

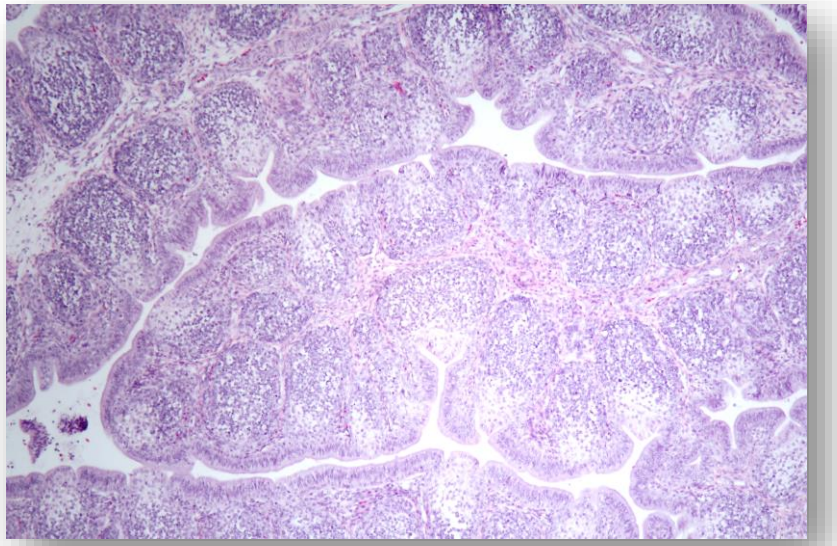
7.2

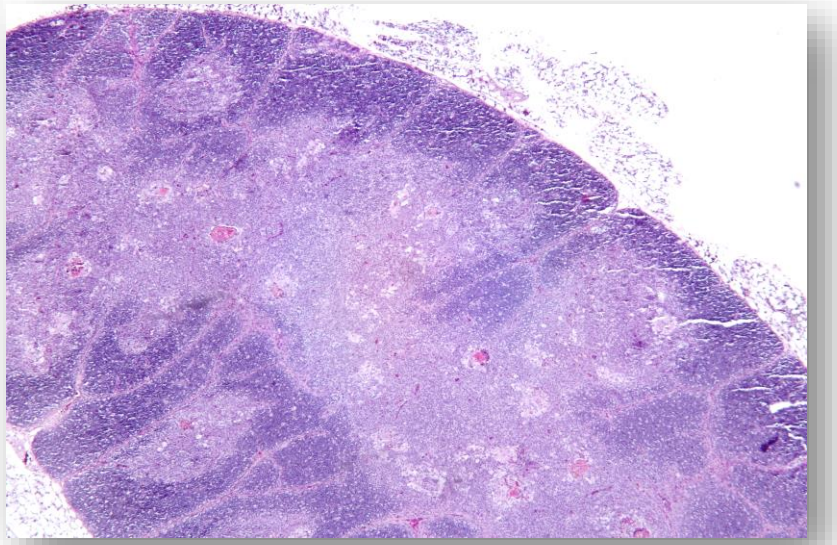
USA, Broilers, viral arthritis (reovirus)



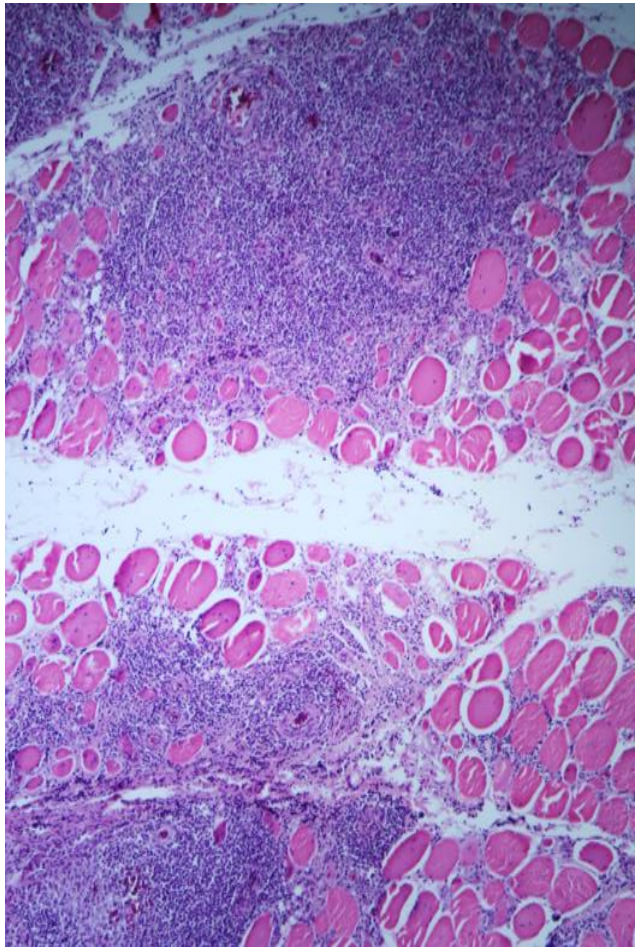


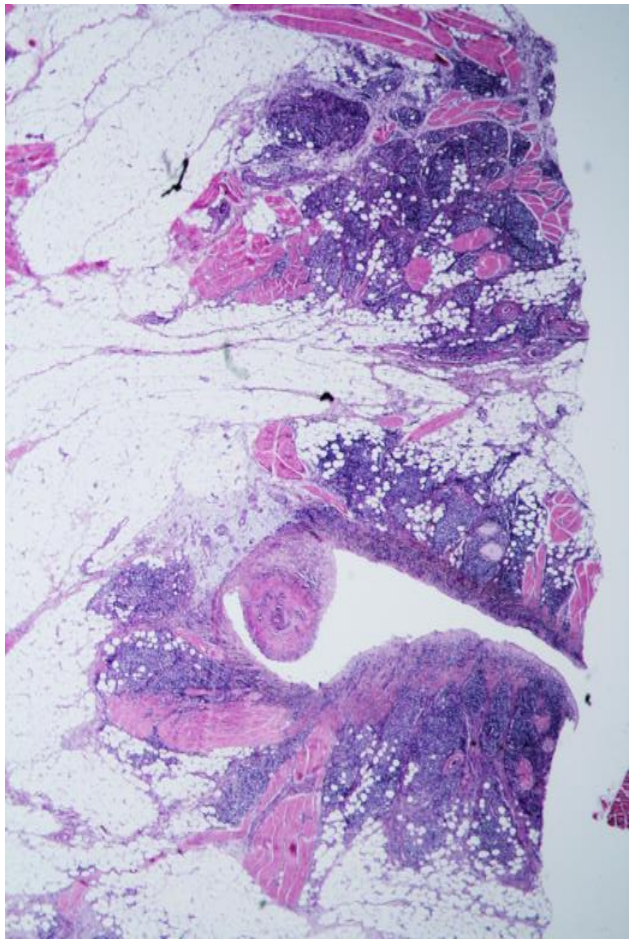


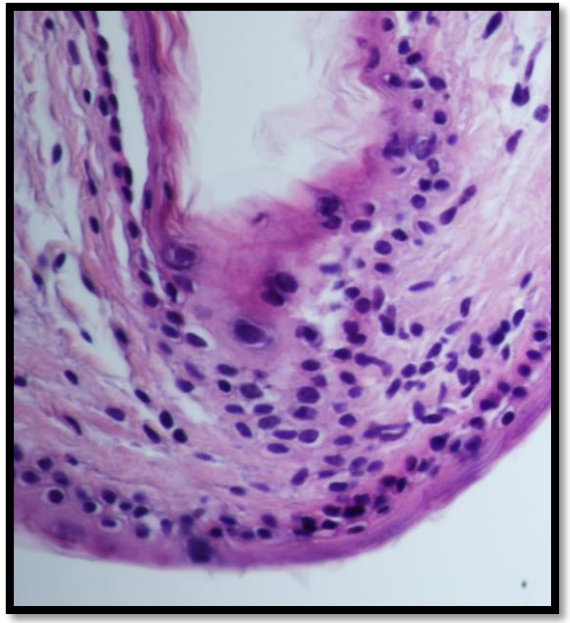




USA, Processed broiler carcasses (62 days) Marek's Disease, Herpesvirus

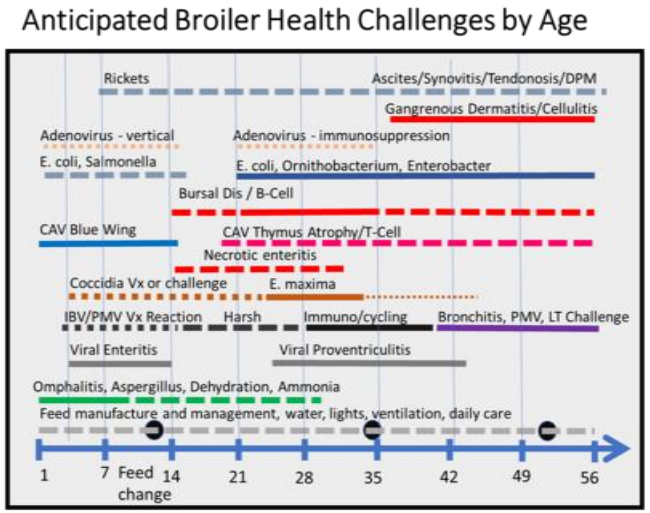


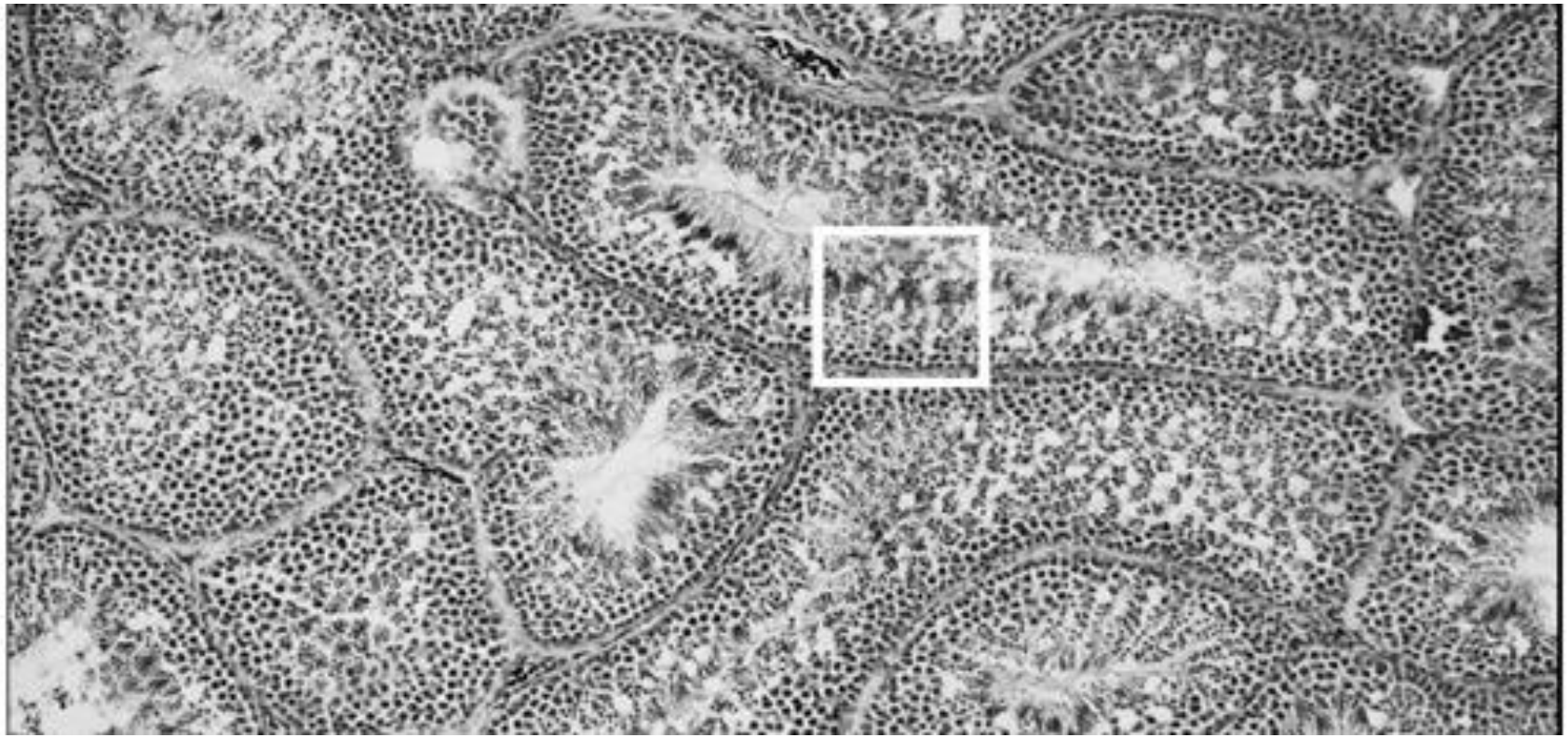




Immune Stress

- Key diseases infectious bursal disease and chicken infectious anemia
- Contributing diseases – early and ongoing
  - Stress – lymphocytolytic effect of cortisol release
    - Temperature, chick processing, transportation, placement
  - Viral enteritis – gut “virome”, just in the beginning of realizing the scope of this, let alone the influence
  - Marek’s disease challenge
  - Viral arthritis – tenosynovitis
  - Adenovirus
  - Toxicity - mycotoxins



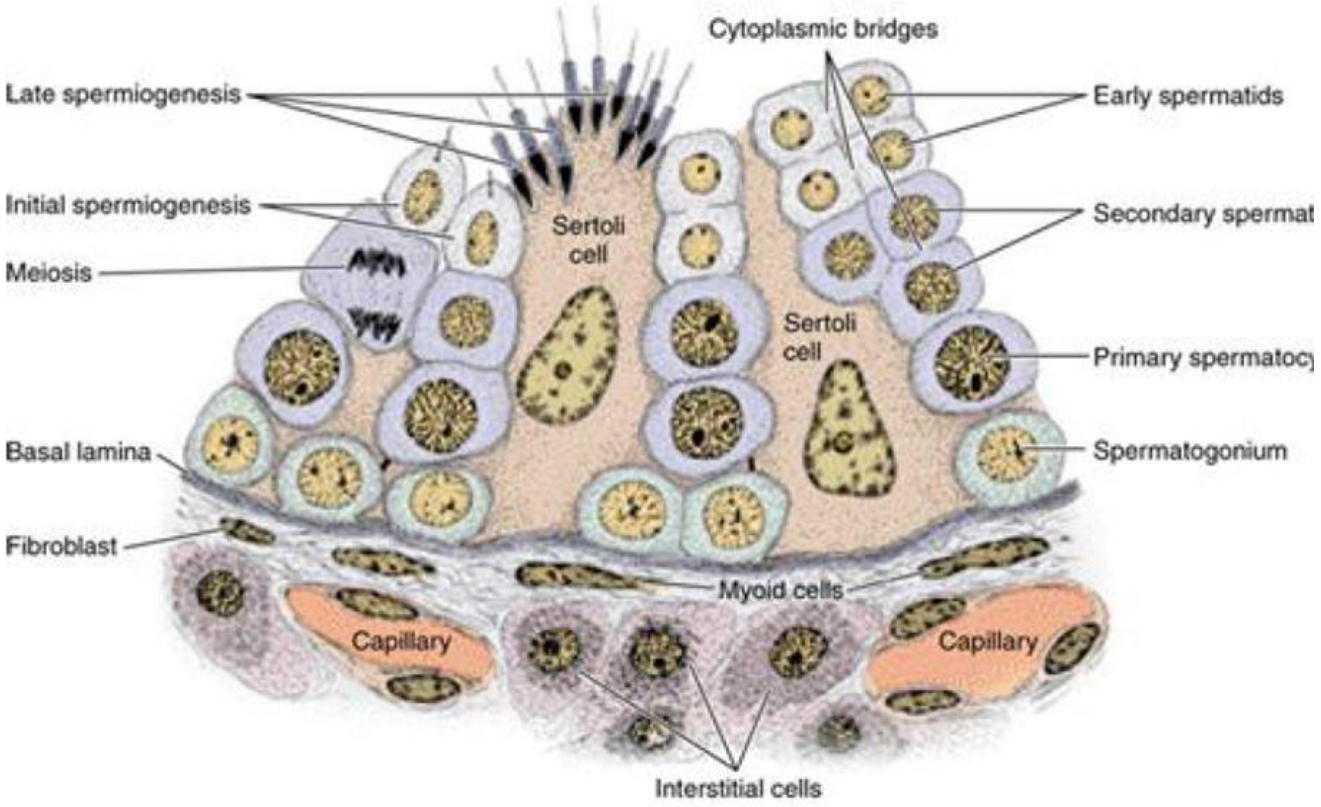


Testicle studies – Sertoli cells and other findings

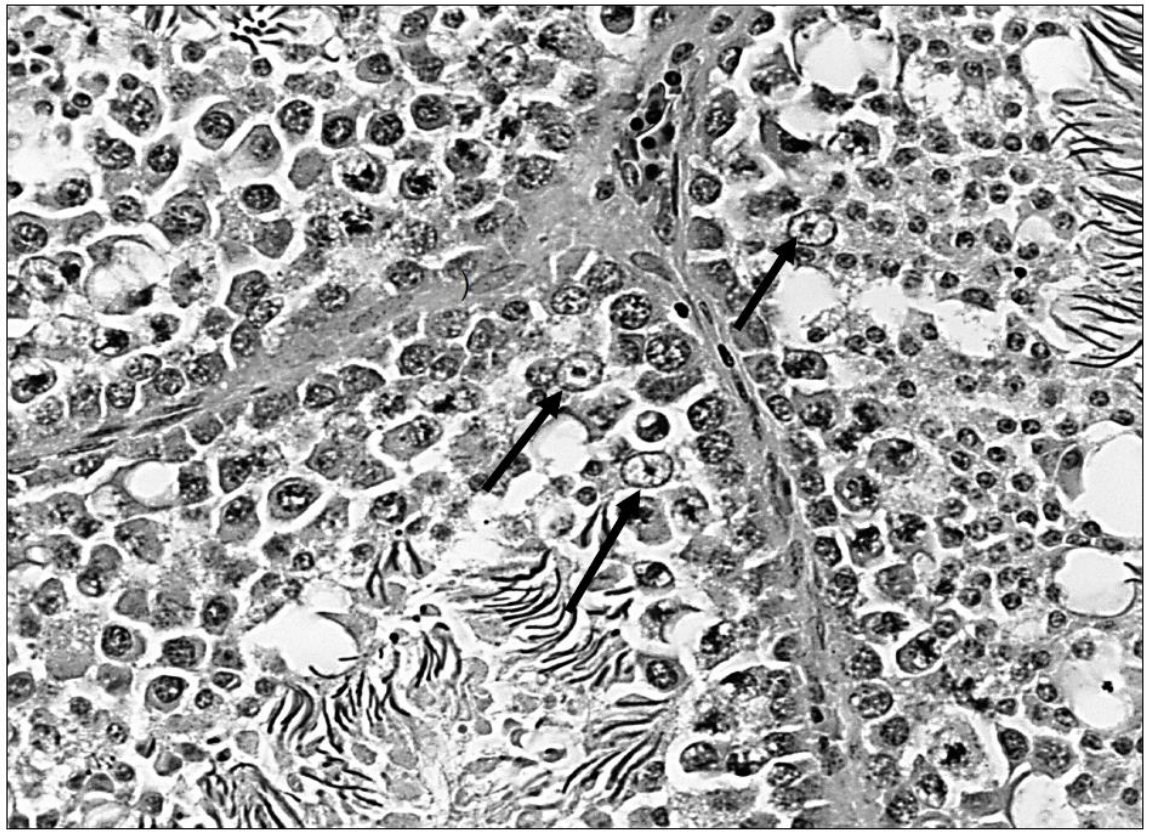
With Dr. Floyd Wilson

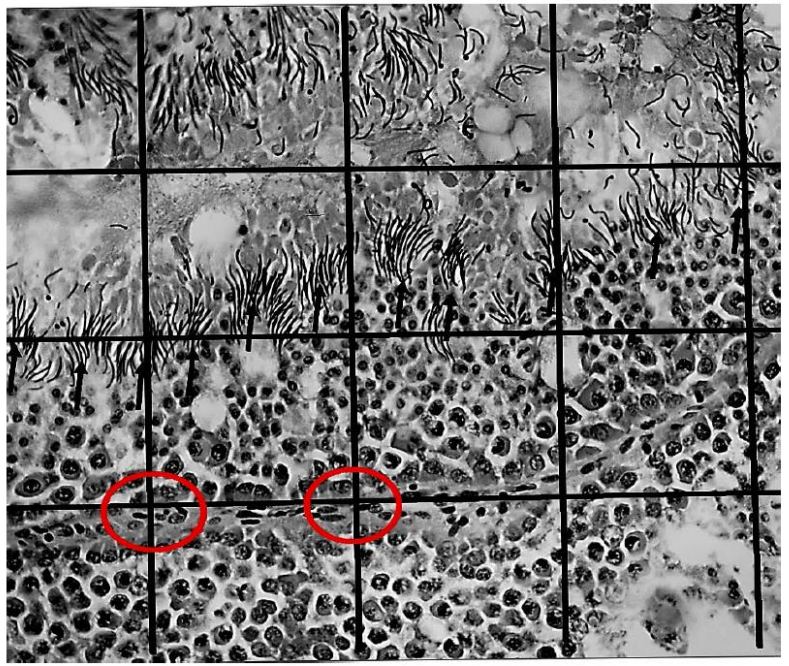
Sertoli cells

- The total number of Sertoli cells is set by 4 days of age
- Nourishment of developing sperm cells during spermatogenesis
    - Nurse function
- Remove residual cytoplasm during spermatogenesis
- Translocation of germ cells at base to seminiferous tubule
- Form the blood-testes barrio
- Maintain and self-renewal of spermatogonia stem cells and differentiation

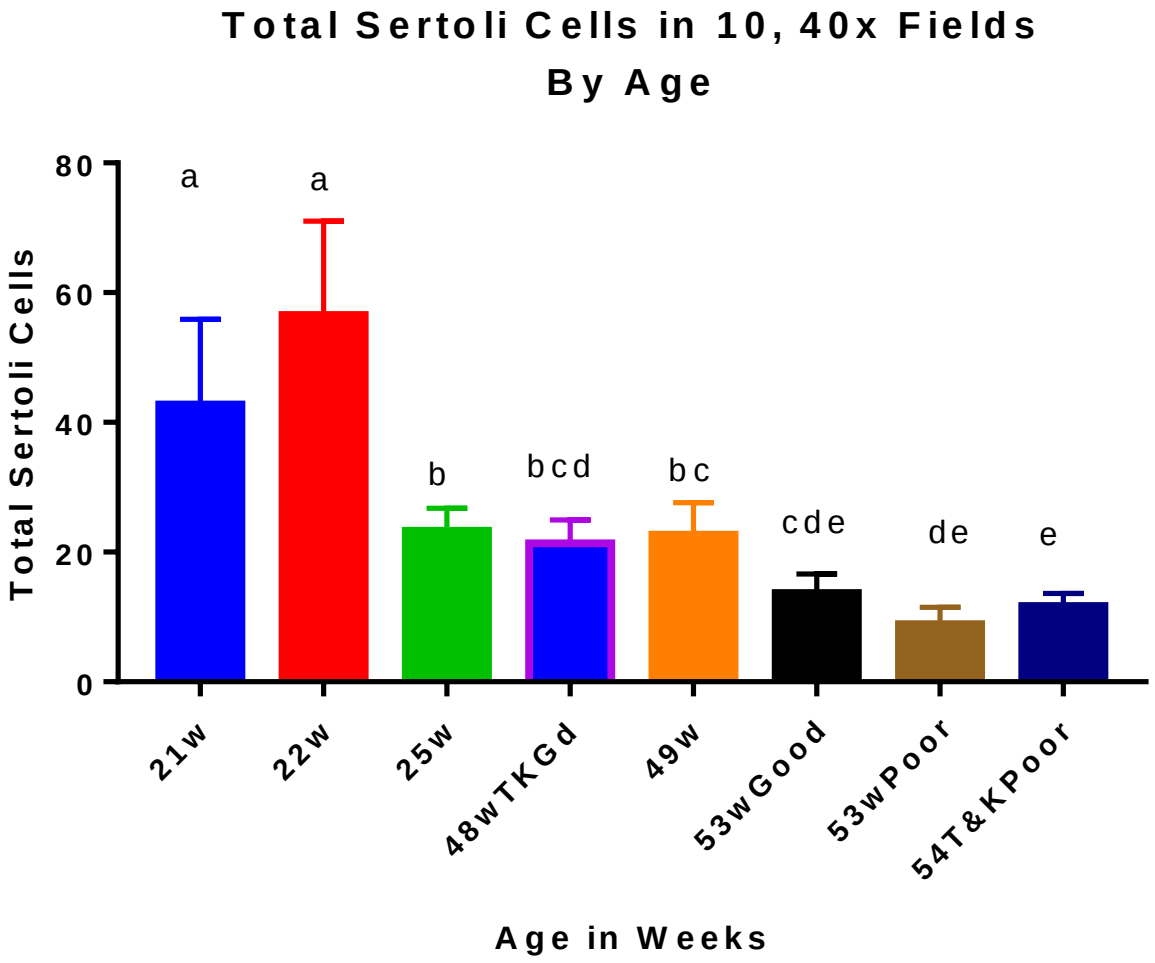


Broiler breeder males, testicular morphometrics to guide nutrition and management





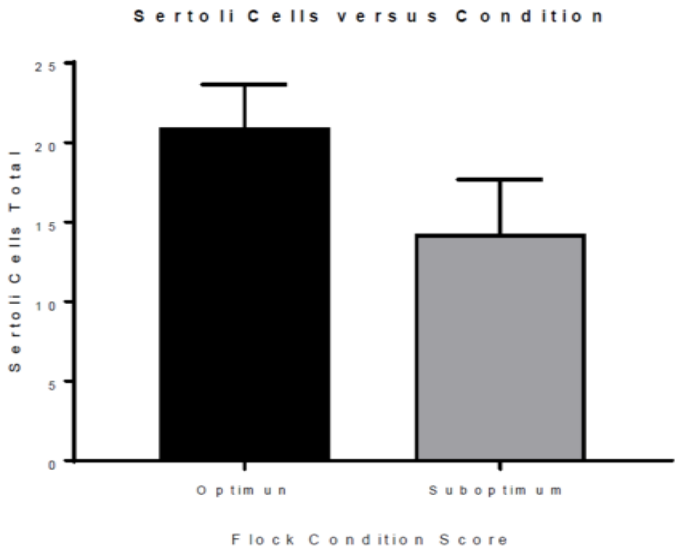
Testicular morphometrics

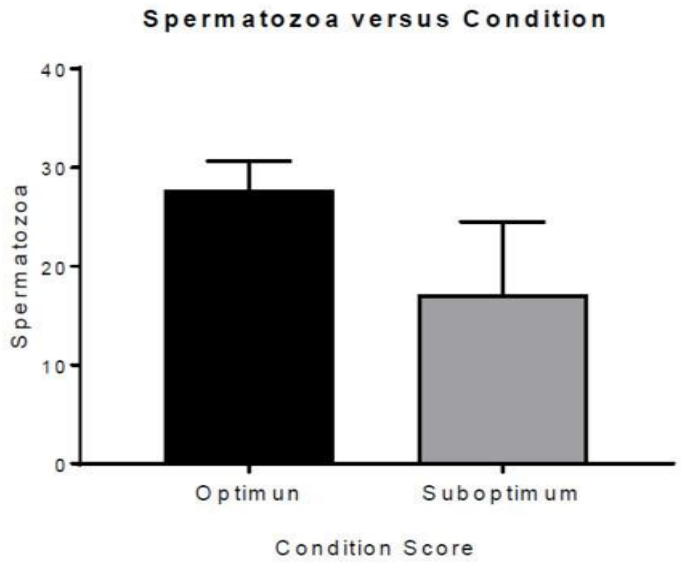


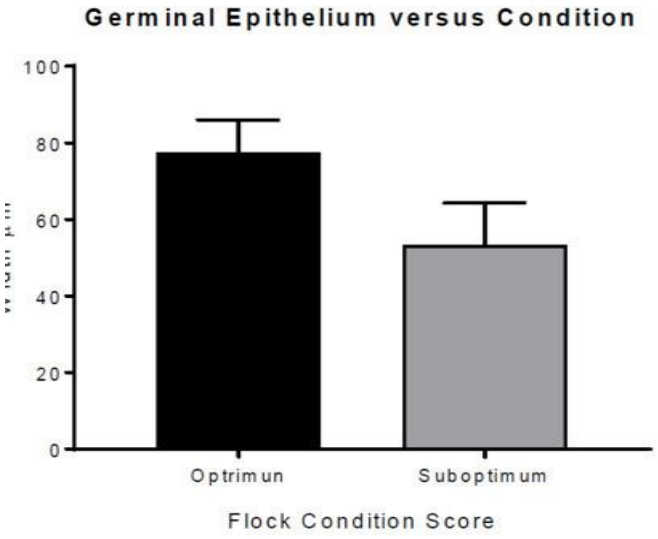
D. Johnson F. Wilson, and F.J. Hoerr 2016

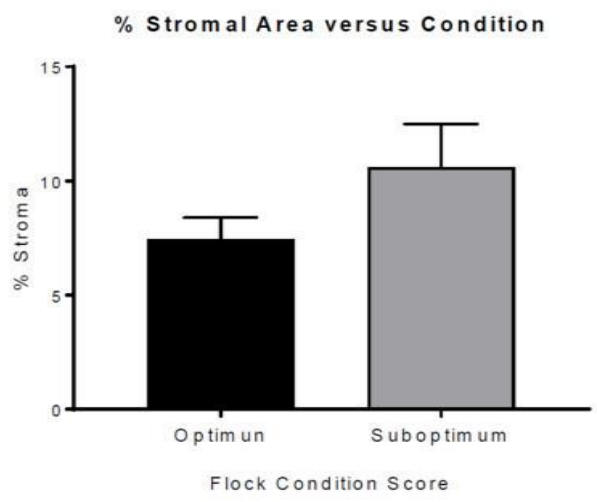
Study 1.

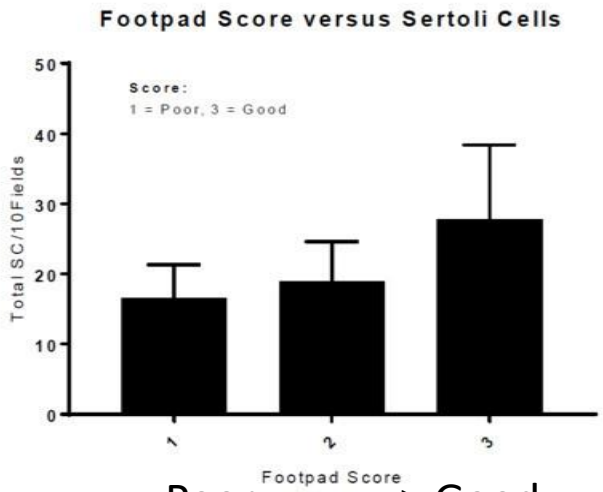
- 59-week broiler breeder roosters from two flocks
  - 10 birds good body condition and foot pad scores with normal testicular and body weights (optimal profile group).
  - 10 birds relatively poor expression of testicular and body weights (suboptimal group)

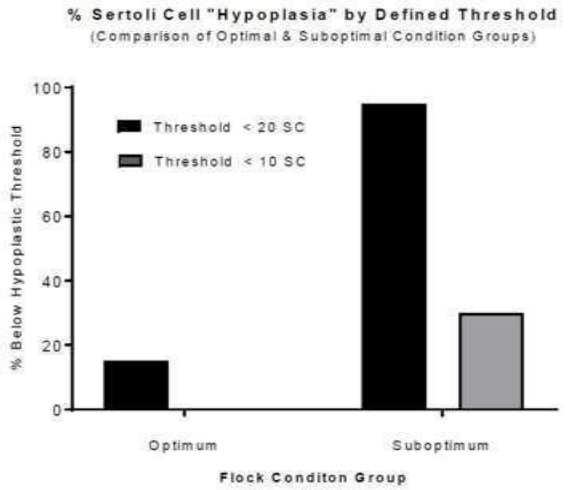

Sertoli Cells versus Condition
Sertoli Cells Total
25
20
15
10
5
0
Optimun
Suboptimum
Flock Condition Score


Spermatozoa versus Condition
Spermatozoa
40
30
20
10
0
Optimun
Suboptimum
Condition Score


Germinal Epithelium versus Condition
100
80
60
40
20
0
Optrimun
Suboptimum
Flock Condition Score


% Stromal Area versus Condition
% Stroma
15
10
5
0
Optimun
Suboptimum
Flock Condition Score

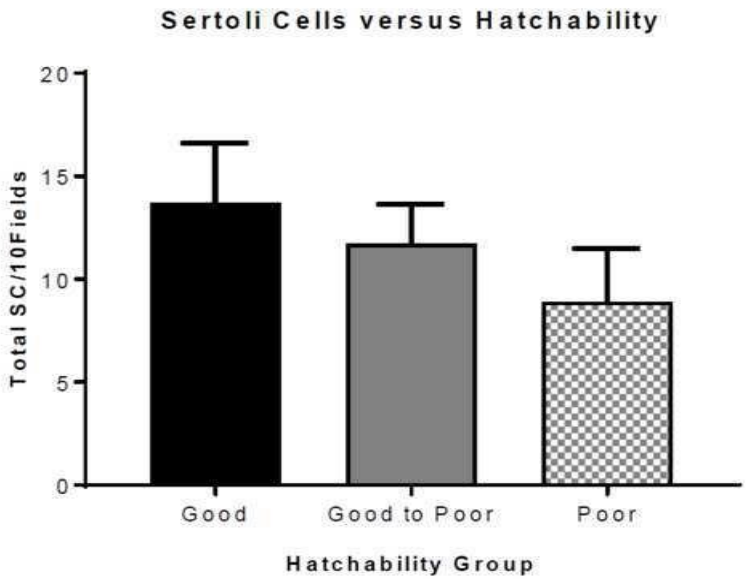

Footpad Score versus Sertoli Cells
Score:
1 = Poor, 3 = Good
Total SC/10Fields
50
40
30
20
10
0
1
2
3
Footpad Score

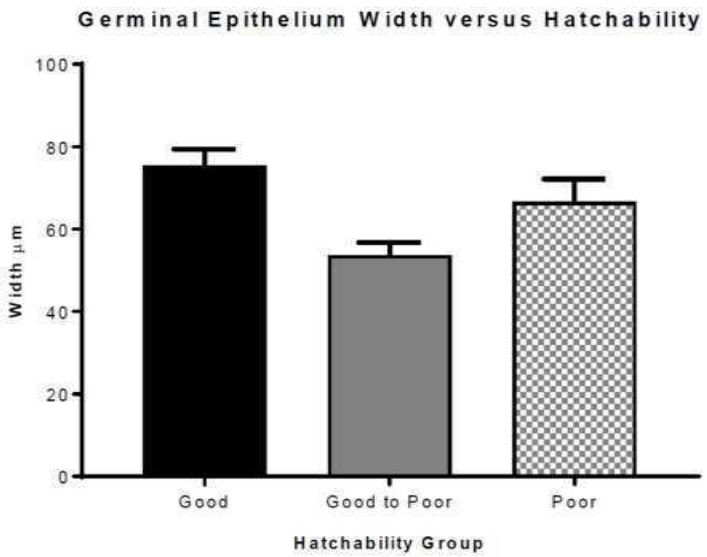

% Sertoli Cell "Hypoplasia" by Defined Threshold
(Comparison of Optimal & Suboptimal Condition Groups)
% Below Hypoplastic Threshold
100
80
60
40
20
0
Threshold < 20 SC
Threshold < 10 SC
Optimum
Suboptimum
Flock Conditon Group

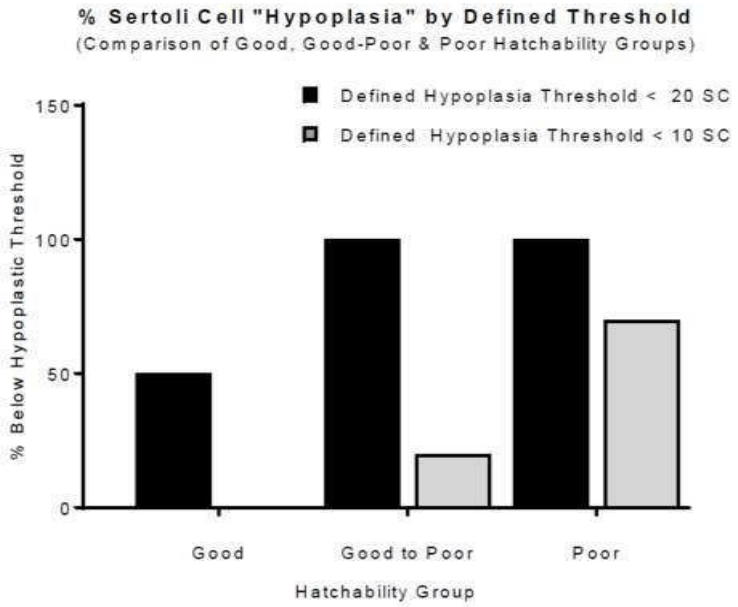
Poor ---------> Good

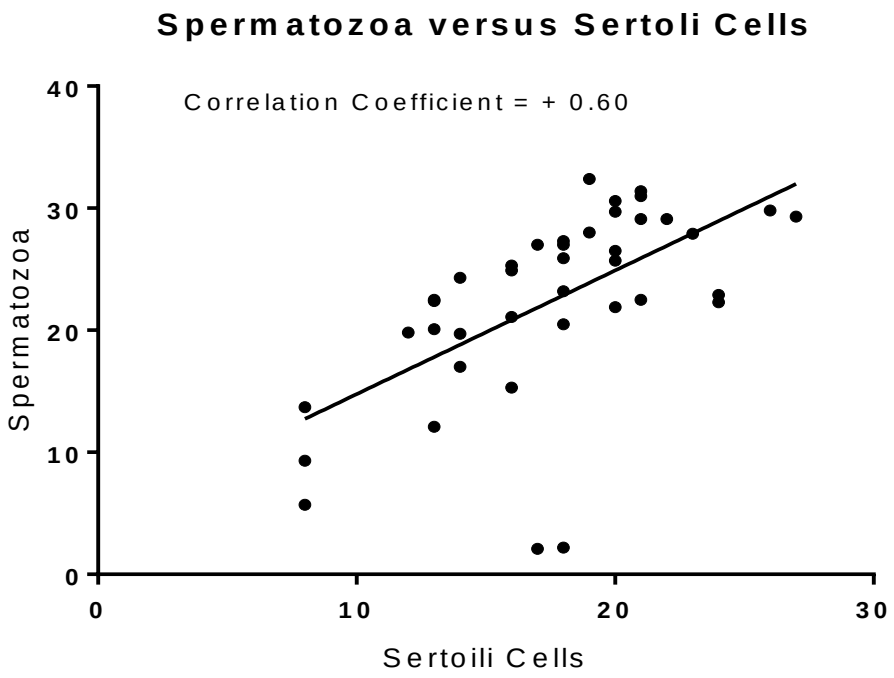
Study 2. Broiler Breeders

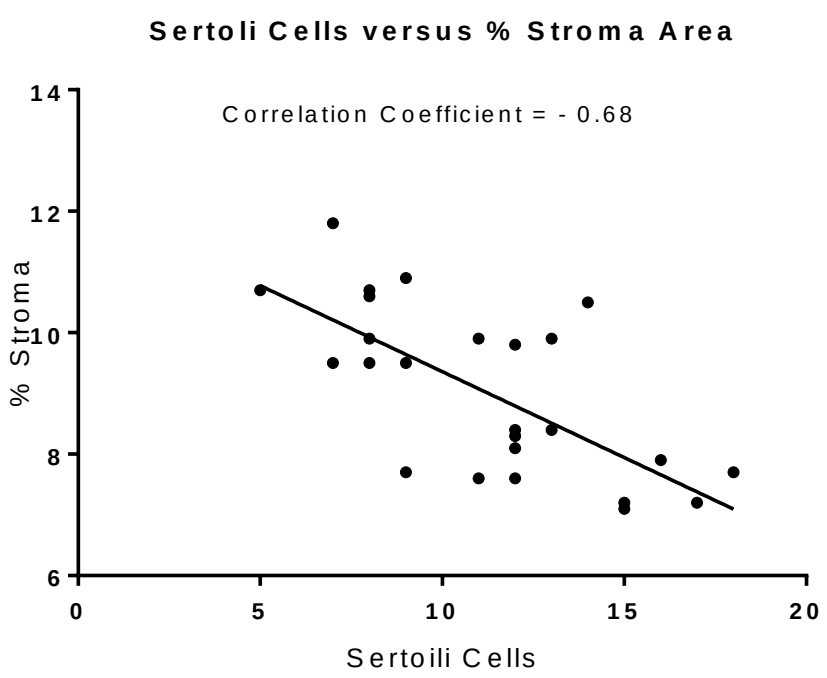
- 53 weeks - Good Hatchability
- 53 weeks - Poor Hatchability
- 54 week – Good Hatchability but declining


Sertoli Cells versus Hatchability
Total SC/10Fields
20
15
10
5
0
Good
Good to Poor
Poor
Hatchability Group


Germinal Epithelium Width versus Hatchability
Width µm
100
80
60
40
20
0
Good
Good to Poor
Poor
Hatchability Group


% Sertoli Cell "Hypoplasia" by Defined Threshold
(Comparison of Good, Good-Poor & Poor Hatchability Groups)
Defined Hypoplasia Threshold < 20 SC
Defined Hypoplasia Threshold < 10 SC
% Below Hypoplastic Threshold
150
100
50
0
Good
Good to Poor
Poor
Hatchability Group


Spermatozoa versus Sertoli Cells
Correlation Coefficient = + 0.60
Spermatozoa
Sertoili Cells
0
10
20
30
40


Sertoli Cells versus % Stroma Area
Correlation Coefficient = - 0.68
% Stroma
Sertoili Cells
6
8
10
12
14
0
5
10
15
20

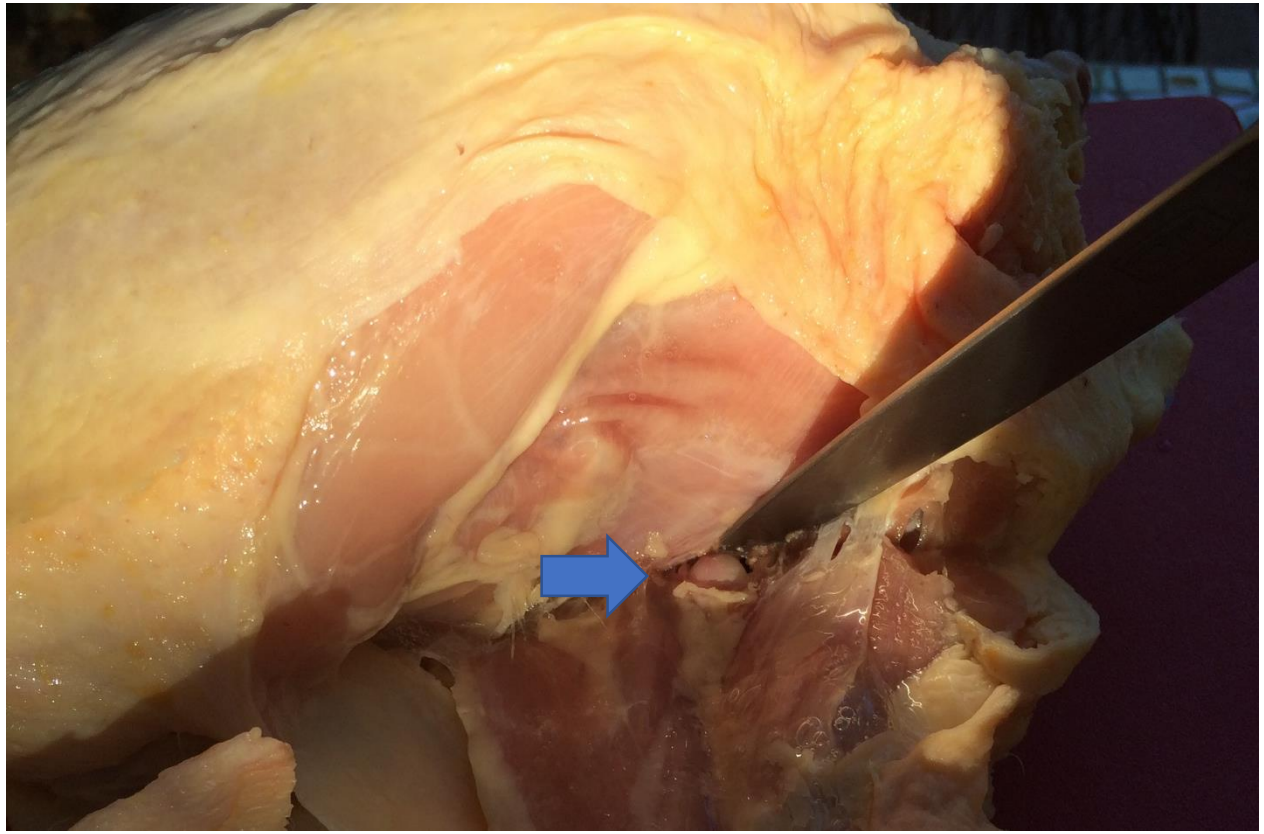
Conclusions

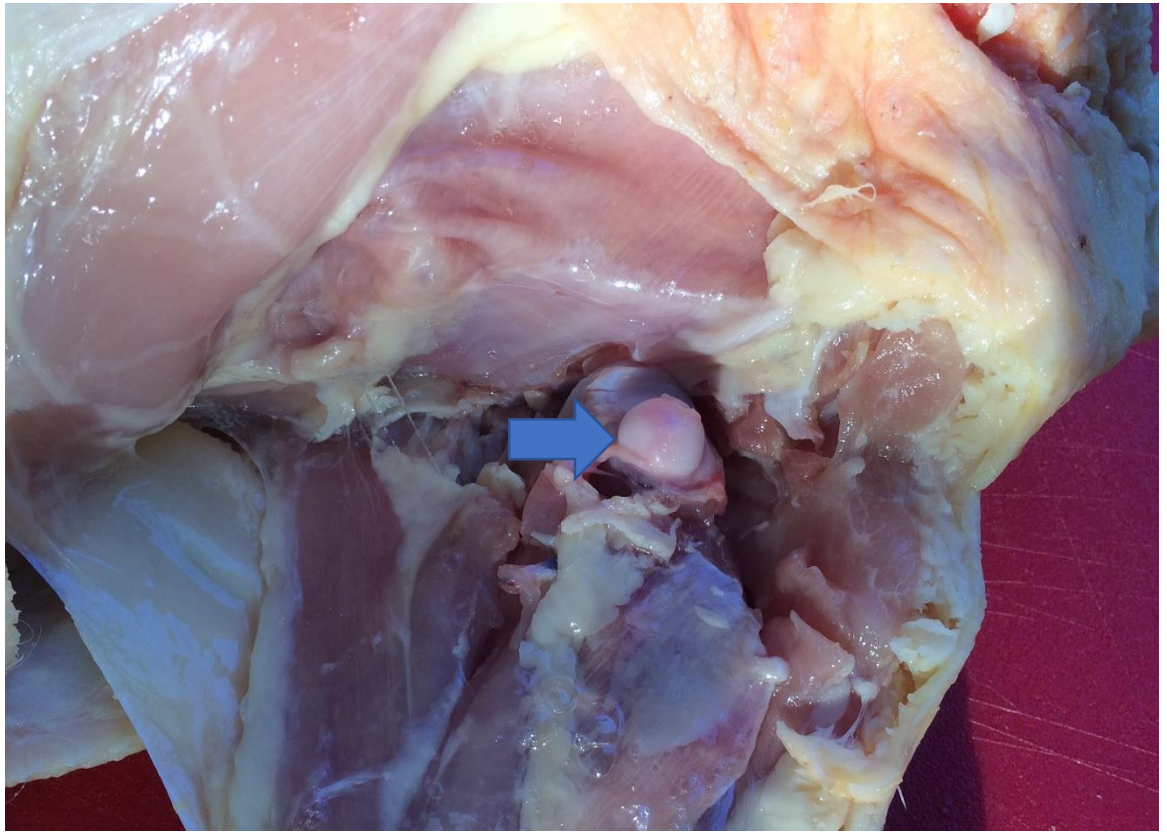
- Histologic assessment of testes can provide useful information for evaluations of fertility and hatchability
- Sertoli cell quantitation correlates well with measurements of **spermatogenesis, germinal epithelium and stromal area**
- Sertoli cell concentrations correlated well with **hatchability (fertility)**
- Sertoli cell numbers correlated with scores for **general body condition and footpad lesions**
- Age-associated changes in Sertoli cell concentrations correlated with scores for spermatogenesis and onset of puberty

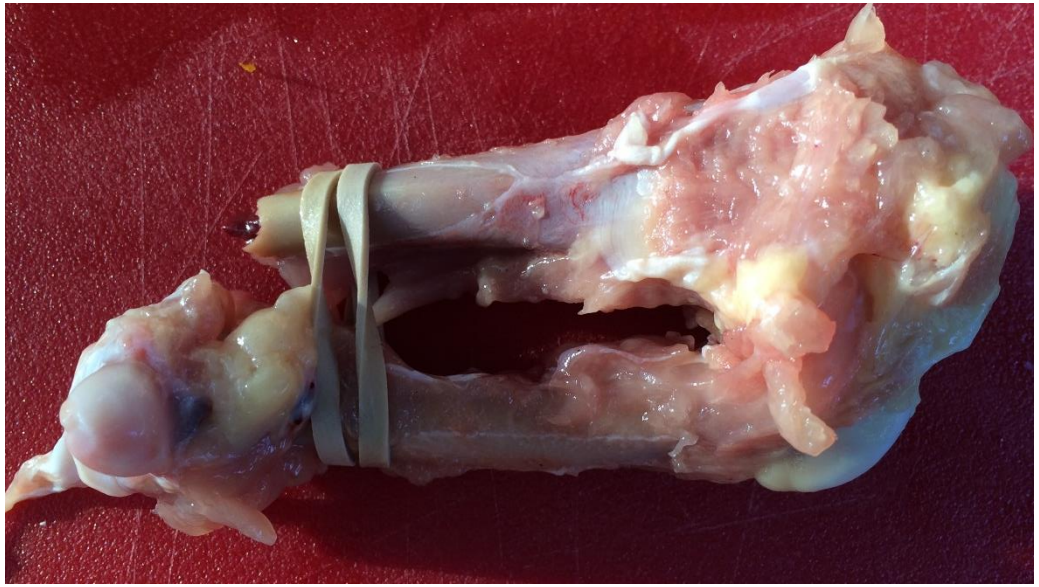
18.5 days hatchery to day 2 field

Skeletal Pathology Surveys

Do not pop the femoral head out of the joint. Palpate the hip joint, insert knife tip, and cut the ligament of the femoral head. Open joint with cartilage intact.

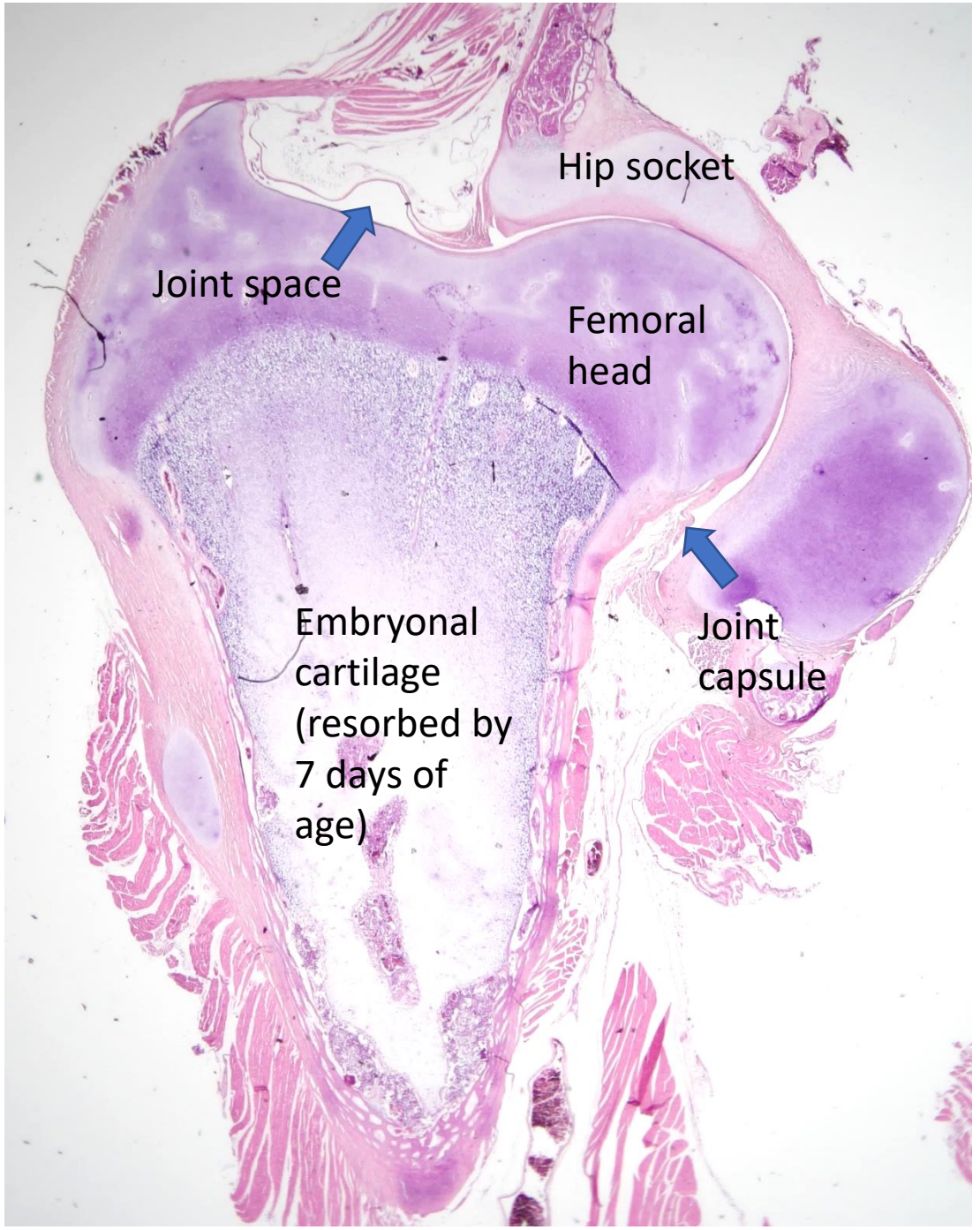




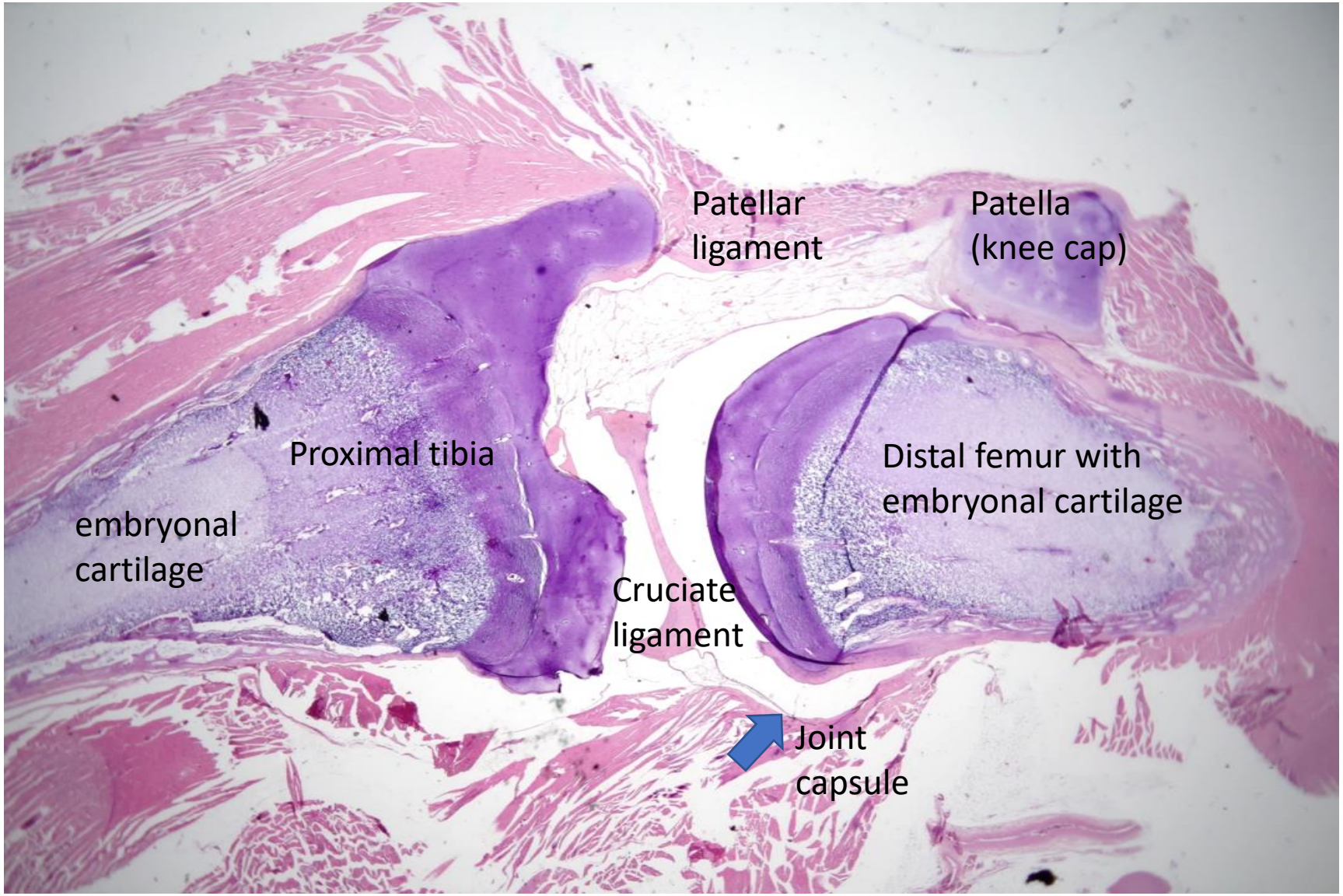


Fill to top with formalin, covering all bone tissue

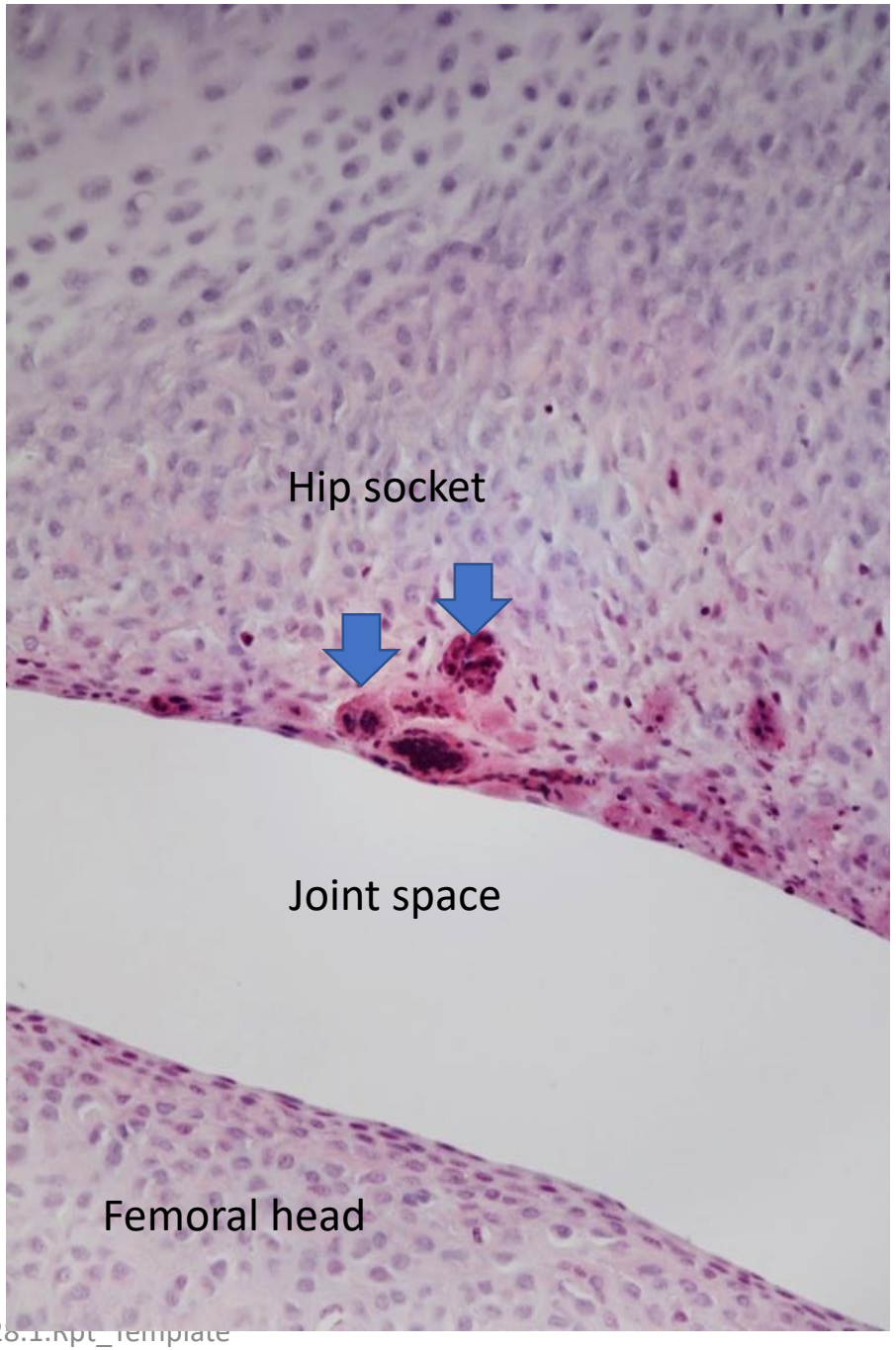
18.5 days, pre-in ovo, proximal femur and hip joint, provided for orientation.



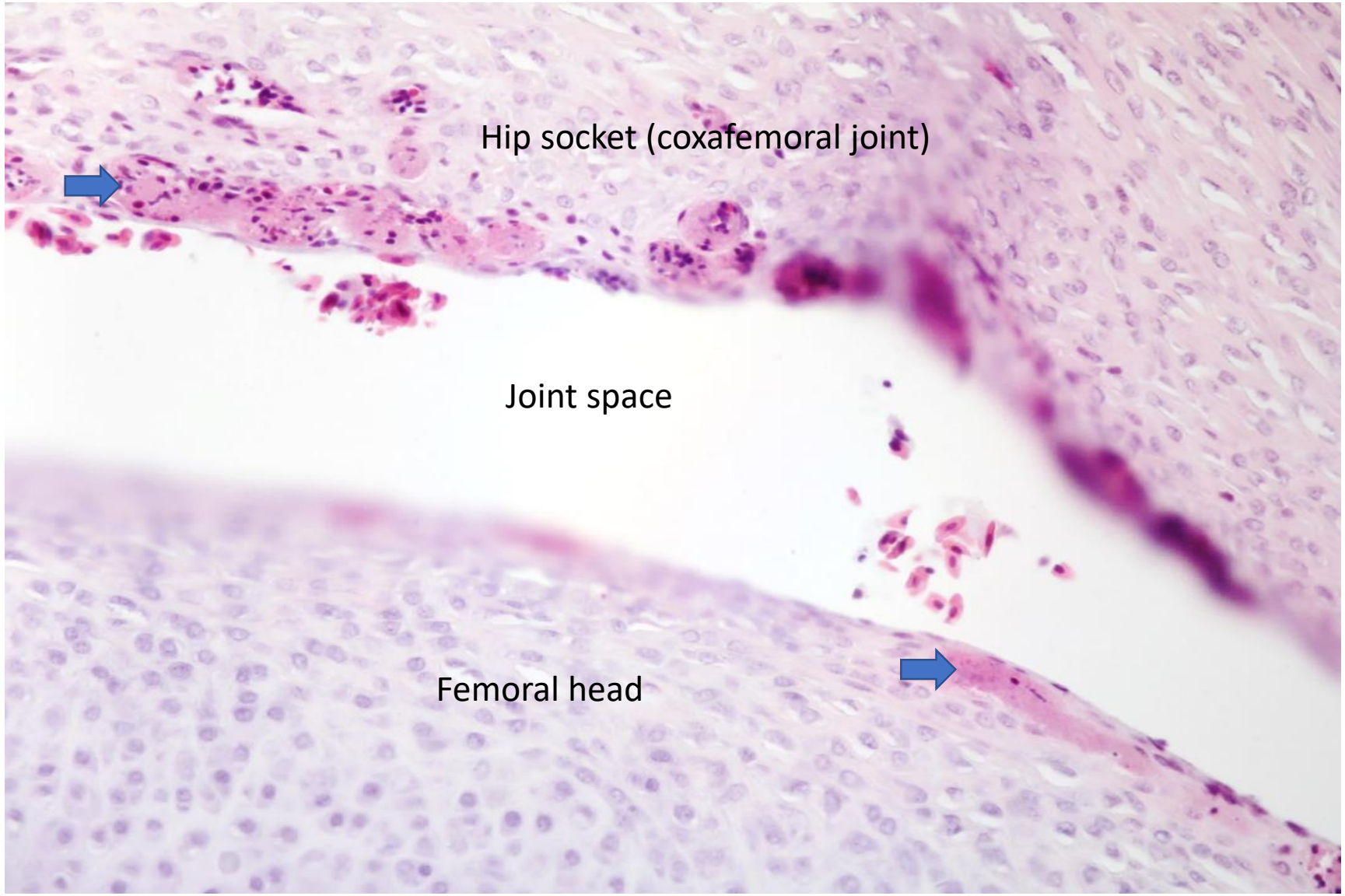
Knee (stifle), pre-*in ovo*. Photo provided for orientation.



Hip joint, 18.5 days, post in ovo, old parent flock.
The superficial blood vessels of the hip socket have many thrombi, consistent with pressure point lesion.
These thrombi represent blood stasis and could be a nidus for development of the bacterial infection, as well as causing mild deformation of the hip joint.

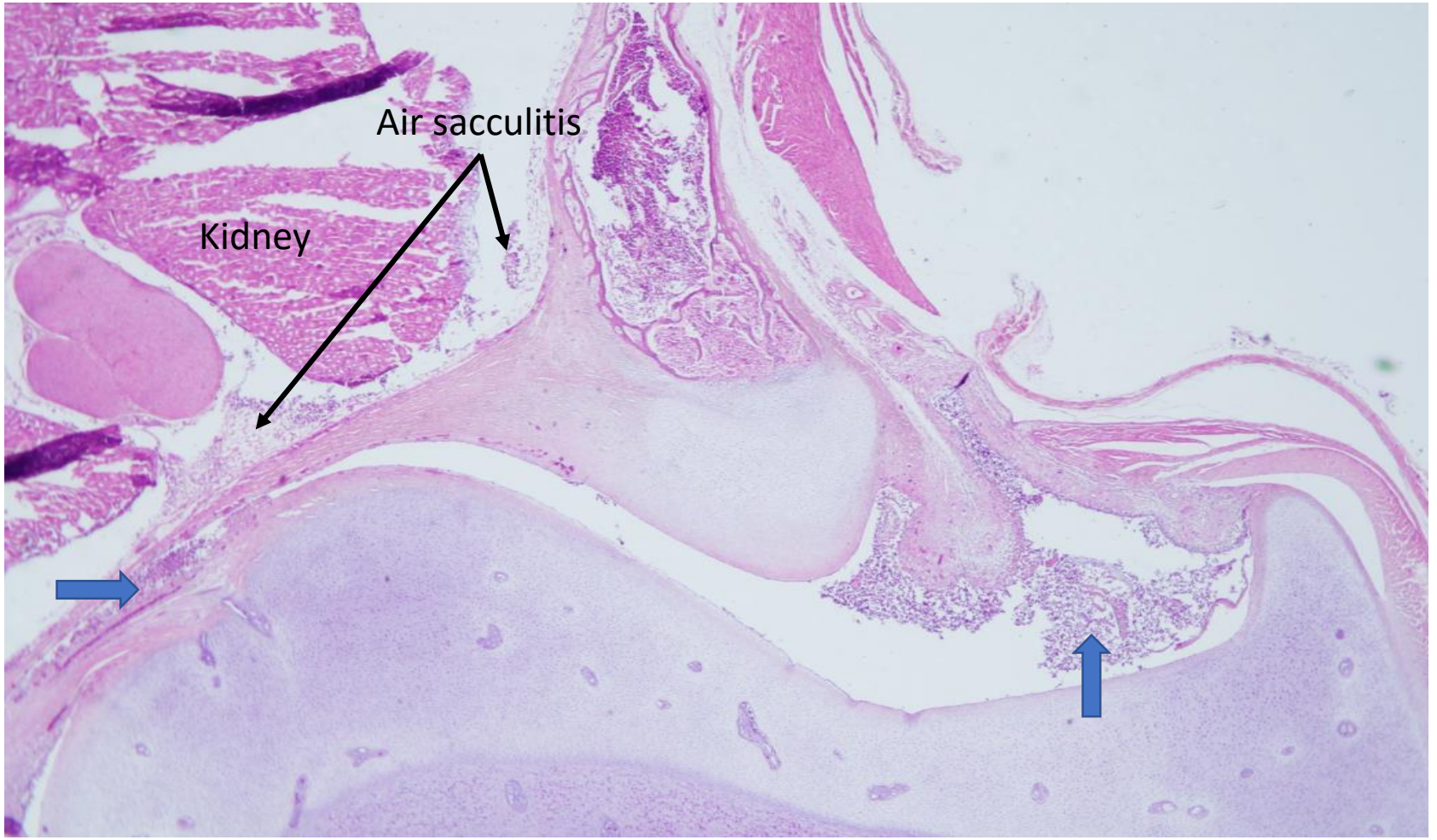


18.5 days, post in ovo, old parent flock. ***The hip socket in the femoral head both have numerous thrombi in superficial blood vessels***. This likely represents a pressure point causing blood stasis and thrombosis. This is potentially a nidus for bacterial localization and infection.

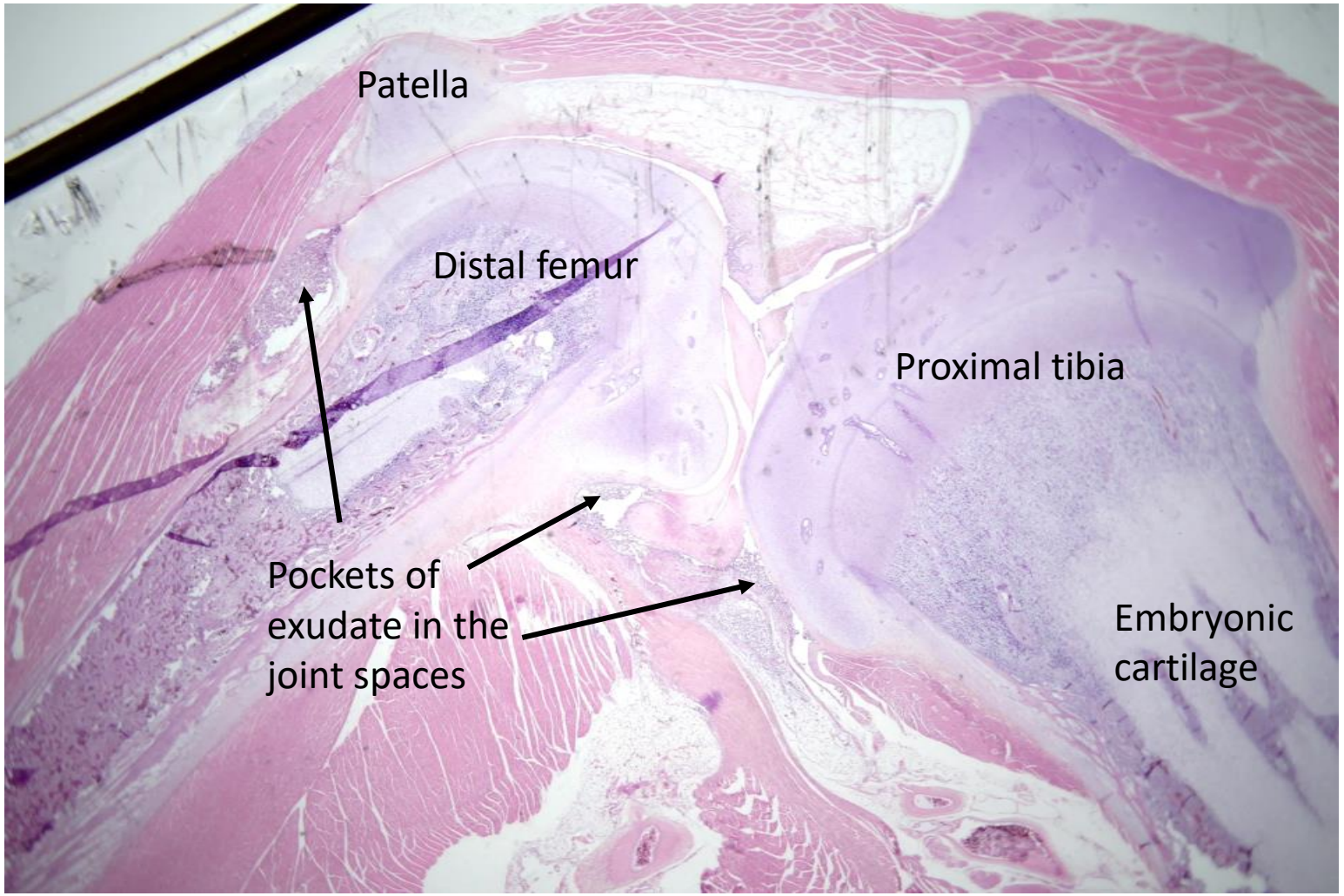


Day 3, lame broiler.
The joint capsule contains an irregular focus of mixed fibrin and heterophilic inflammation, indicative of acute arthritis, likely bacterial arthritis.

3 days of age, Lame chicken, hip joint. The hip joint has heterophilic inflammation (bacterial arthritis). Perirenal air sacs are also inflamed, suggestive of the source of bacterial infection being via respiratory route.

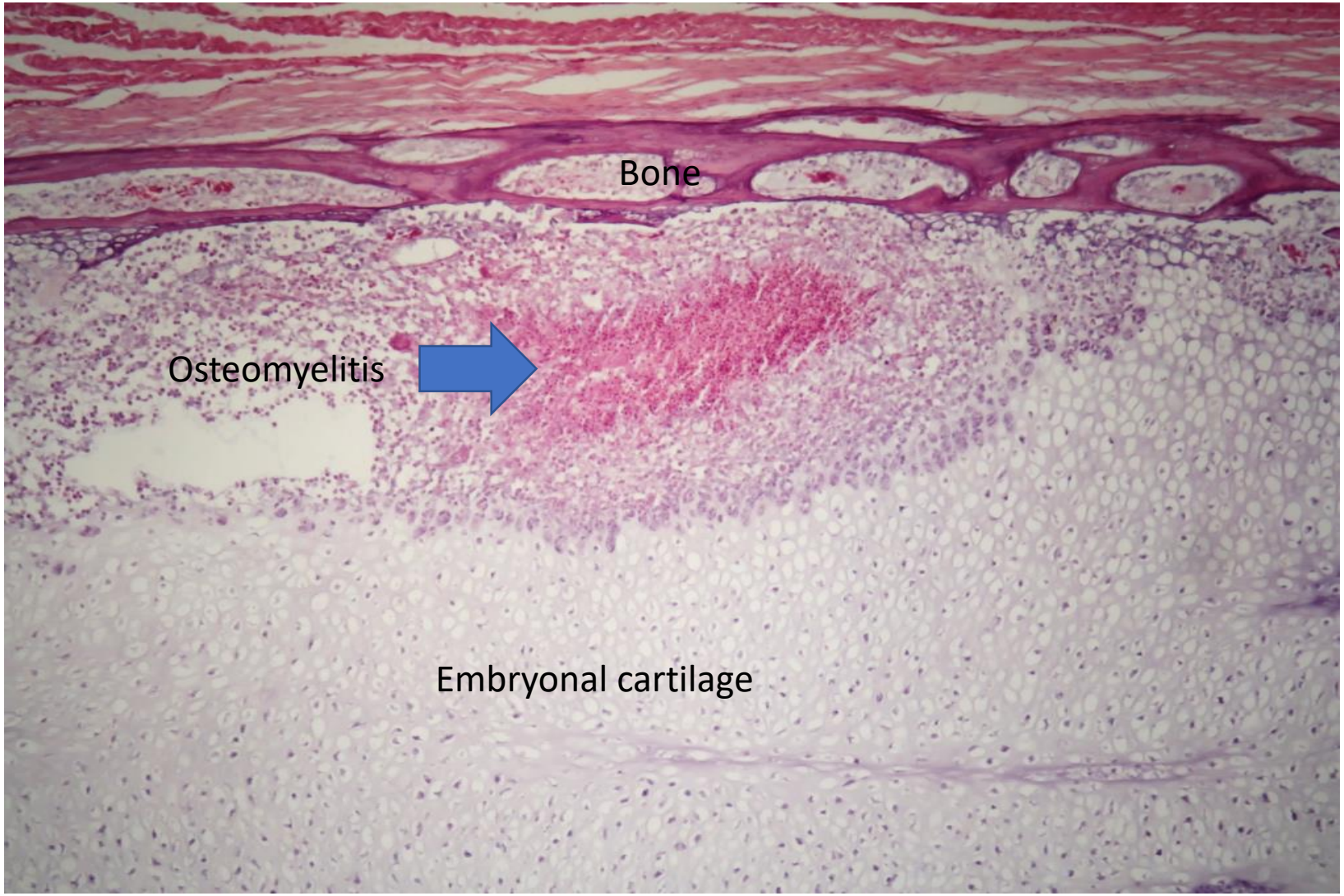


Stifle joint, lame chicken. 2 pockets of exudate in the present in the joint. Higher magnification reveals the exudate to be predominately heterophils, consistent with bacterial arthritis.



#6, lame chicken, 3 days of age. The midshaft femur contains a focus of osteomyelitis, located between diaphyseal bone the embryonal cartilage. ***This is bacterial osteomyelitis***.

FJH: Pre-existing at the time of euthanasia



Hatchery - Percentage with Lesions

- Intermittant evidence of inflammation at 18.5 days of incubation through hatch
- Bacterial osteomyelitis at 5 and 8 days

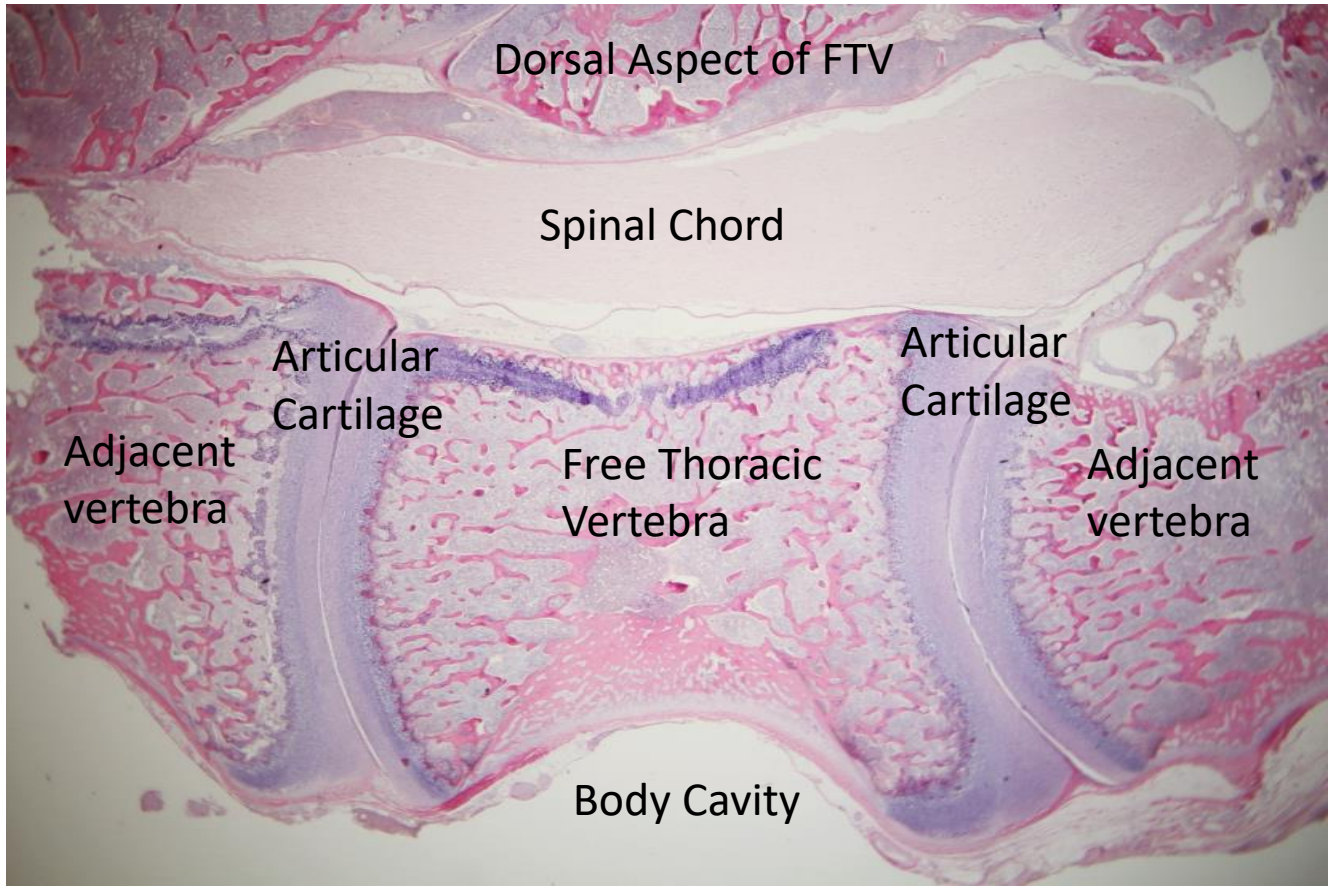
			Legs			Vertebrae
Case	Age	Stage in Hatchery/Grow Out	Inflam	Fx/FCD	Osteo-chondrosis	Inflam - Fx/FCD/OC
31135	18.5dE	Pre In-ovo 2059	5	5	0	0
31136	18.5dE	Pre In-ovo 5225	10	0	0	0
31137	18.5dE	Post In-ovo 2059	10	0	10	0
31138	18.5dE	Post In-ovo 5225	15	5	5	0
31139	18.5dE	Pre In-ovo-Problem 5368	0	0	0	0
31140	0d	Pre Pull/Process-young 2059	0	0	0	0
31141	0d	Pre Pull/Process-Hot Chicks 2059	0	0	0	0
31142	0d	Pre Pull/Process-Spines/Back 2059	NA	NA	NA	0
31143	0d	Pre Pull/Process-old 5225	0	0	0	0
31144	0d	Pre Pull/Process-Spines/Back old 5225	NA	NA	NA	0
31145	0d	Post Process-young 2059 Line A	0	0	0	0
31146	0d	Post Process-young 2059 Line B	10	0	0	0
31147	0d	Post-Process-Spines/Back young 2059 Line A	NA	NA	NA	0
31148	0d	Post-Process-Spines/Back young 2059 Line B	NA	NA	NA	0
31149	0d	Post Process-old 5225 Line A	10	0	0	0
31150	0d	Post Process-old 5225 Line B	0	0	0	0
31151	0d	Post-Process-Spines/Back old 5225 Line A	NA	NA	NA	0
31152	0d	Post-Process-Spines/Back old 5225 Line B	NA	NA	NA	0
31153	0d	Pre Process-Normal Muscle Color; Hot Temps 4380	0	0	0	NA
31154	0d	Pre Process-Red Muscle Color; Normal Temps 2060	0	0	0	0
31155	0d	Post Placement-young 2059	0	0	0	0
31156	0d	Post Placement-old 5225	5	5	0	0
31157	5	Asbill Farm-normal H1&H2	0	5	0	0
31158	5	Asbill Farm-Lame H1 & H2	20	0	0	NA
31159	8	Canoy Farm-normal H1&H2	0	0	0	NA
31160	8	Canoy Farm-lame H1&H2	44	0	0	NA

Histologically aseptic lesions in the free thoracic vertebra

Survey of broilers 22 to 43 days of age

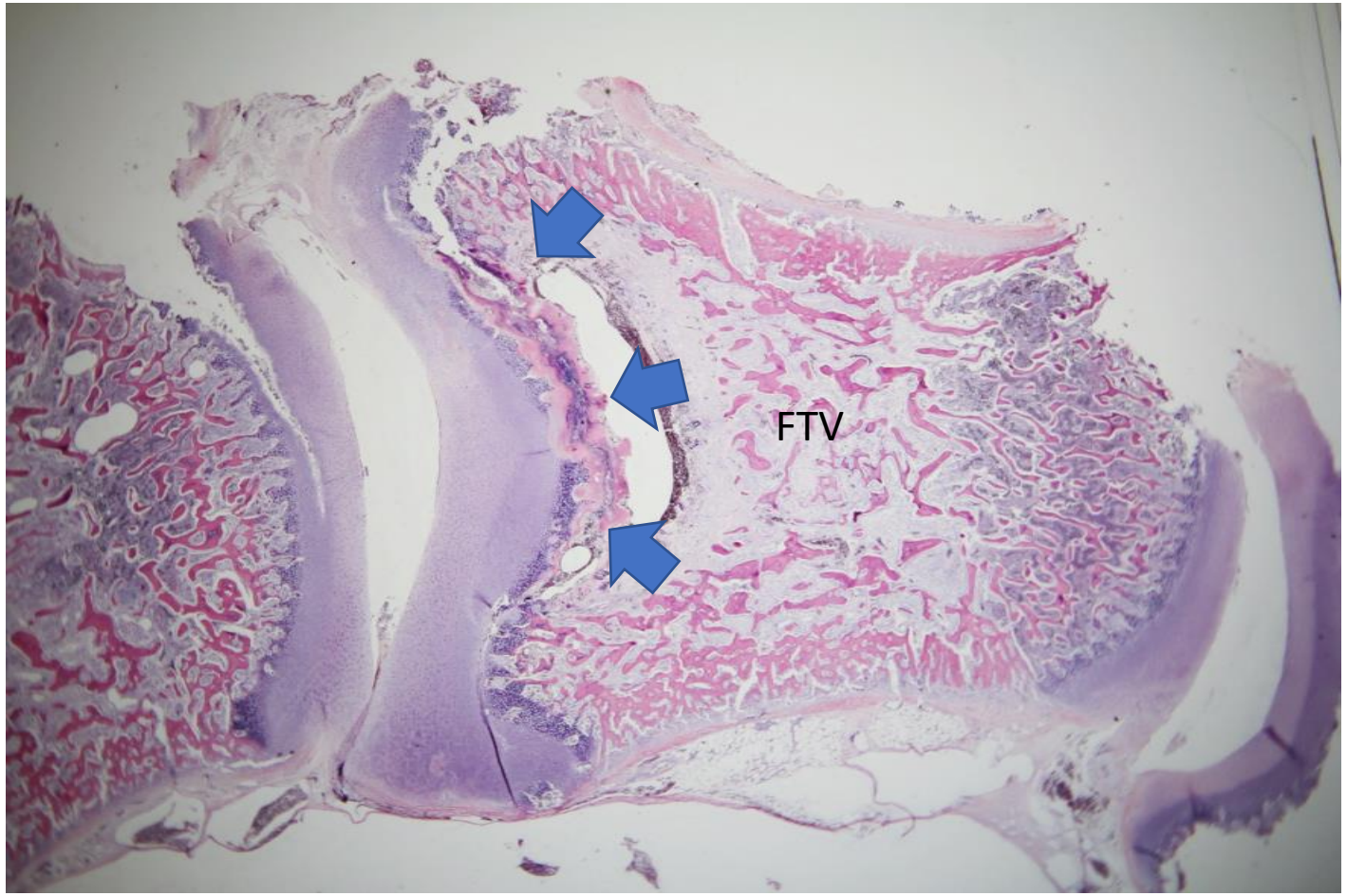
Normal Anatomy, 22 days

Free thoracic vertebra



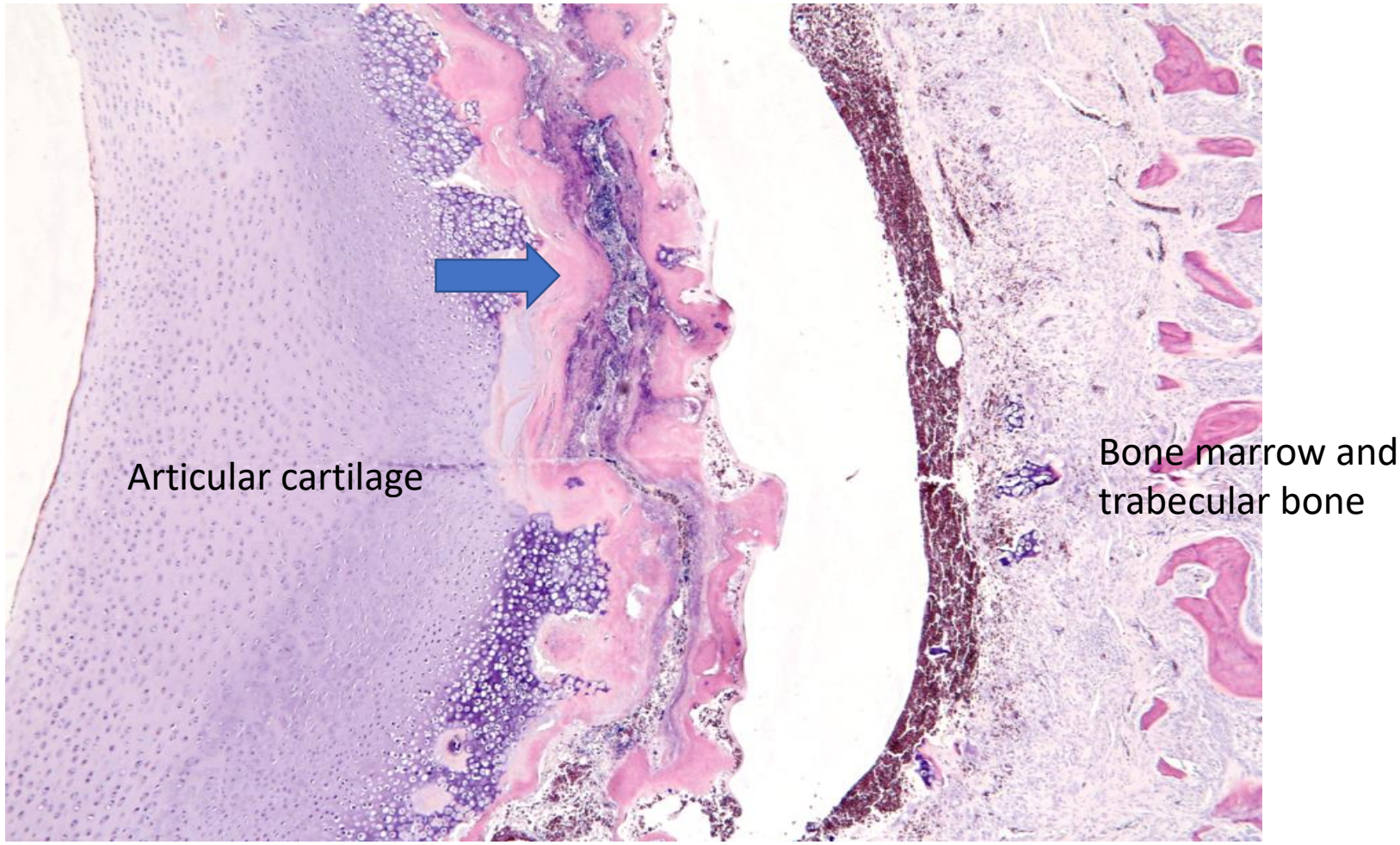
Broiler, 28 days, subchondral fracture in FTV

This fracture site and pattern is consistent with a ***compression fracture***. Neither bacteria nor heterophilic inflammation were present in the lesion, only ***chronic blood clots with more acute hemorrhage***. This was the most common site for these fractures, both in the FTV and the adjacent vertebrae



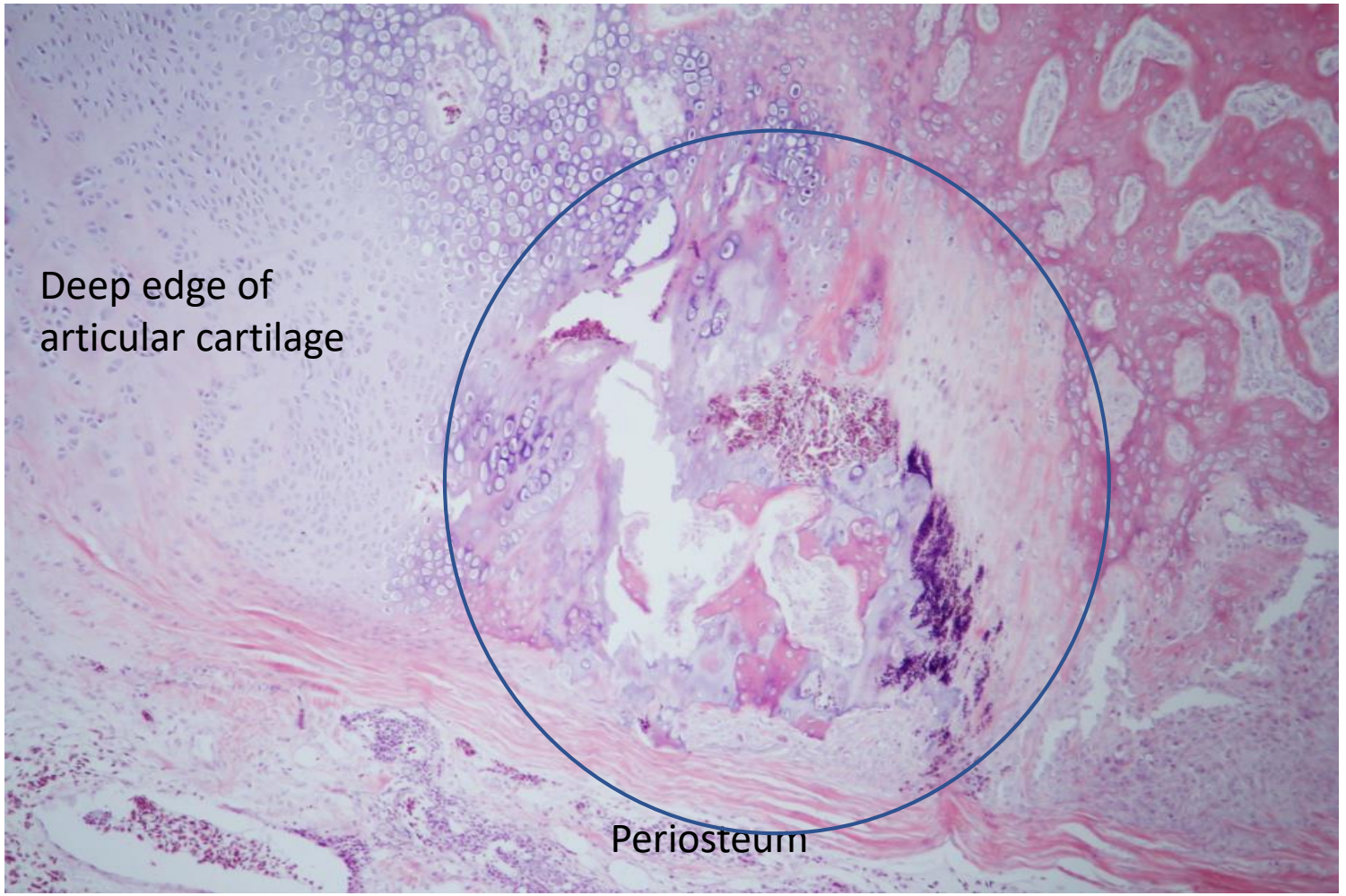
Broiler, 28 days, subchondral fracture in FTV, higher magnification

This fracture located below the articular cartilage has fibrin and degenerated erythrocytes, but lacks bacteria and heterophil inflammation, typical of a bacterial infection. The fracture occurred in a clinically normal bird. ***This area of blood stasis may be a predisposing site for bacterial infection.***



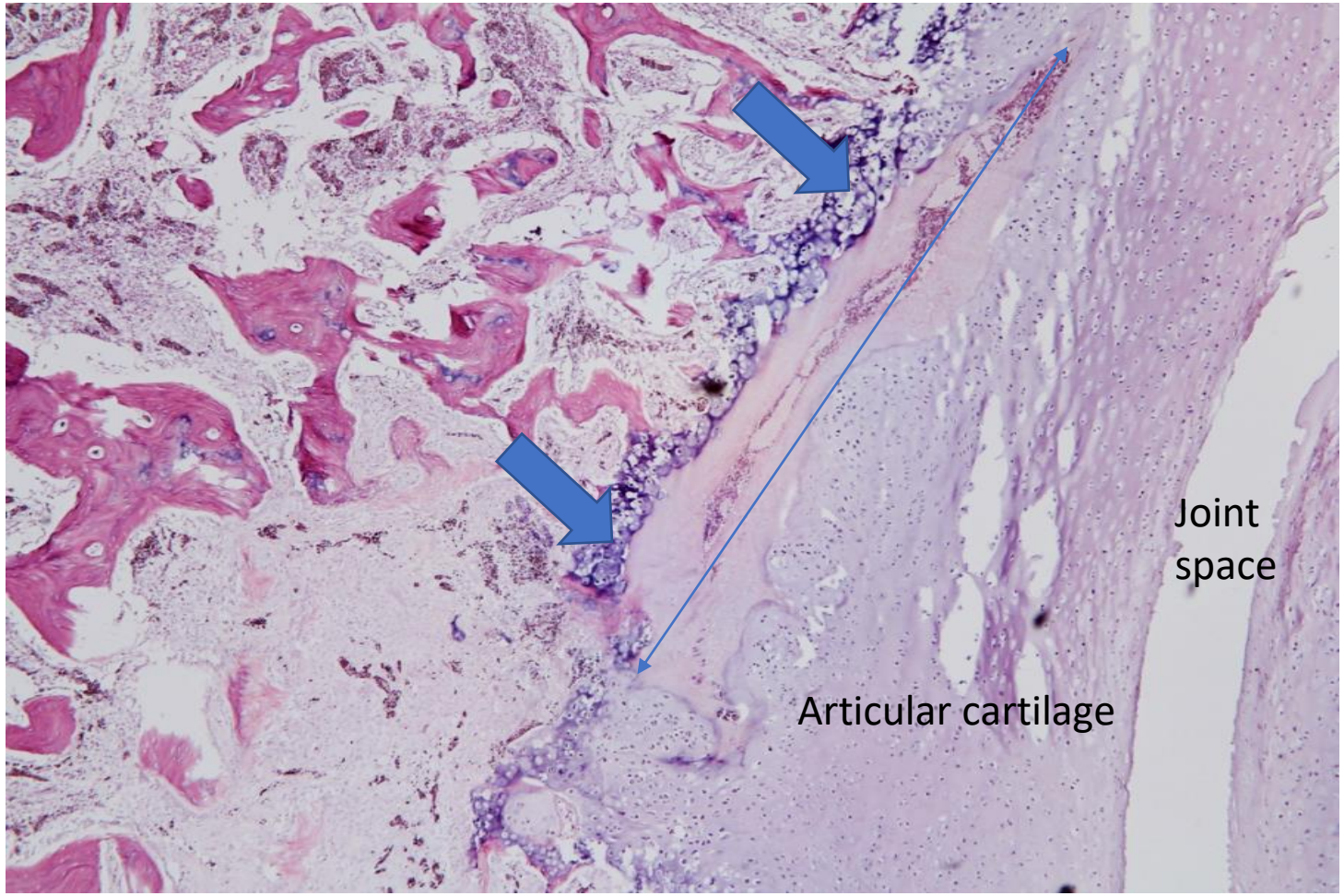
Broiler, 36 days, subchondral fracture at outer edge of FTV,

Another fracture, consistent with a focal compression fracture, between the articular cartilage of FTV and the periosteum (likely the corner of the FTV). There is blood clot, fractured bone trabeculae, pale necrotic bone, and ***blood clot in the circled fracture site.*** This is likely a sterile lesion.



Broiler, 43 days, subchondral fracture in FTV

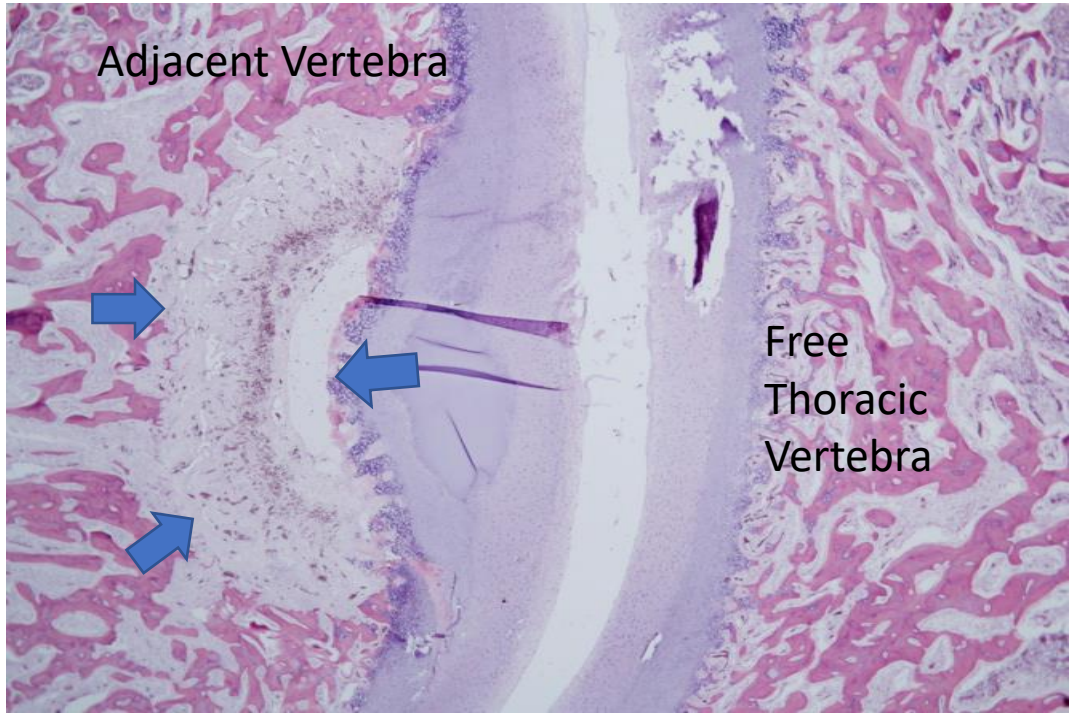
Linear fracture under the midbody articular cartilage of the FTV. Linear separation of the cartilage from the underlying trabecular bone. Neither bacteria nor a septic inflammatory response are present; ***likely a sterile lesion but with potential to become septic due to vascular disruption.***



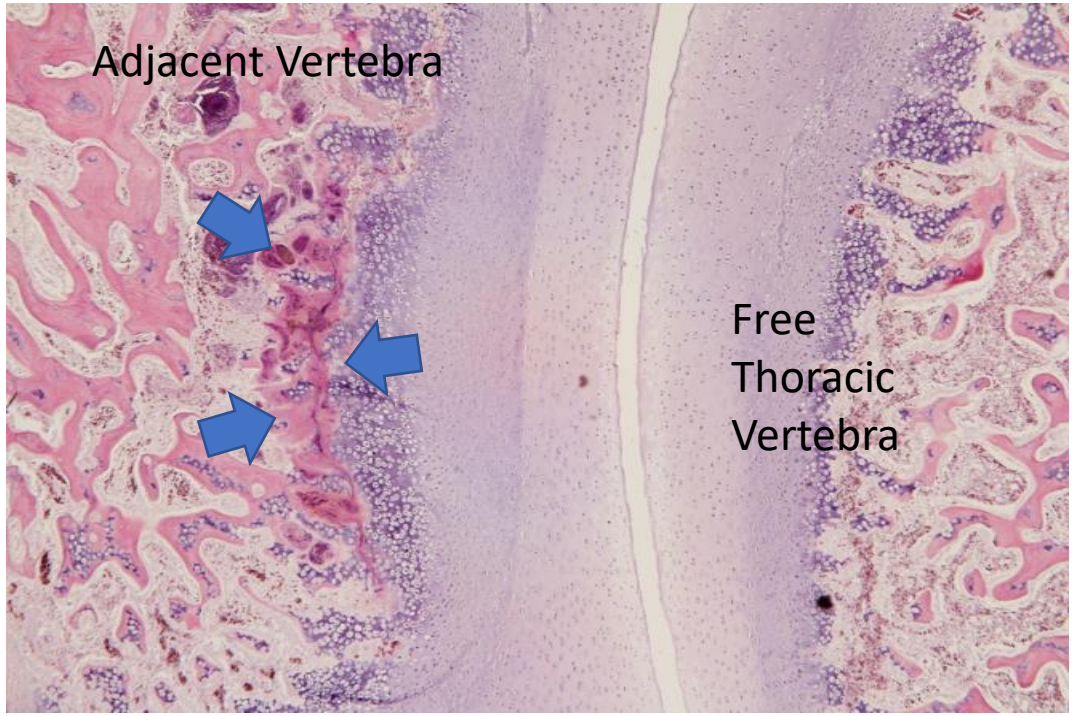
Broiler, 22 days, microfracture in FTV

A small fracture site is composed of clotted fibrin and degenerated erythrocytes, surrounded by fibroplasia (early callus formation). Bacteria were not observed.

Broiler, 36 days, subchondral fractures of vertebrae adjacent to FTV



Separation of articular cartilage from subchondral bone, with hemorrhage and zone of fibroplasia.



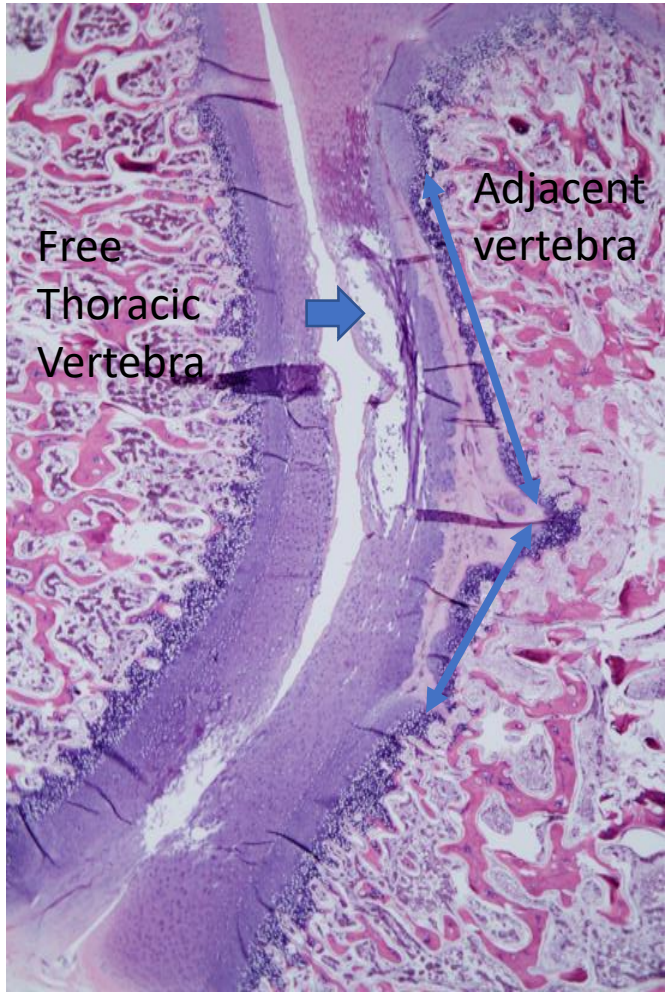
Acute subchondral fracture, consistent with compression fracture, ***with accumulation of clotted blood.***

Broiler, 43 days, fracture of articular process and ligament attachment site, dorsal aspect of FTV

This vertebral attachment site of a ligament has a fractured tip. There is necrotic bone, ***clotted blood,*** and early fibroplasia (callus). This vertebra is either the FTV or an adjacent vertebra.

Broiler, 43 days, linear fracture of the articular cartilage of adjacent bacteria

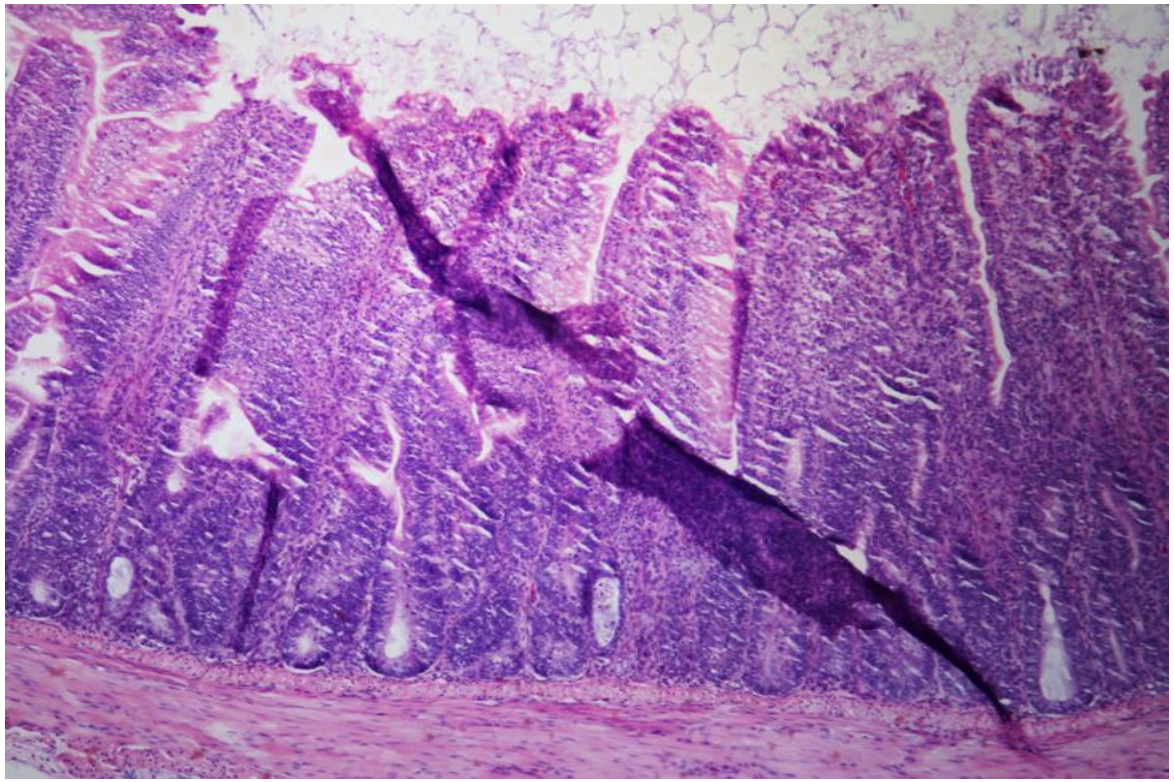
This vertebra has a linear fracture and separation of articular cartilage. ***The cleft is filled with fibrin and clotted blood.*** The overlying cartilage (arrow) is discontinuous and fibrillated. This is consistent with a compression injury.

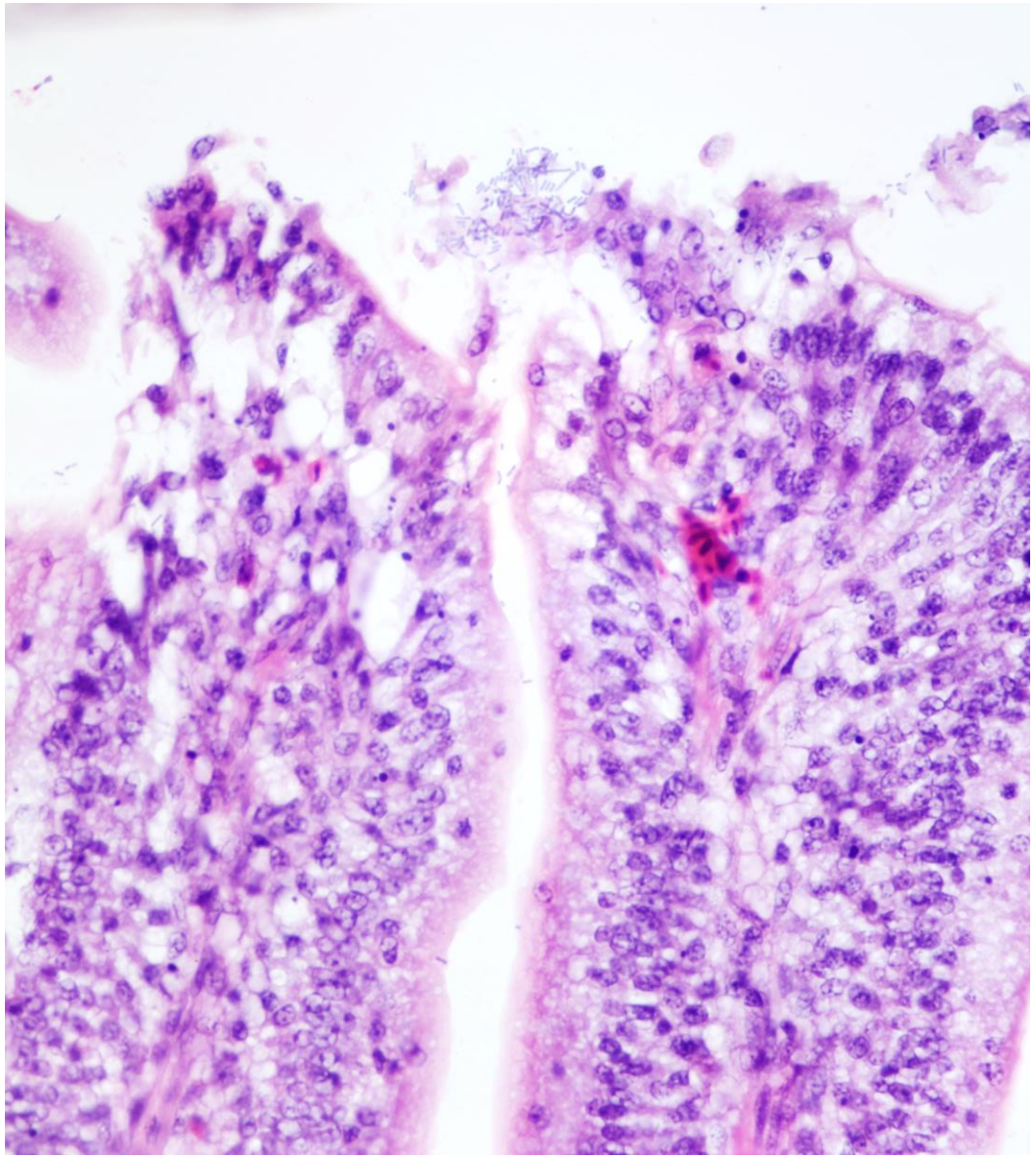


Potential sources of bacteria in the systemic circulation

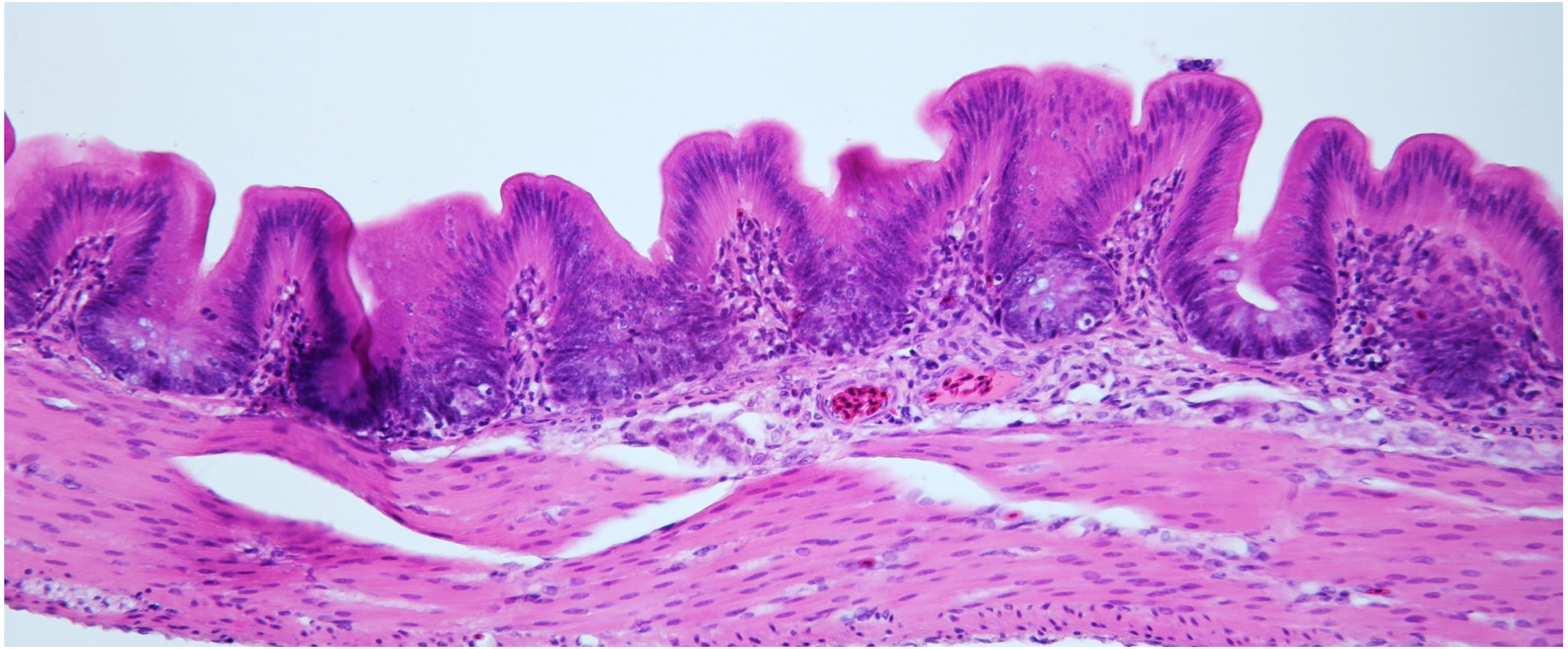
Capable of lodging in lesions with blood stasis in the free thoracic vertebra

RSS, dysbacteriosis and damaged tips of villi

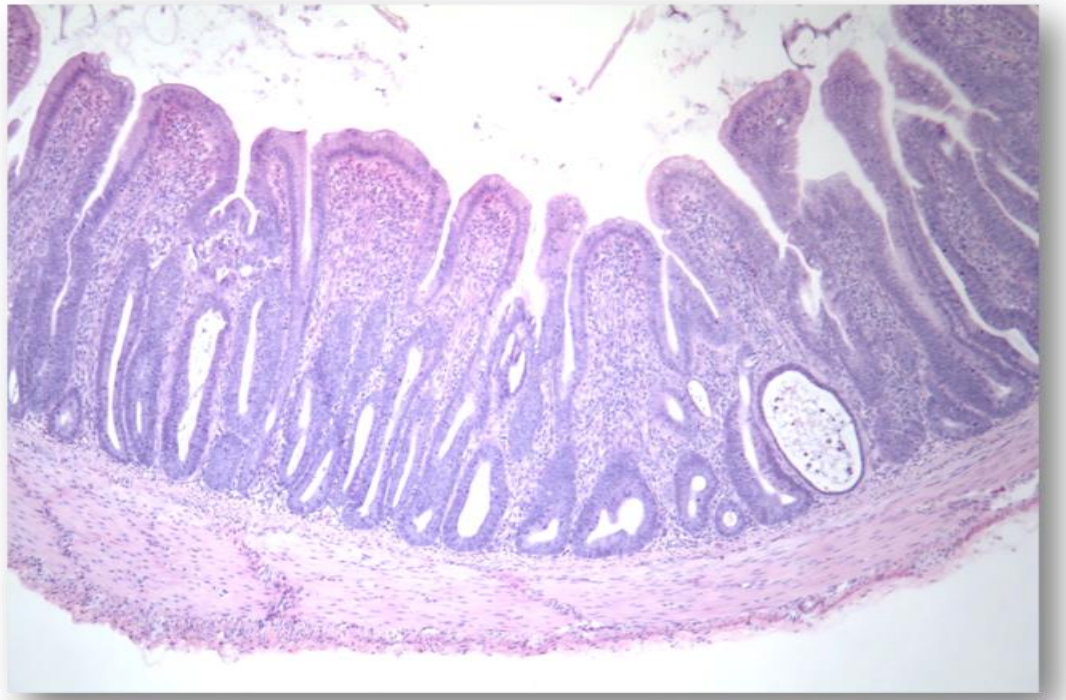




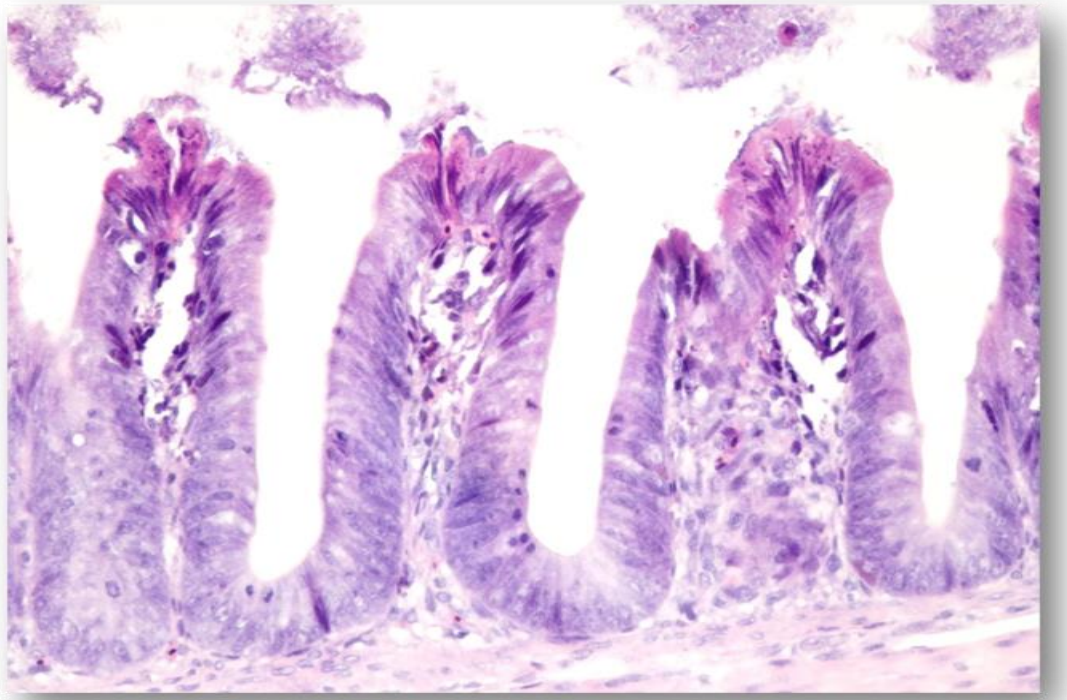
Normal cecum



Viral enteritis and cecal dysbacteriosis



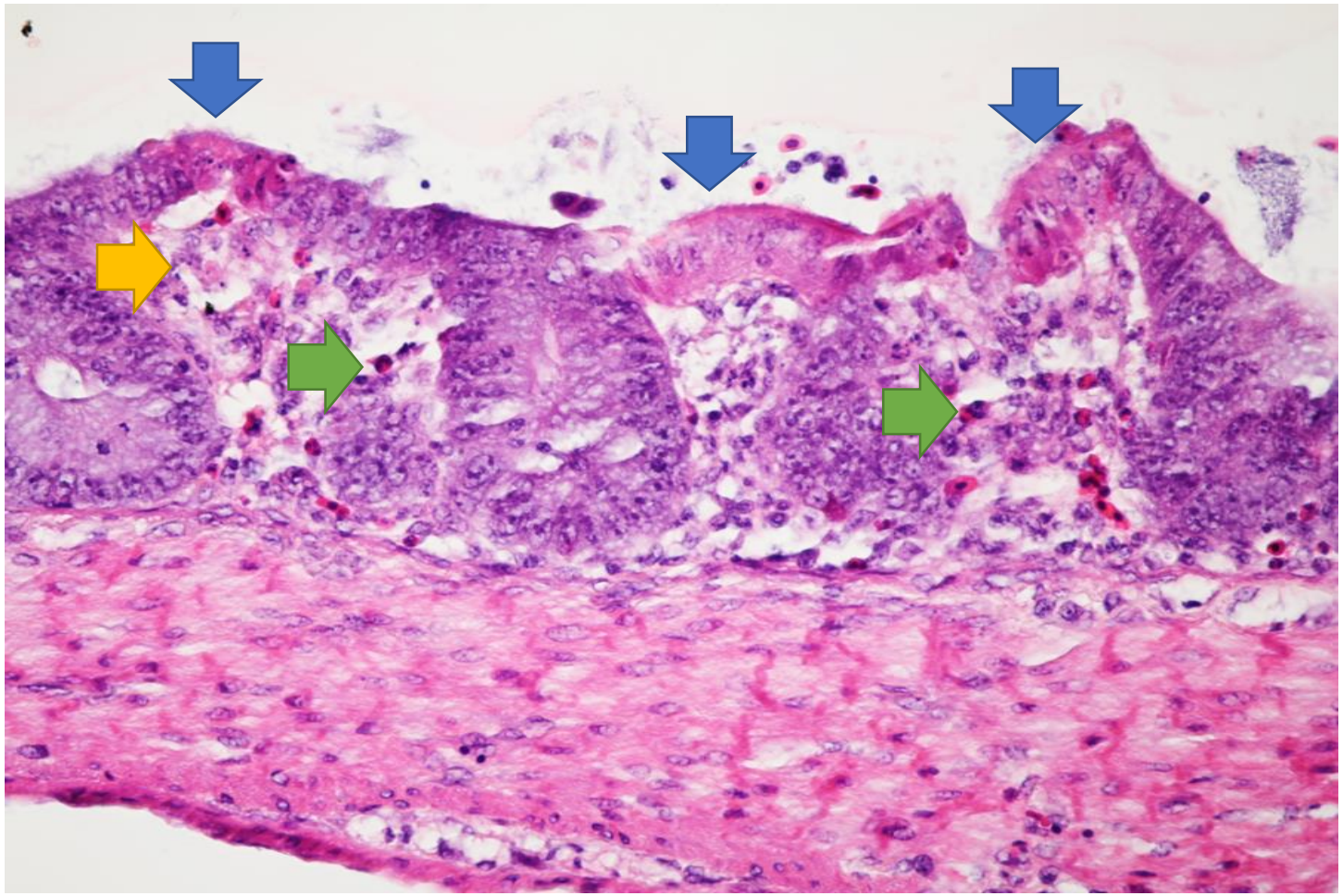
Midgut



Cecum

Cecum, apoptosis, heterophis, and degeneration of epithelial covering

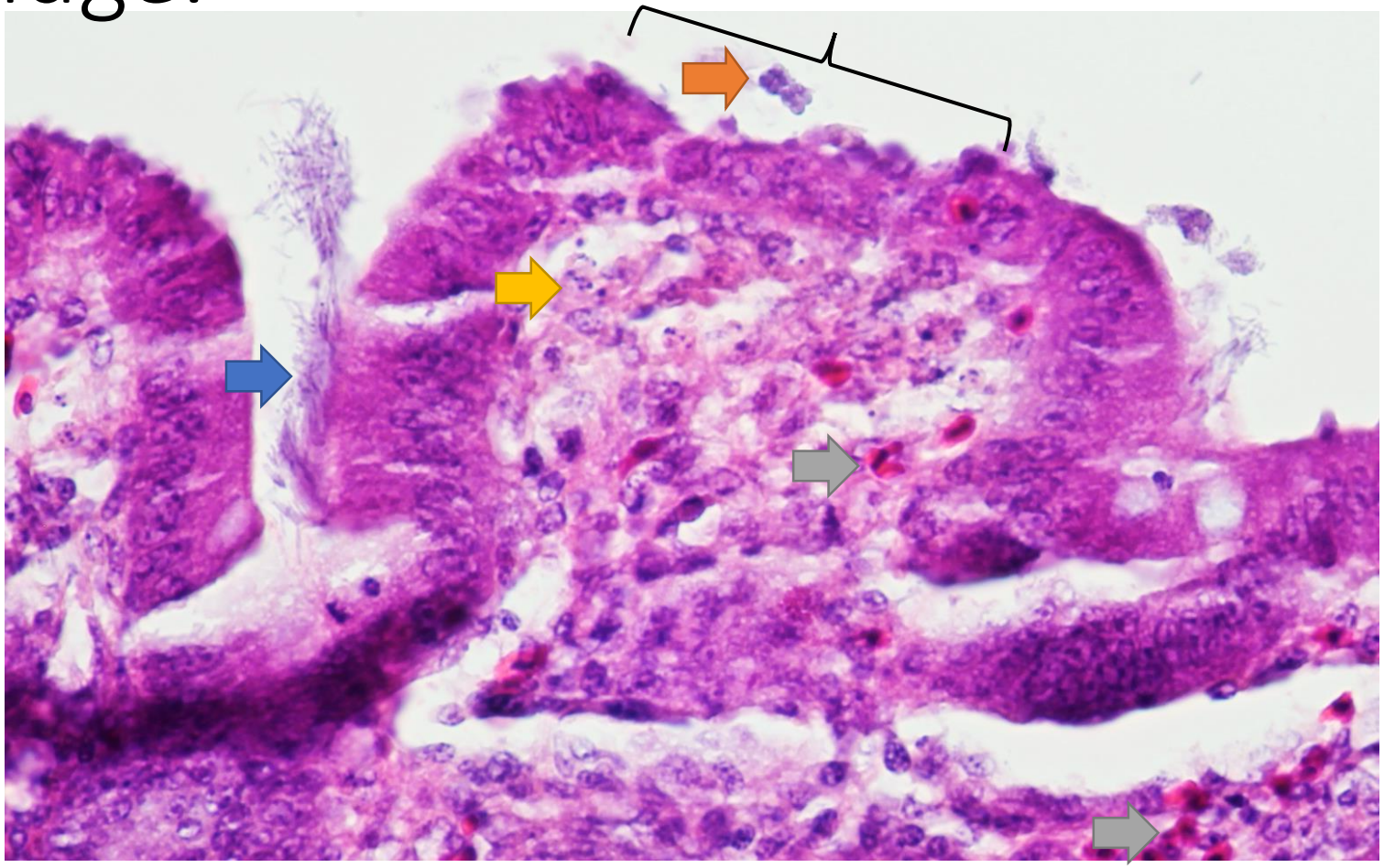
Blue: Apoptosis/necrosis of epithelium on mucosal ridge
Yellow: apoptosis of lamina propria
Green: heterophils in LP



Cecum, digitally magnified, erosion/ulceration of the mucosal ridge.

- Blue: adherent bacterial rods
- Black bracket: erosion of the mucosal ridge
- Orange: *Sarcina* sp. Bacteria
- Yellow: apoptosis in the lamina propria supporting the mucosal ridge
- Gray: Heterophils

Breach in intestinal integrity.



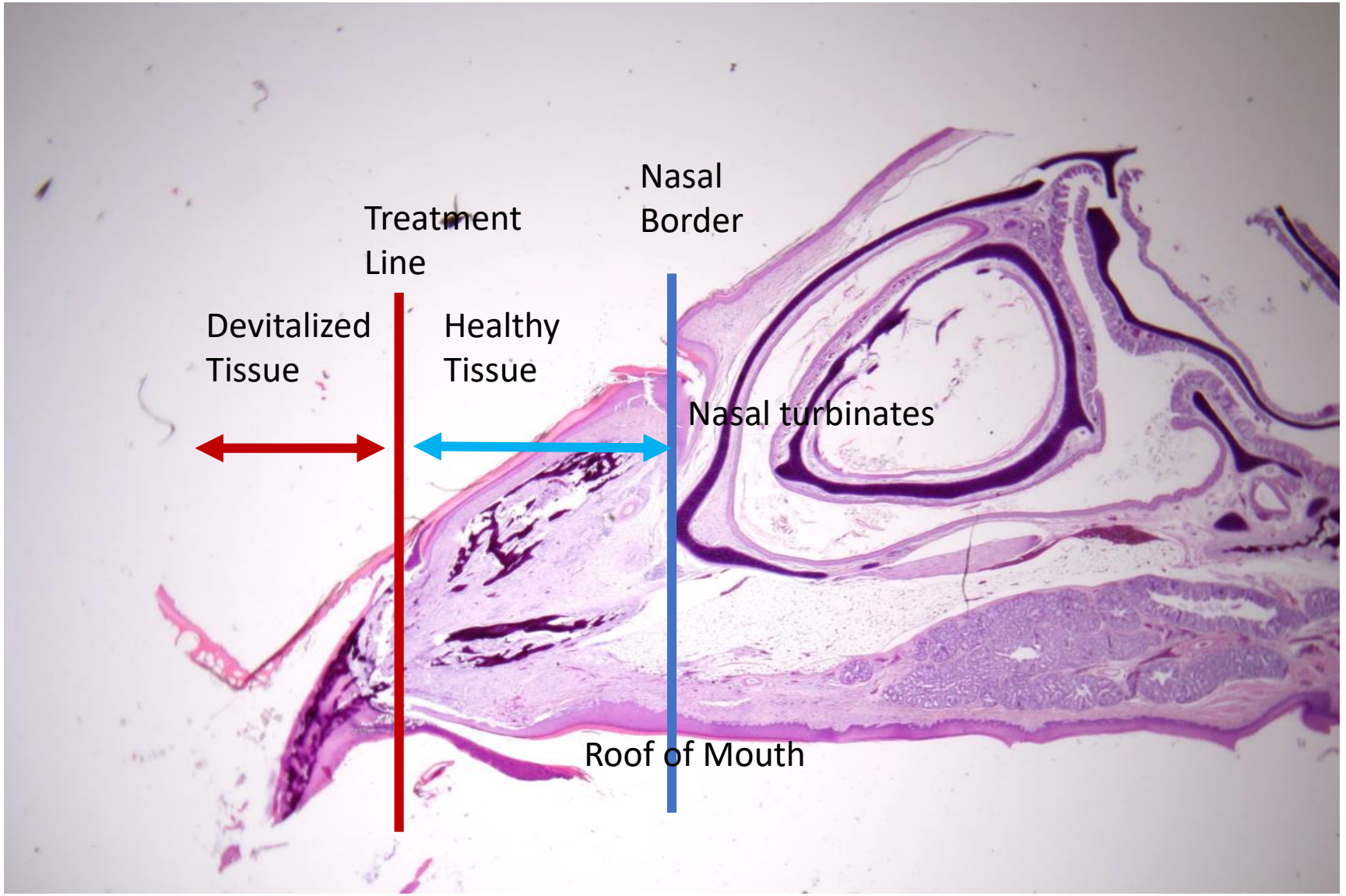
Vertebral Osteomyelitis

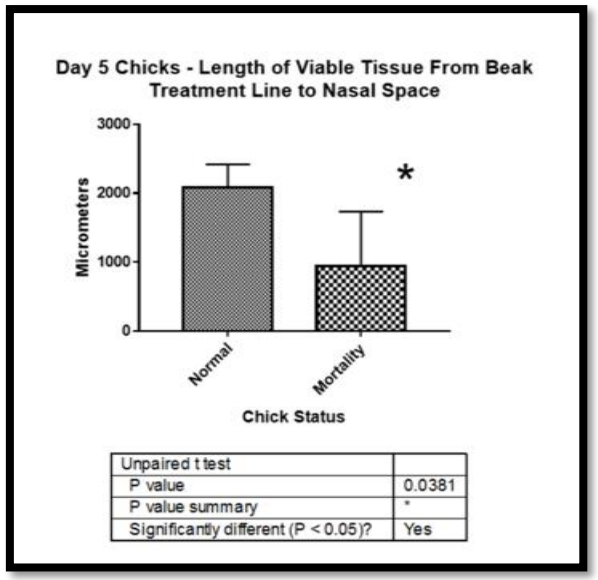
- *Enterococcus cecorum* and other bacteria
  - Primary bacterial disease or more complex pathogenesis
  - Free thoracic vertebra is subject to trauma
- Trauma lesions are initially aseptic (histologically)
- Gut lesions with breached mucosal integrity are common
  - Small gut tips of villi
  - Cecum, eroded and ulcerated mucosal ridges
- Vertebral trauma lesion are suggestive of complex pathogenesis
  - Trauma (or osteochondrosis), gut leakage of bacteria, bacterial entrapment in slowed vascular flow at site of trauma

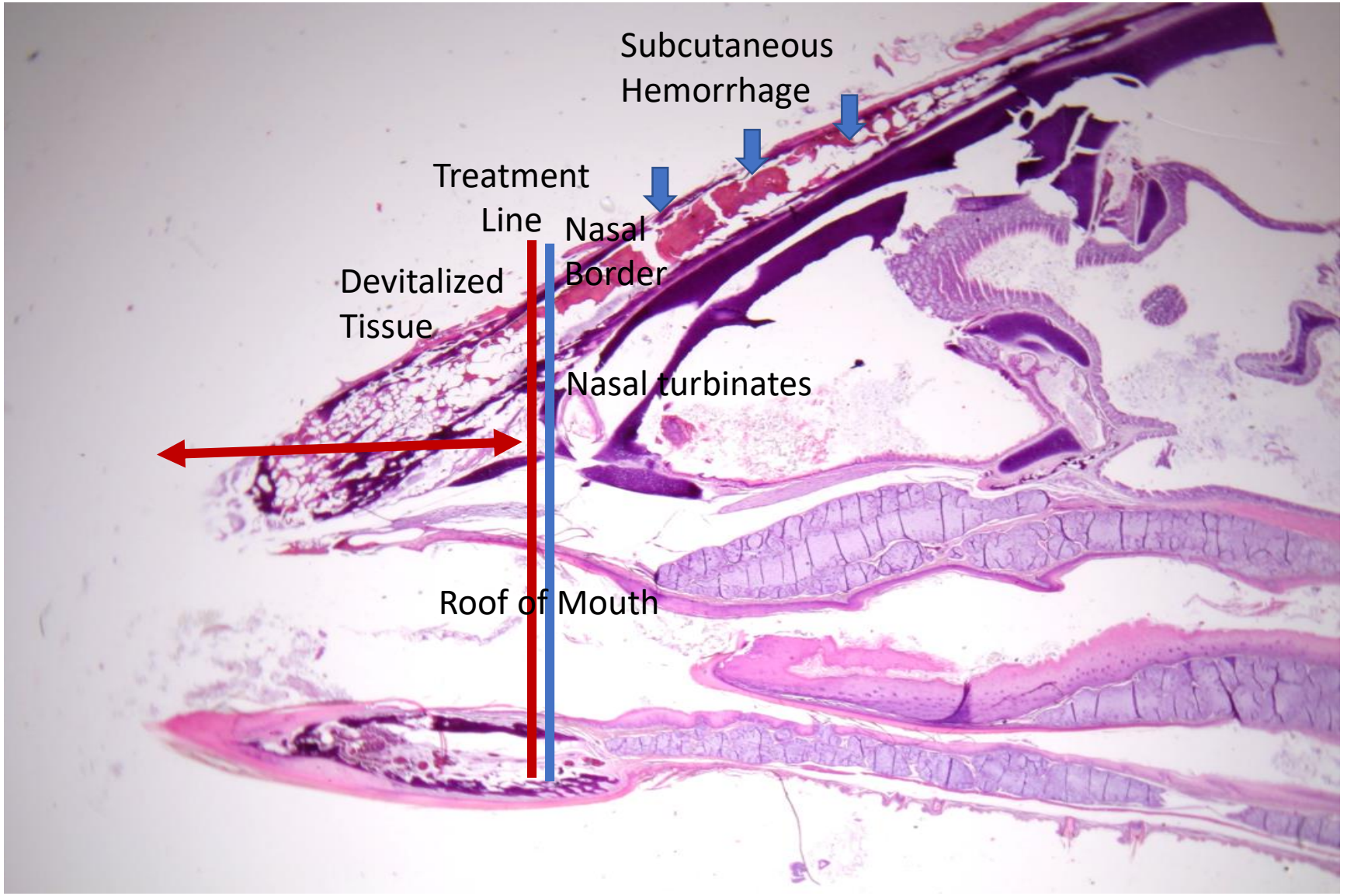
Beak Conditioning Histopathology

Method

- Beaks from starve-out layer pullets at 4 days compared to normal pullets at 4 days of age
- Head sectioned through the median plane and routinely processed for histopathology
- Representative heads with intact components photographed at 12.5x magnification




Day 5 Chicks - Length of Viable Tissue From Beak Treatment Line to Nasal Space
3000
2000
1000
0
Micrometers
*
Normal
Mortality
Chick Status
Unpaired t test
P value
0.0381
P value summary
*
Significantly different (P < 0.05)?
Yes

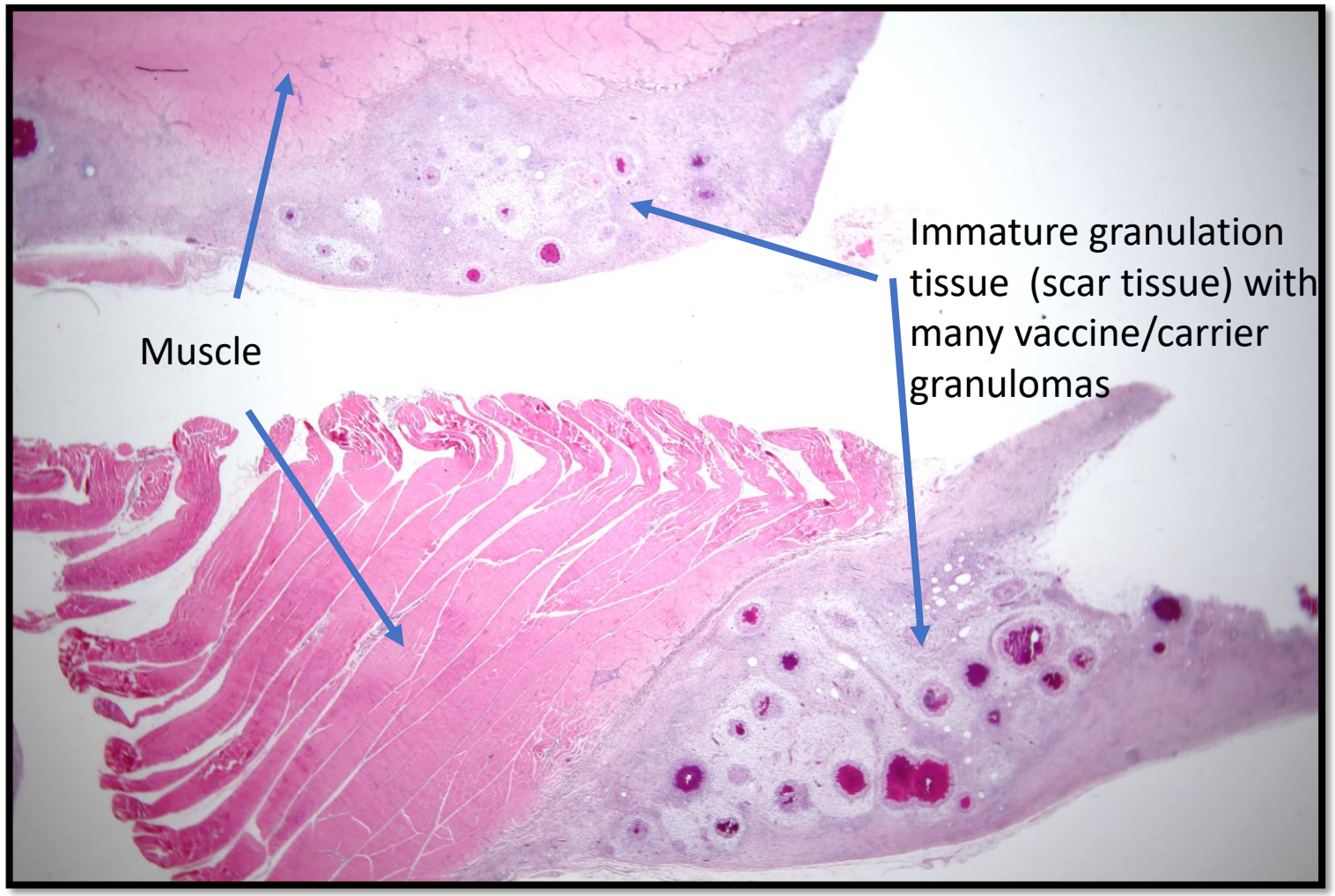

Subcutaneous Hemorrhage
Treatment Line
Nasal Border
Devitalized Tissue
Nasal turbinates
Roof of Mouth

Inactivated bacterial vaccine reactions

Breeder pullets, 8 weeks

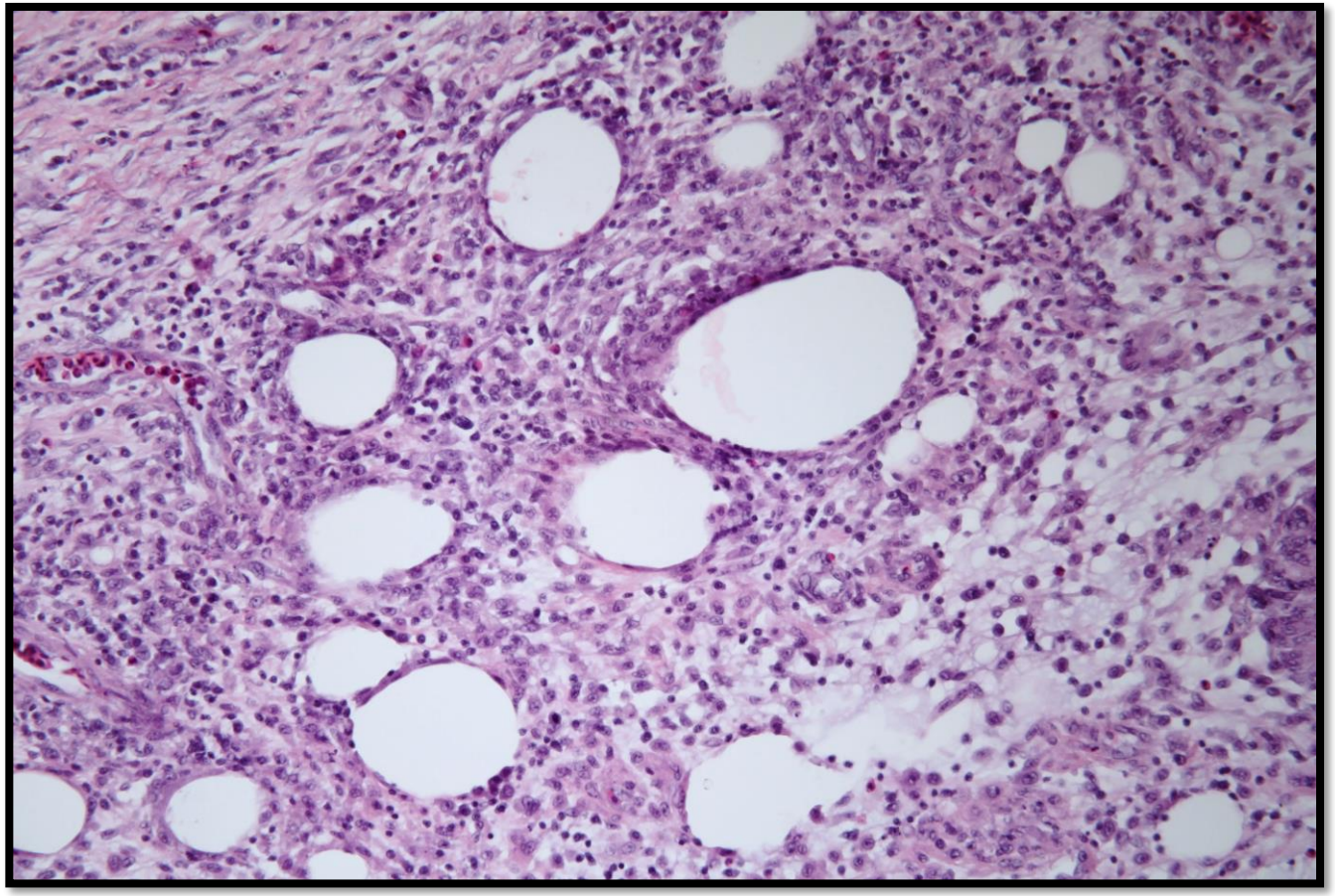
- Excessive reaction to vaccine presumed
- No additional information

Lesion Overview



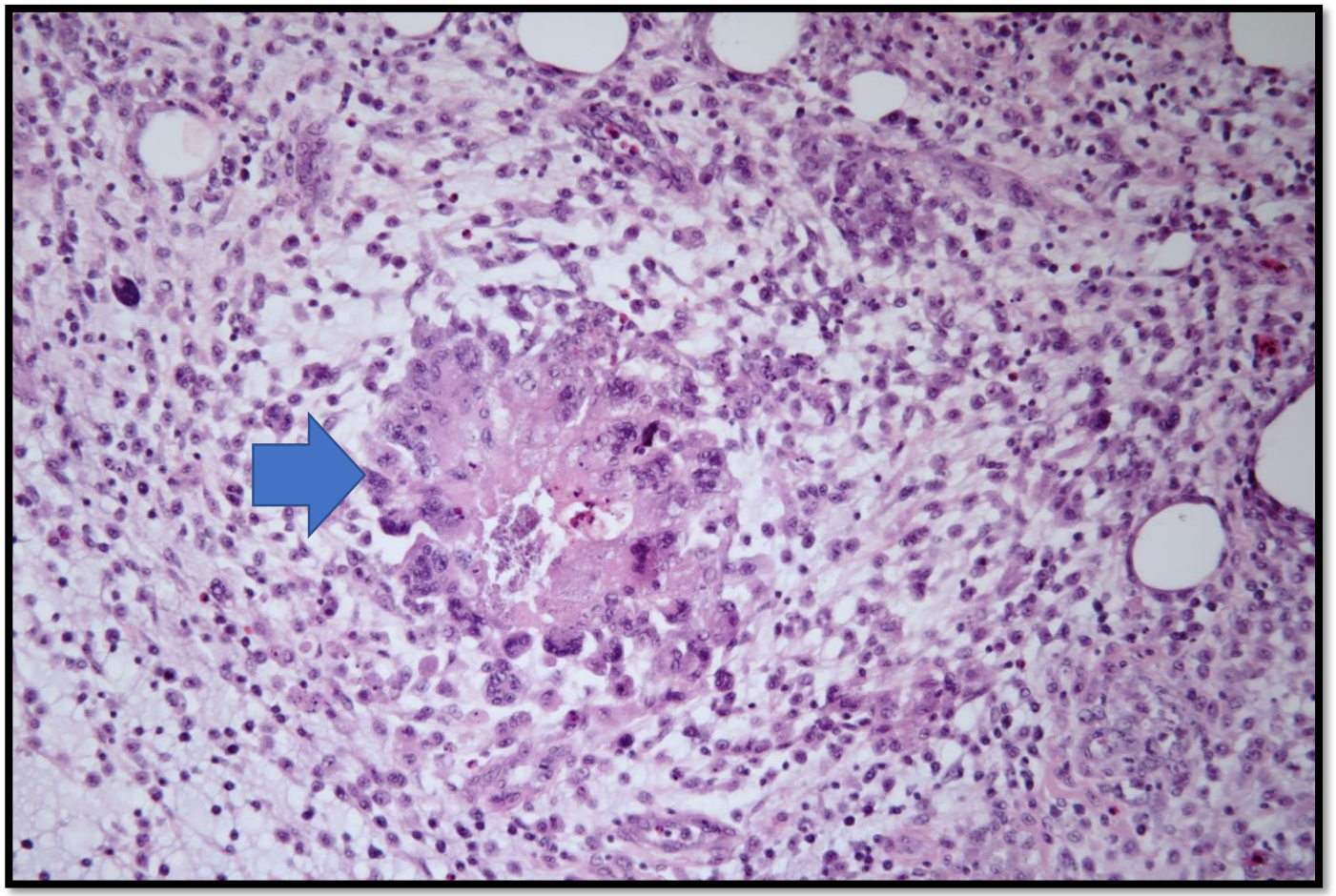
Various Stages and Reactions to Process Vaccine Droplets

Vaccine oil droplets surrounded by lymphohistiocytic inflammation



Various Stages and Reactions to Process Vaccine Droplets

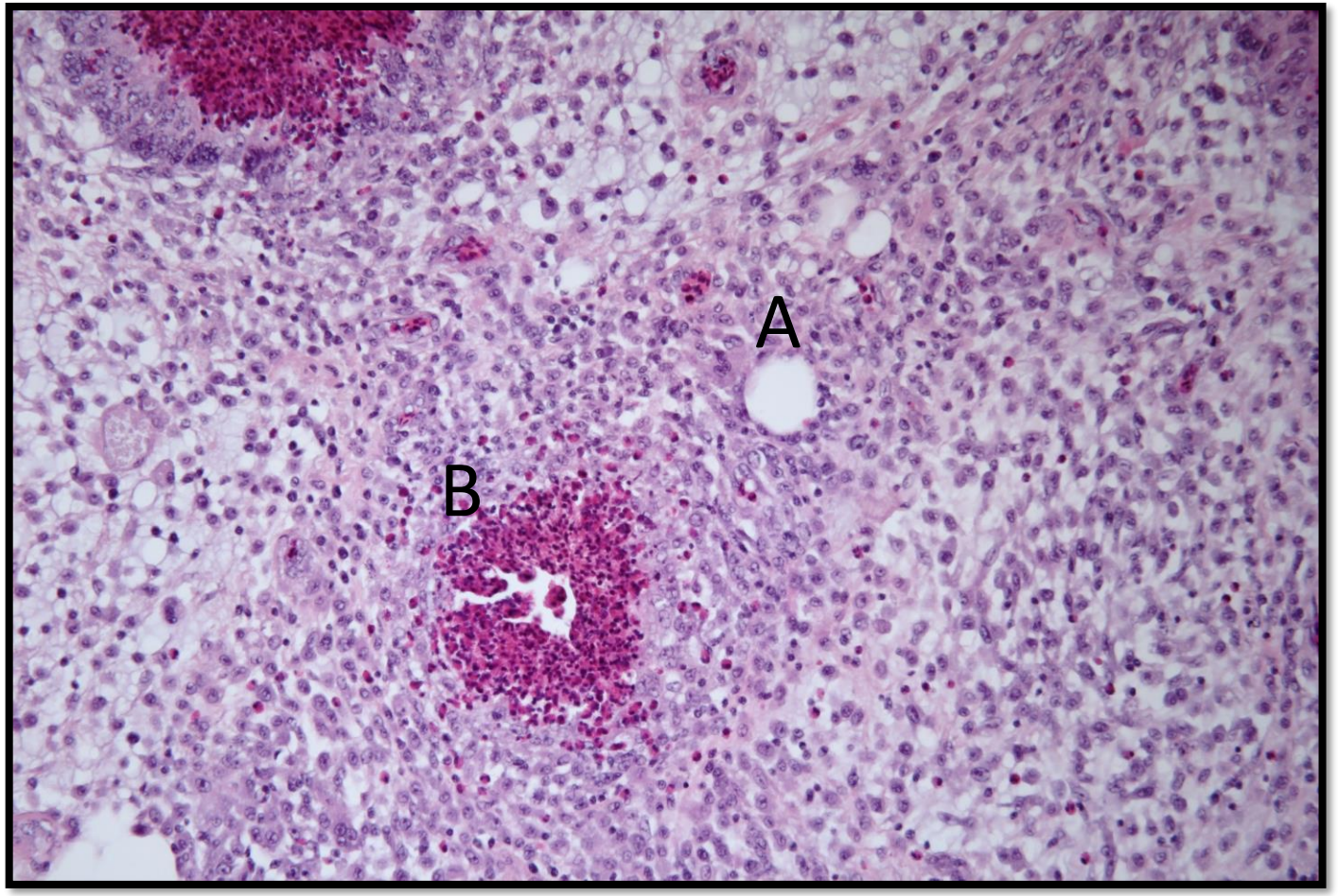
Granuloma surrounding a likely degraded oil droplet



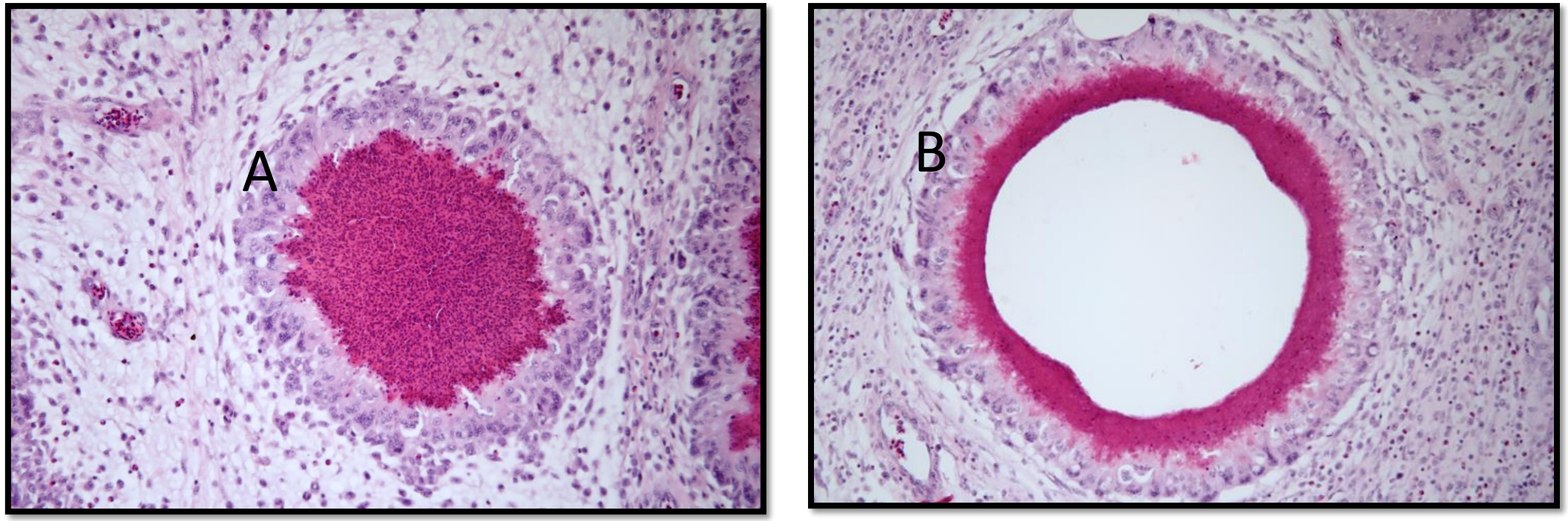
Various Stages and Reactions to Process Vaccine Droplets

Two oil droplets

A. Lymphohistiocytic inflammation
B. Heterophils surrounding the droplet, surrounded by lymphohistiocytic inflammation



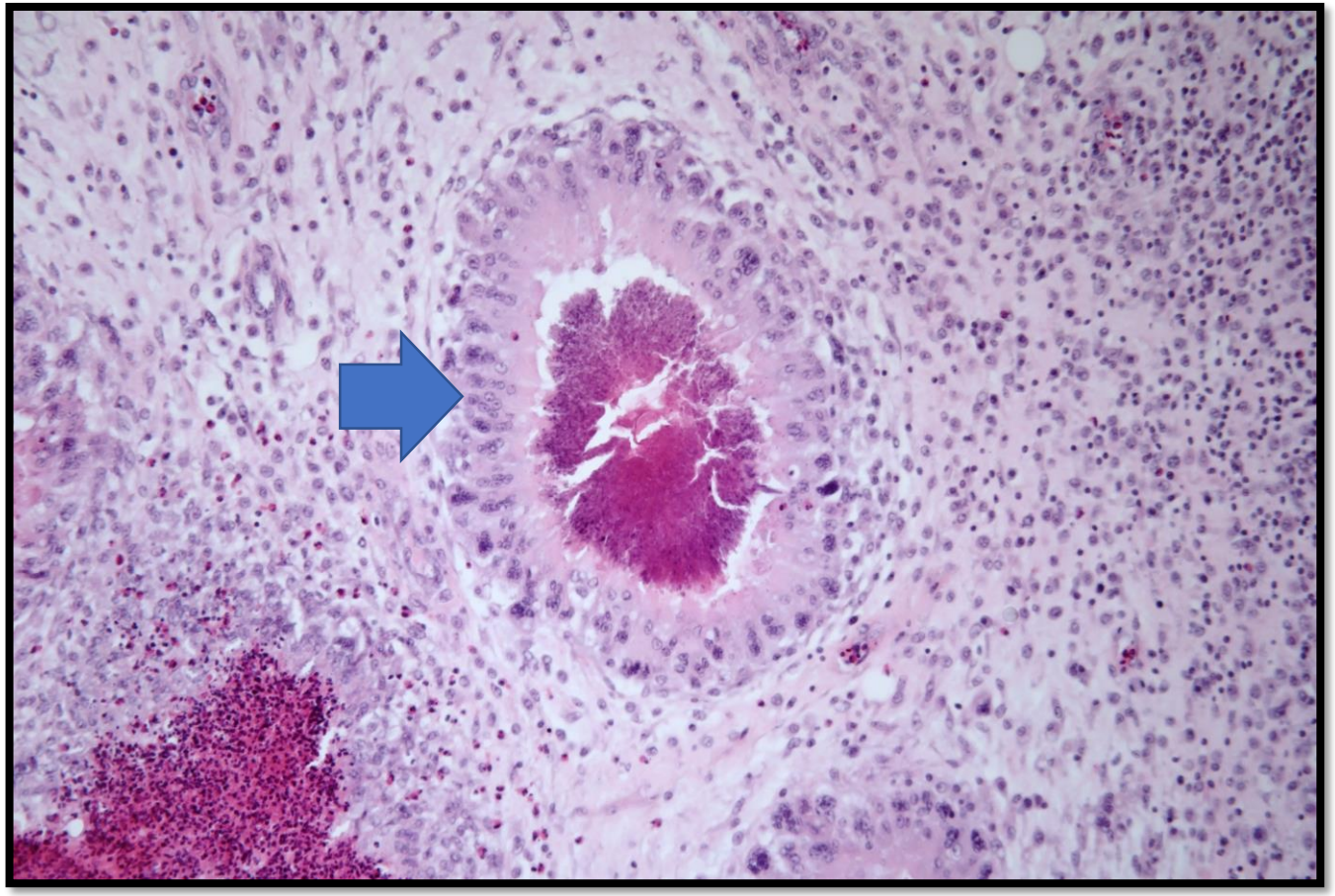
Various Stages and Reactions to Process Vaccine Droplets



Heterophilic granulomas - two variations.
A. The center of the granuloma is filled with a coagulum of degenerated heterophils, surrounded by macrophages.
B. The center of the granuloma is a large droplet of vaccine carrier, surrounded by degenerated heterophils, and an outer zone of macrophages.

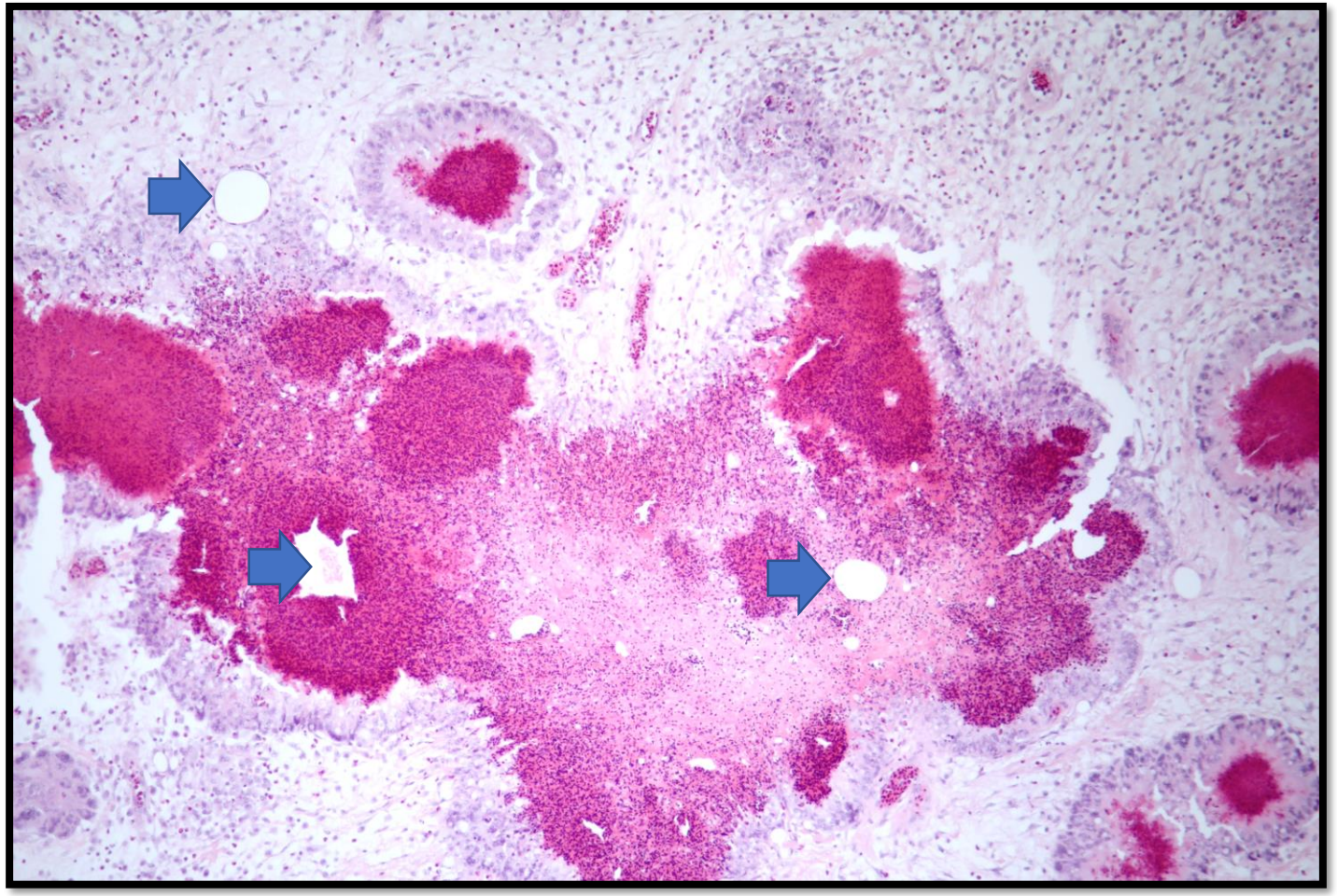
Various Stages and Reactions to Process Vaccine Droplets

Mature heterophilic granuloma, probably resolving due to the granular center with increased basophilic staining.



Various Stages and Reactions to Process Vaccine Droplets

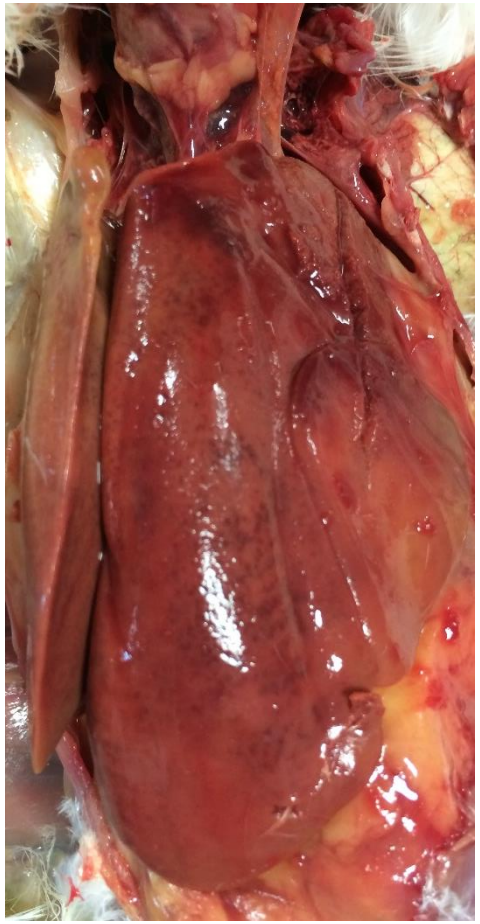
Large, multicentric and coalescing vaccine/carrier granuloma surrounded by smaller granulomas and immature granulation (scar) tissue. Arrows show oil droplets.



Issues

- Inactivated vaccines elicit extensive foreign body inflammatory reaction (portions are desirable)
- Exuberant inflammatory reactions feature
  - Heterophilic granulomas
  - Extensive granulation tissue (scar tissue) formation
  - Variable lymphocytic inflammation
  - Muscle degeneration and necrosis, chronic muscle fascia cellulitis

Post-Salmonella Bacterin Hepatopathy Bovans, 23 weeks of age



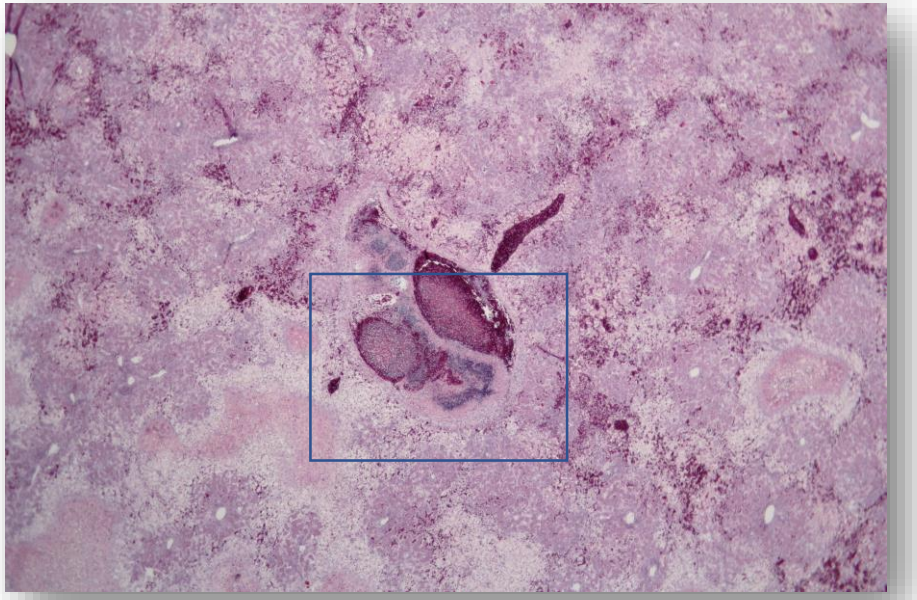
The livers and spleen are enlarged and pale, or have patchy reddening. This is consistent with amyloidosis. Acute livers with this syndrome have impaired blood circulation (infarction) and necrosis.

History, Broiler Breeder Pullets

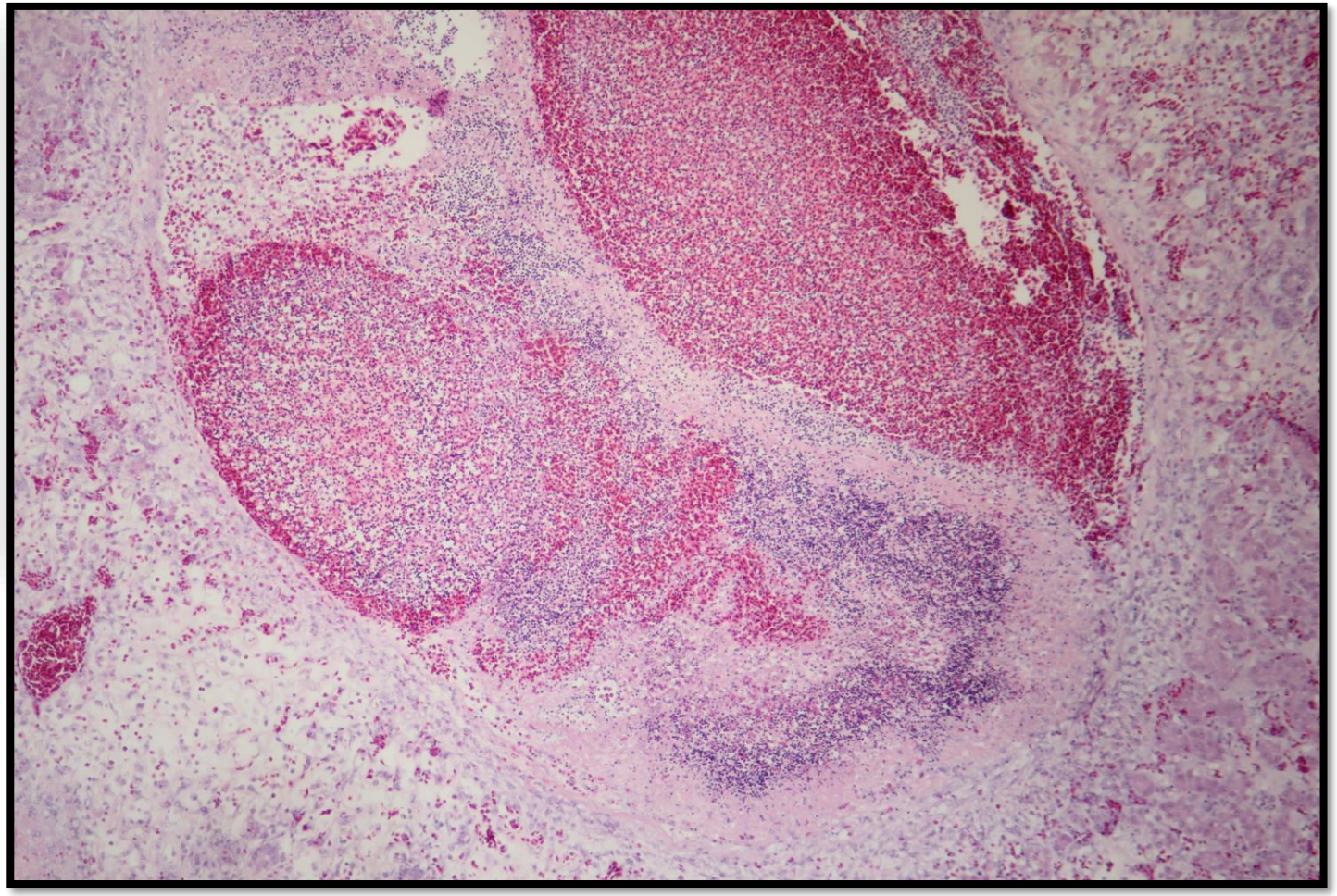
- 14 weeks
- Liver lesions beginning 10-15 days post vaccination
- Rule out post bacterin syndrome and histomoniasis

Necrotizing Hepatitis with portal vein thrombosis

Broiler breeders 14 wks; 10-13 days post bacterin administration



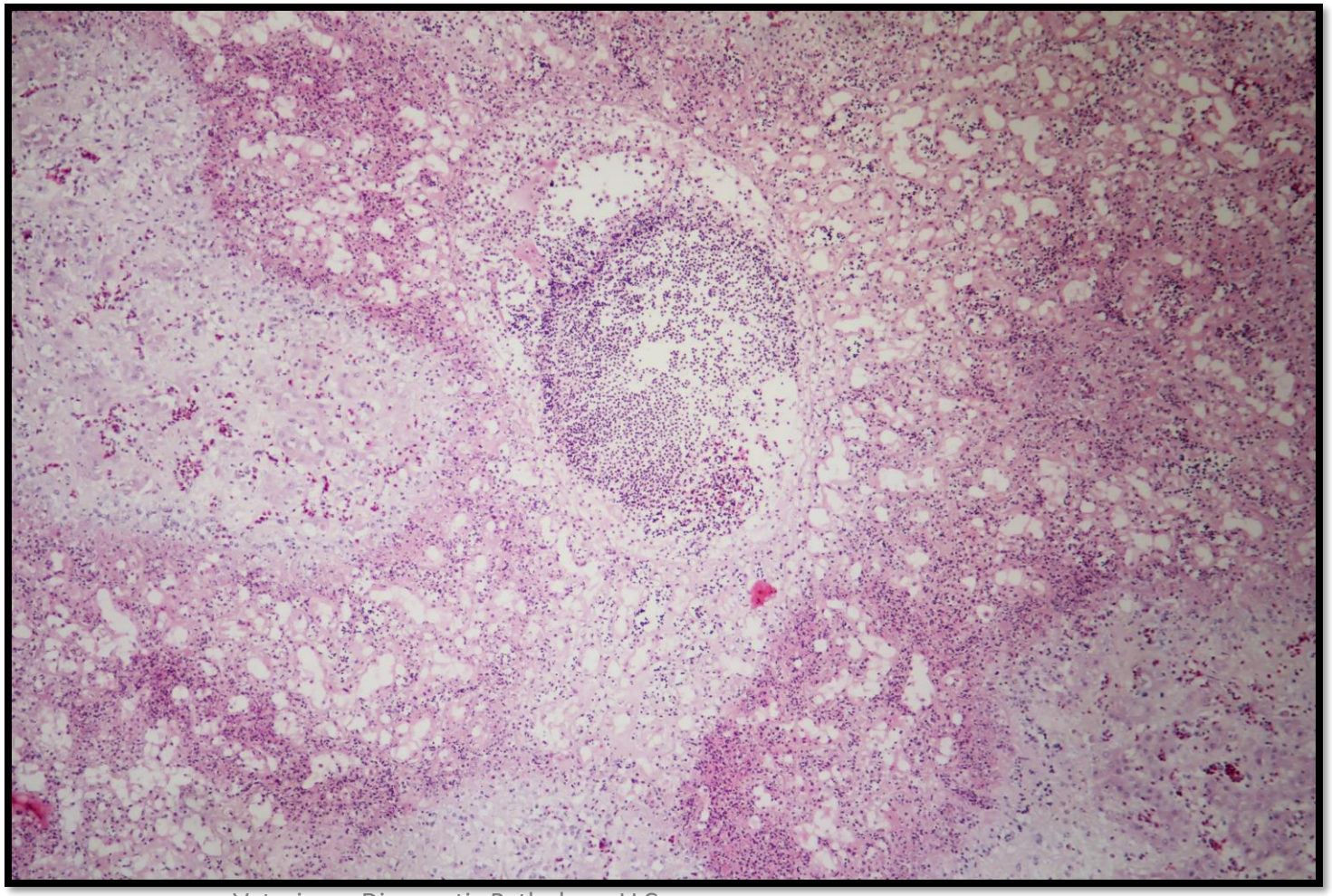
Portal vein branch thrombosis



Necrotizing Hepatitis

Broiler breeders 14 wks; 10-13 days post bacterin administration

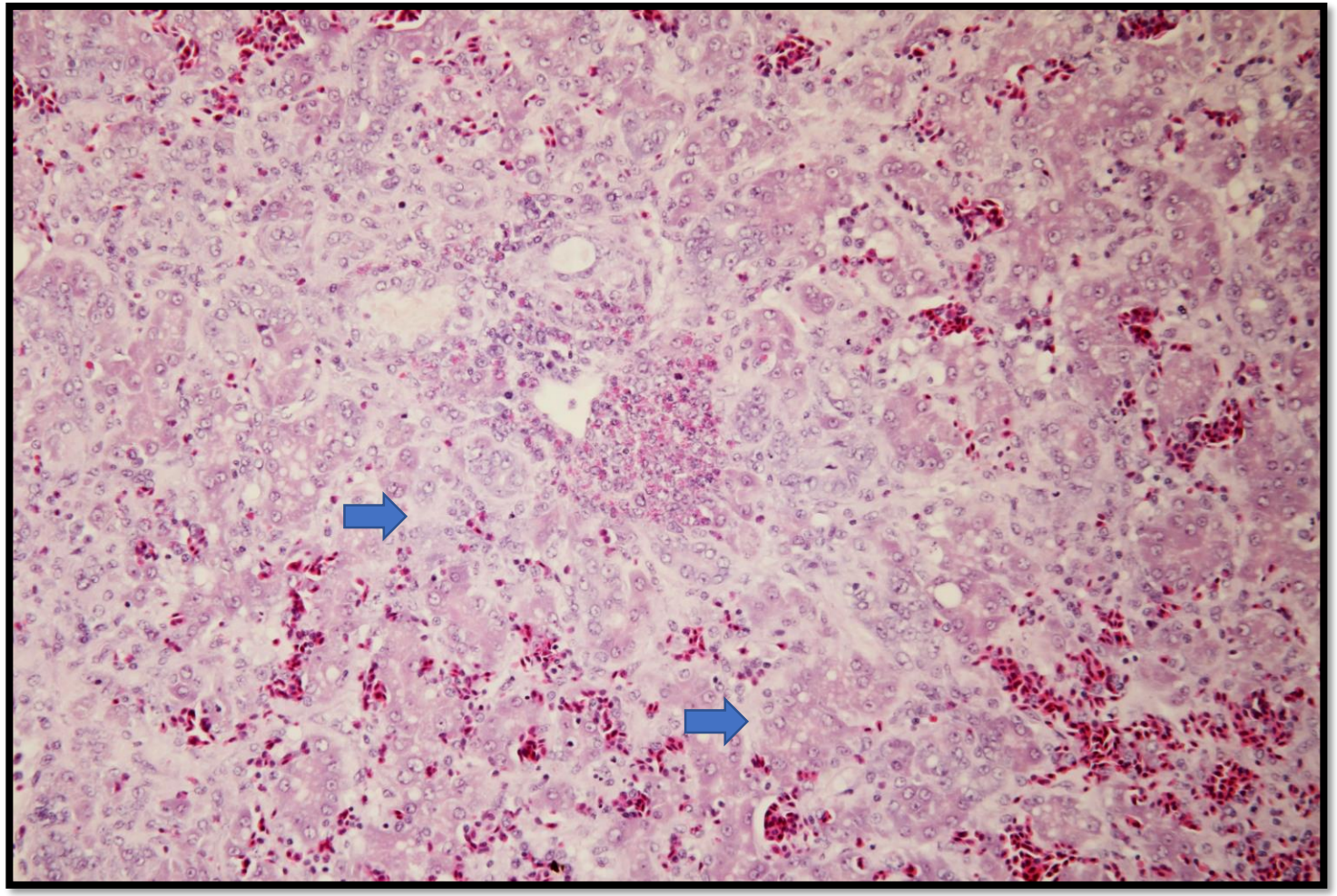
- Portal vein branch thrombosis
- Extensive coagulation necrosis of hepatocytes



Necrotizing Hepatitis

Broiler breeders 14 wks; 10-13 days post bacterin administration

- Progression to chronic hepatitis.
- Periportal heterophil inflammation
- Bile ductule proliferation
- Hepatic plates compressed by widened sinusoids, filled with eosinophilic amorphous material (arrow); either edema, space of Disse, and/or amyloid deposition

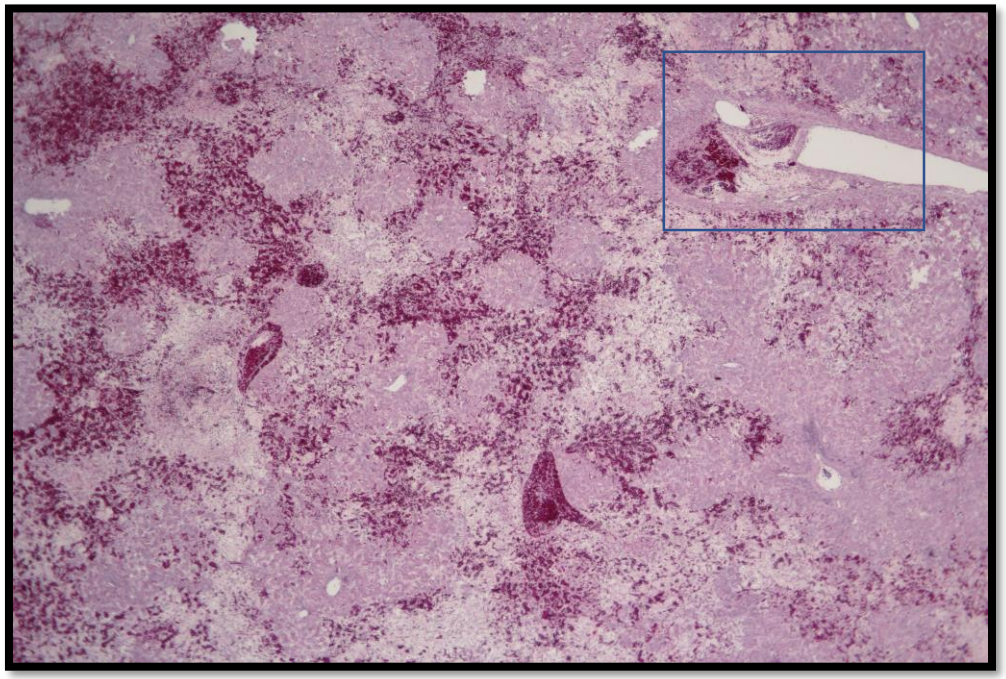


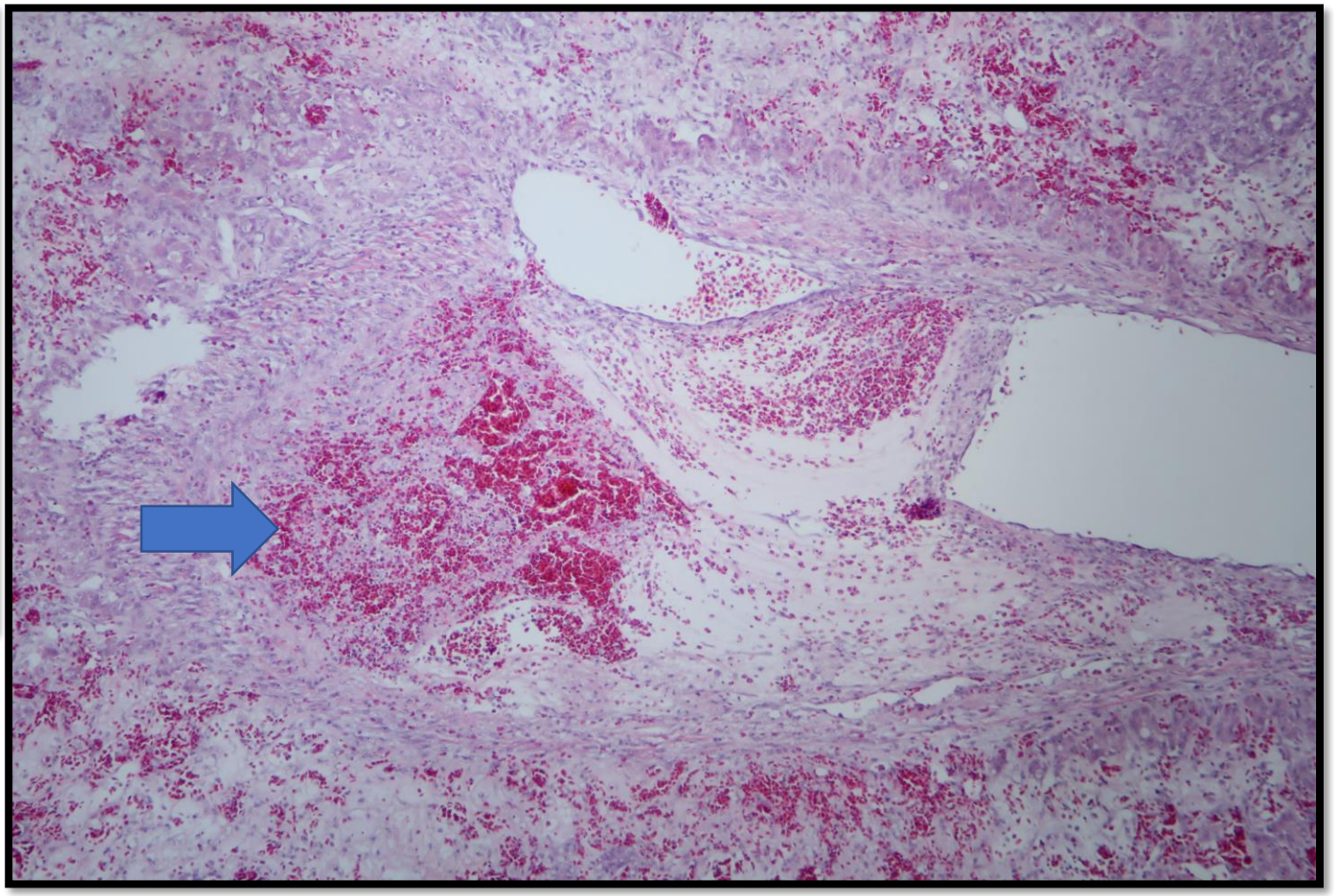
Conclusions

- Portal vein phlebitis and thrombosis leading to extensive necrosis of zone 2 hepatocytes (hypoxia)
- Granuloma formation and portal hepatitis
- Bile ductule proliferation and regenerative hepatocytes
- Diffuse widening of sinusoids, consistent with amyloidosis and/or edema space of Disse
- Compression and loss of functional liver tissue

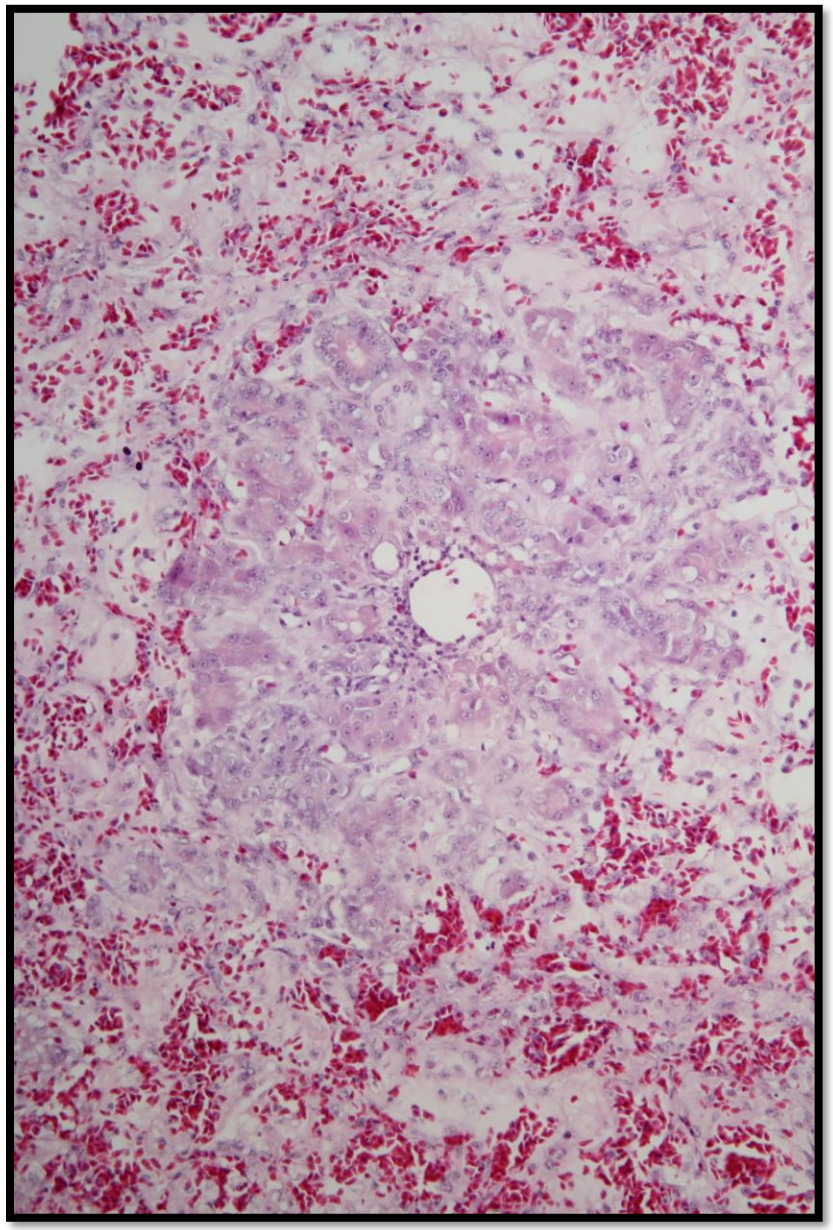
History, Broiler Breeders, 20 weeks

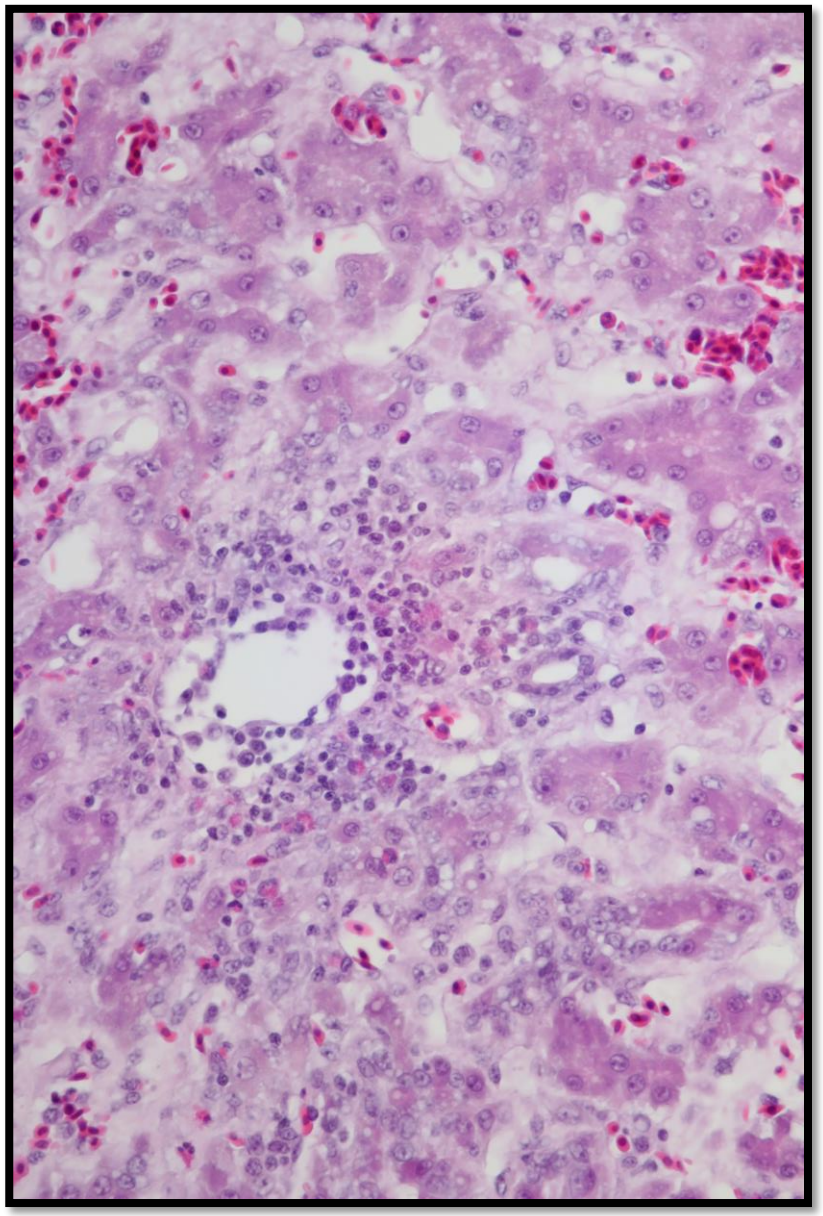
- 18 weeks, Salmonella inactivated vaccine injected in neck
- 19 weeks, mortality elevated to 100 per day, suddenly inactive
- Necropsy: enlarged liver and excessive vaccine reaction in neck





Thrombosis of the main portal vein or a major branch.

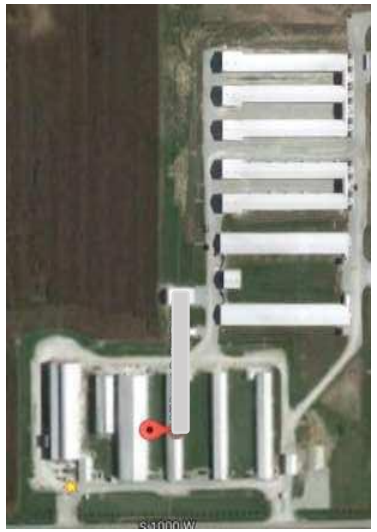




Inactivated bacterial vaccines (Salmonella)

- Problems with excessive reaction at sites of vaccination
- Liver issues
  - Thrombosis
  - Chronic inflammatory reactions
  - Extensive loss of functional liver tissue
  - Culling and mortality

Commercial Layer Mortality Surveys



February 2014 Mortality Survey Summary

Farm	H	Date	Age	Body Wt. Lbs		Total	Cyn-Fungus	Fowlpox	Colibacillosis	Pasteurellosis	Coccidiosis	Gout	Salpingitis	Injury	Ovarian	Prolapse	Peritonitis	Cannibalism	Hemorrhagic	Cloacitis	Ruptured Liver	Unclassified	Emaciation	Starvation	Fly	Unclassified	Other
Loda	1	2/12/14	29	Mort N Fik Ave	73.50	%	8.3	0.0	8.3	50.0	0.0	16.7	0.0	0.0	0.0	0.0	0.0	8.3	0.0	0.0	0.0	8.3	0.0	0.0	0.0	0.0	8.3
Loda	3	2/12/14	m 27	Mort N Fik Ave	103.81	%	0.0	0.0	0.0	28.6	42.9	0.0	0.0	0.0	0.0	0.0	0.0	42.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Loda	4	2/12/14	47	Mort N Fik Ave	85.67	%	0.0	0.0	28.6	28.6	0.0	0.0	0.0	0.0	42.9	0.0	0.0	0.0	0.0	0.0	0.0	14.3	0.0	14.3			
Loda	5	2/12/14	m 20	Mort N Fik Ave	86.75	%	0.0	0.0	12.5	12.5	25.0	12.5	0.0	12.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	0.0			
Loda	6	2/12/14	m 35	Mort N Fik Ave	83.88	%	0.0	0.0	0.0	40.0	10.0	0.0	0.0	0.0	0.0	0.0	10.0	10.0	0.0	10.0	0.0	0.0	0.0	20.0	0.0		
Loda	7	2/12/14	24	Mort N Fik Ave	70.71	%	0.0	20.0	0.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0			
Loda	9	2/12/14	53	Mort N Fik Ave	77.54	%	40.0	0.0	0.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	10.0	0.0	0.0	0.0	0.0	10.0	10.0			
Loda	10	2/12/14	73	Mort N Fik Ave	77.73	%	0.0	0.0	10.0	30.0	0.0	20.0	0.0	0.0	10.0	0.0	10.0	0.0	10.0	0.0	0.0	0.0	10.0	0.0			
AEP	1	2/11/14	52	Mort N Fik Ave		%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	66.7	0.0	0.0	100.0			
AEP	2	2/11/14	59	Mort N Fik Ave		%	0.0	20.0	0.0	60.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	0.0	0.0	0.0			
AEP	3	2/11/14	30	Mort N Fik Ave		%	0.0	0.0	0.0	66.7	0.0	33.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
AEP	4	2/11/14	25	Mort N Fik Ave		%	0.0	0.0	0.0	66.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.3	0.0	0.0	0.0	0.0	0.0			
AEP	5	2/11/14	73	Mort N Fik Ave		%	0.0	0.0	0.0	0.0	0.0	75.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	0.0	0.0	0.0	0.0			
AEP	8	2/11/14	m 12	Mort N Fik Ave	79.75	%	0.0	6.7	26.7	13.3	6.7	0.0	6.7	0.0	6.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
AEP	9	2/11/14	37	Mort N Fik Ave	75.88	%	0.0	0.0	30.0	10.0	0.0	10.0	20.0	0.0	0.0	0.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0			
AEP	10	2/11/14	20	Mort N Fik Ave	81.93	%	0.0	20.0	0.0	30.0	0.0	0.0	0.0	0.0	40.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0			
AEP	11	2/11/14	m 03	Mort N Fik Ave	95.24	%	0.0	0.0	0.0	16.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	0.0	0.0	0.0	16.7			
FRSS	1	2/13/14	40	Mort N Fik Ave	63.28	%	20.0	0.0	0.0	20.0	20.0	0.0	0.0	0.0	0.0	20.0	0.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0			
FRSS	2	2/13/14	26	Mort N Fik Ave	57.64	%	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
FRSS	3	2/13/14	61	Mort N Fik Ave		%	0.0	0.0	33.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.3	0.0	0.0	0.0	33.3			
FRSS	4	2/13/14	62	Mort N Fik Ave		%	0.0	0.0	25.0	50.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			

VDP PathPro Reports Surveys Settings

Create Mortality Survey

Flock AEP 01 4404

Date 2017-10-26

Laying Cycle First Lay

Flock Age (weeks) 50

Flock Weight 0

Notes

Cancel Save

* Required Field

VDP PathPro Reports Surveys Settings

Create Mortality Entry

Weight b

Findings

- Beak problem
- Cage Fatigue
- Candidiasis
- Coccidiosis
- Decomposed
- Dehydration
- Emaciated
- Gout - Urolith
- Gut - Enteritis
- Gut - Other
- Lice
- Liver, fatty, hemorrhage
- Liver - Hepatitis - Sepsis
- Lung, pneumonia
- Lung, other
- Mites
- Omphalitis
- Oral Ulcers
- Other
- Peritonitis
- Prolapse
- Salpingitis, Repro - Other
- Suffocation/piling
- Tetany, metabolic
- Tracheitis - Plug
- Trauma - Injury
- Trauma - Contributing
- Tumor
- Undetermined
- Vaccine error, reaction
- Worms, cecal
- Worms, round
- Worms, tapeworms

Notes

Cancel Save

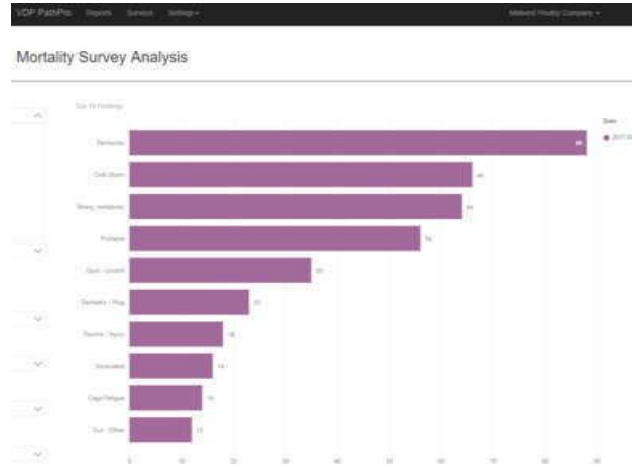
VDP PathPro Reports Surveys Settings

Edit Mortality Survey

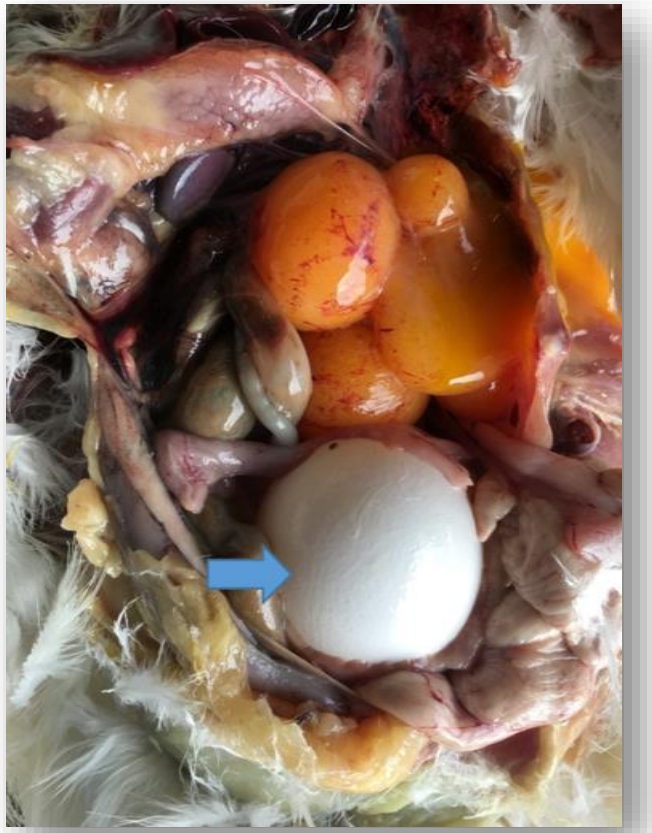
Date 2017-08-23
Flock AEP 08 4472
Flock Age 50 Weeks
Laying Cycle First
Flock Weight 3.13
Mort Avg Weight 2.95
Mort % Flock Weight 94.21%

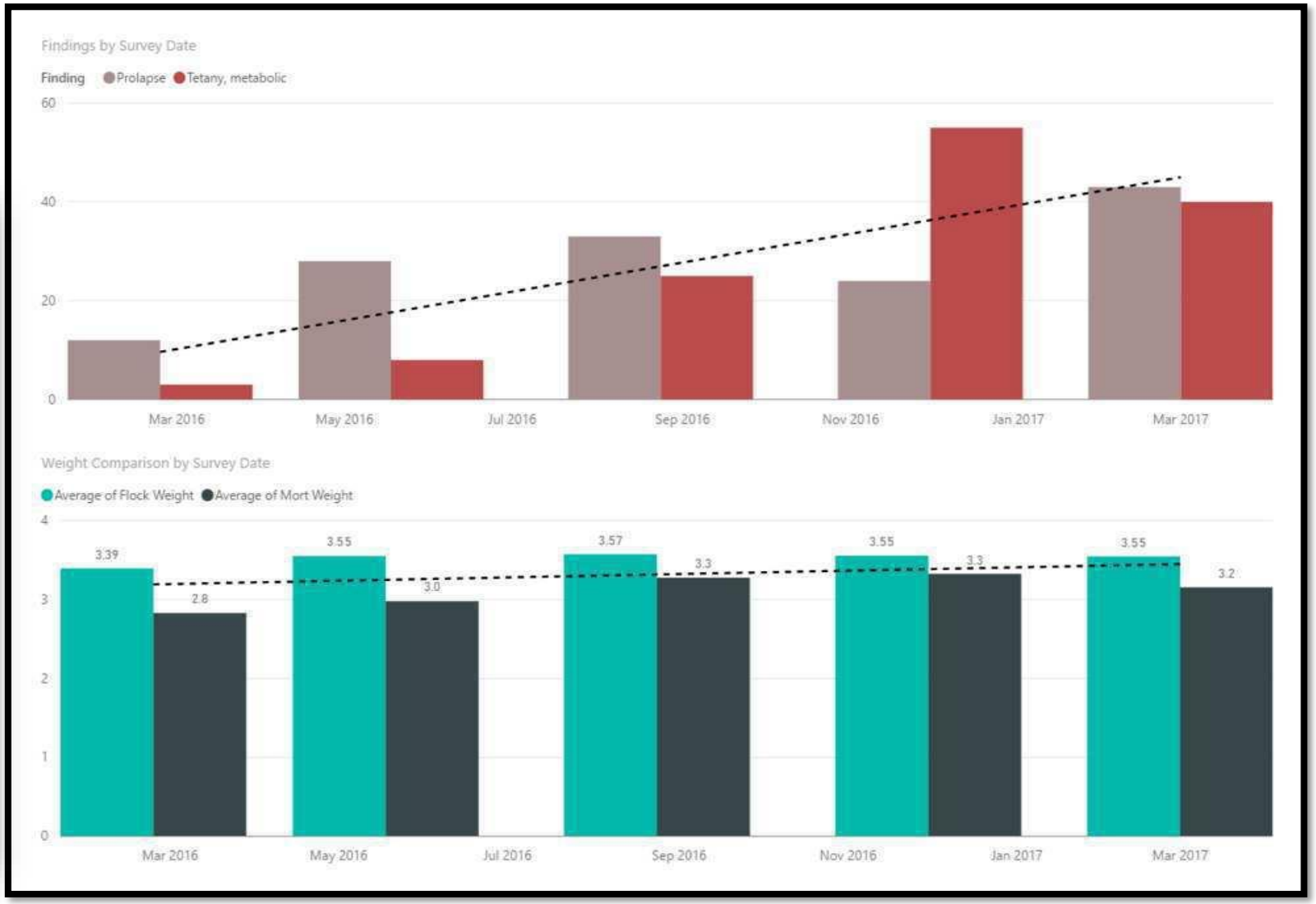
+ Create New

Bird	Weight	Findings
1	3.66	Oral Ulcers, Prolapse
2	2.03	Liver - Hepatitis - Sepsis
3	2.09	Peritonitis
4	3.93	Oral Ulcers, Prolapse
5	2.57	Tracheitis - Plug
6	2.55	Oral Ulcers, Peritonitis
7	3.21	Oral Ulcers, Prolapse
8	3.55	Tumor

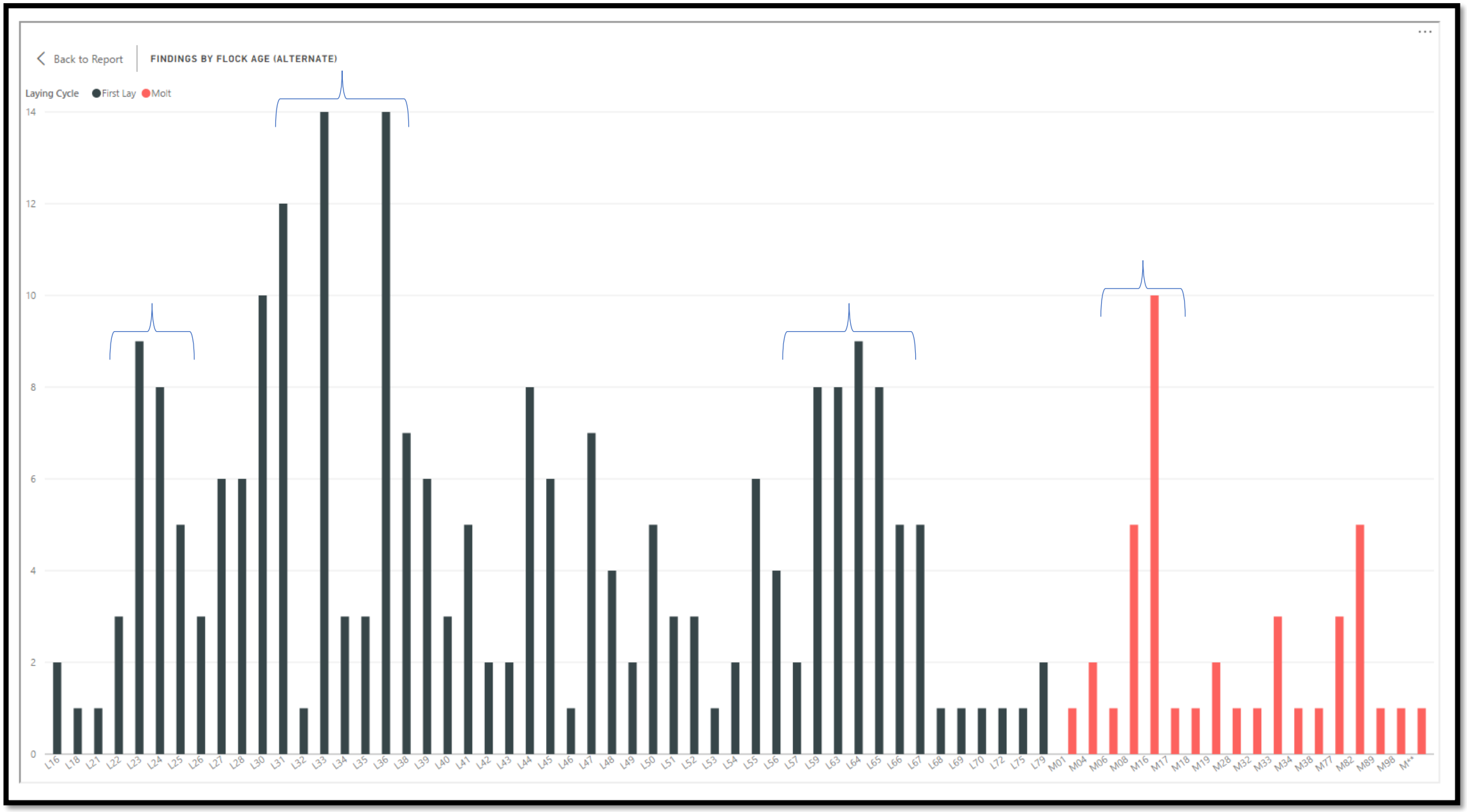


Prolapse and Tetany – All Complexes





Prolapse and Tetany by Age: – 2016 to 2017



END

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