Sudden Death in Cattle: How to Maximize Laboratory Results

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April 1, 2023

College of Veterinary Medicine | Animal Health Diagnostic Center

Outline

- Clinical presentation of sudden death in cattle- real case example
  - Initial exam findings
  - Differential list, diagnostics
  - Sample submission to the Cornell AHDC
  - Diagnosis
- Discussion of the diagnosis
- Implications for the diagnosis

Herd background:

- 1,100 milking dairy herd in NY
- Milking in 2 different barns
  - 800 milking with 4 Lely robots
  - 300 milking in parlor – this houses the lower producing and older cows
- Diet:
  - Started feeding 2022 1st cut haylage 3 wks ago
  - Parlor cows on low forage and DNB cows
  - Drinking water is town water
    - waterers scrubbed weekly
- Herd production steady
- Sprinklers are well water
- No rumination collars

Relevant herd history

- Standard vaccine protocol
- Not testing for BVD
- Herd treated with Ultraboss recently
- Shared needles for vaccines and oxytocin administration
- Send heifers to heifer grower that also purchases and raises other calves from other states

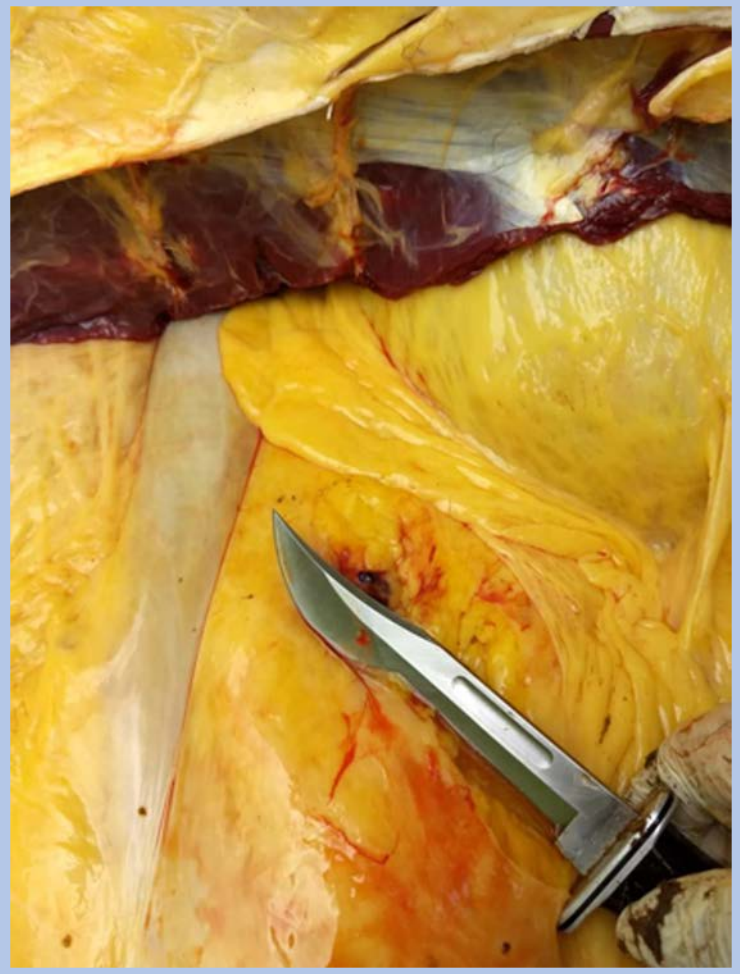
Initial clinical findings:

- July 2022: late lactation cows from only low group affected
  - Affected group is milked in parlor (not by robots)
  - 6 cows died from 7/1-7/5/2022
  - Approx. 30 cows with similar clinical signs over 2-3 week period
- Signs:
  - Severe weakness
  - Anemia
  - Icterus
  - Death

7/5/22: Farm visit and 2 necropsies performed

- Cow 1: 5th LACT, 7 yrs old, 359 DIM, BCS 1/5
- Cow 2: 2nd LACT, 4 yrs old, 281 DIM

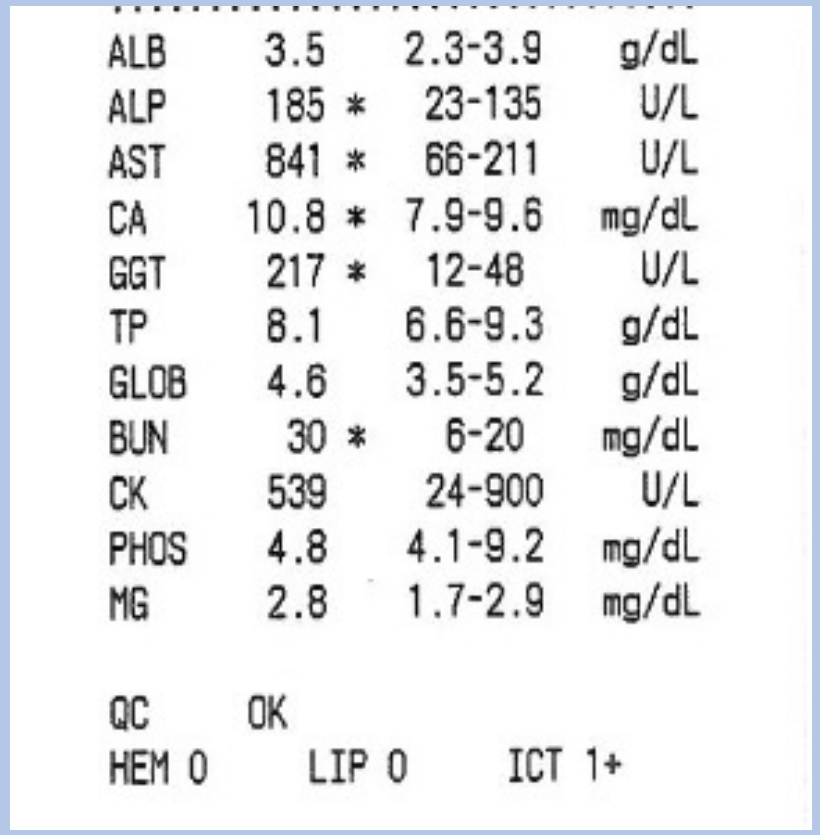
- Necropsy findings on both:
  - Severe icterus
  - Enlarged liver and spleen
  - Liver grainy texture
  - Petechial hemorrhages on heart
  - GI tract empty, poor rumen fill



Photos courtesy of Dr. P. Comyn and Dr. Kevin Lahmers

Cow 3:Antemortem chemistry panel in house

- 2nd LACT, 3 yrs old, 140 DIM, 100 lbs/day
  - Chemistry:
  - Elevated:
    - Alkaline phosphatase (ALP) ↑
    - Aspartate aminotransferase (AST) ↑↑↑
    - Calcium ↑
    - GGT ↑↑↑
    - BUN ↑
    - Ict 1+



ALB	3.5	2.3-3.9	g/dL
ALP	185 *	23-135	U/L
AST	841 *	66-211	U/L
CA	10.8 *	7.9-9.6	mg/dL
GGT	217 *	12-48	U/L
TP	8.1	6.6-9.3	g/dL
GLOB	4.6	3.5-5.2	g/dL
BUN	30 *	6-20	mg/dL
CK	539	24-900	U/L
PHOS	4.8	4.1-9.2	mg/dL
MG	2.8	1.7-2.9	mg/dL

QC OK
HEM 0 LIP 0 ICT 1+

Differential list for acute death with hepatopathy:

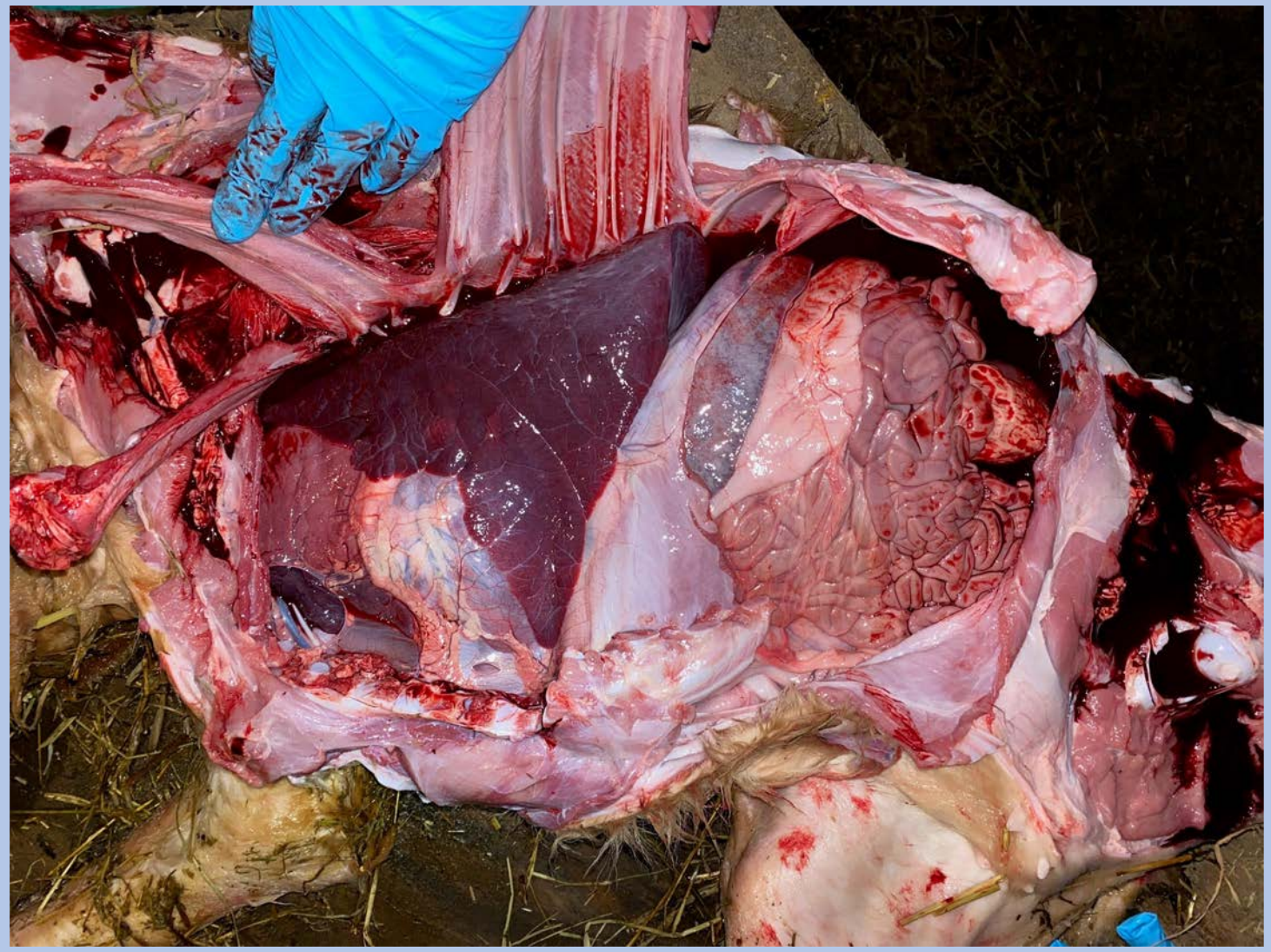
- Infectious
  - Bacterial
    - Clostridial – always a ddx for sudden death
    - C. chauvoei, C. novyii, C. septicum, C. sordellii, C. perfringens / C. botulinum
    - Anaplasma marginale / other tick-borne
    - Leptospirosis
- Viral ?

- Toxins
  - Blue green algae
  - Cyanogenic plants
    - Ex. Sorghum, Sudan grass et al
  - Urea/Fertilizer (call the lab!)
  - Nitrites/nitrates
  - Dicoumarol (ex. Rodenticide)
  - Copper toxicity
  - Iron (injectable)
  - Heavy metals (lead, arsenic, cadmium, etc)
  - Mycotoxins

Some quick field necropsy tips

- Pre-made necropsy sample collection sets - baggies, umbilical tape to tie off SI, formalin, sample jars, Sharpie, etc.
- Double glove - can take one off and put another one on easily and stay clean/safe
- Follow a routine
  - Ex. Cow down on left (rumen down); lift front leg and incise skin to retract leg; lift hindleg and incise skin to retract leg; then reflect skin from elbow to stifle.
    - Cut out from under skin - preserves blade.
    - Scalpel also okay if you're a lazy knife sharpener!
- Open from sternum to pelvis next
  - Axe or Sawzall for ribs
  - Careful to not open viscera when you cut
- Take look at the big picture first - then start sampling.
  - Take samples in specific order each time - helps to not forget any.

Field necropsy tips



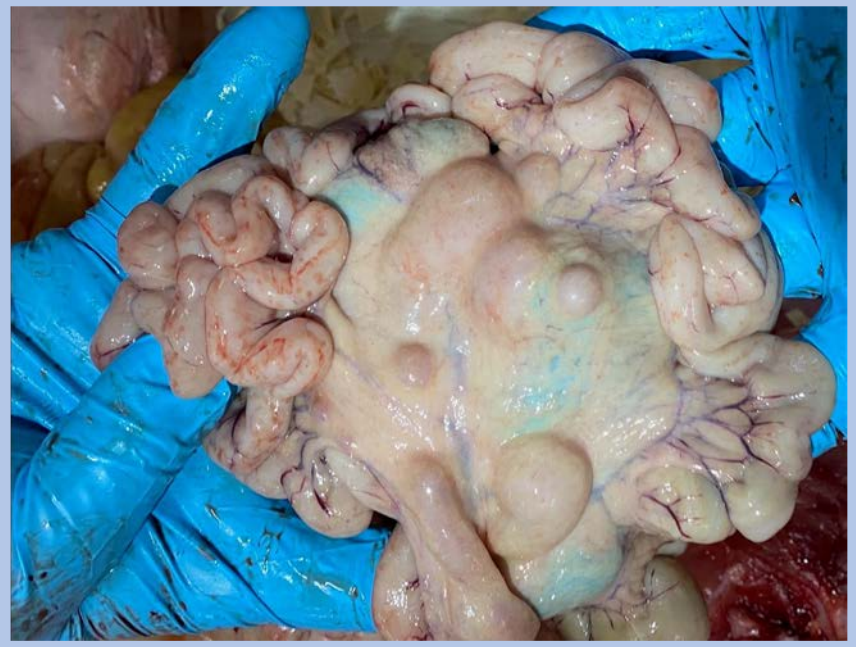
Field necropsy tips, continued

- Other little tips - For toxicity ddx:
  - Don’t forget rumen contents
  - Eyeball (see aqueous slide!)
- TAKE PHOTOS! Put cell phone in a ziplock bag, can shoot through
- Photograph ID tags first
  - Can reference it later
  - Also helps identify your photos on your phone
- Forward photos to AHDC, with labels if it helps them/you (easy to add with iPhone)

Field necropsy tips

- Necropsy as a practice builder
  - Dead animals = Stress for farmer
  - Necropsy shows you care and will do the work towards finding a solution
  - It is possible that no one has ever offered them.

- Necropsy is CE you're (usually) paid to do!

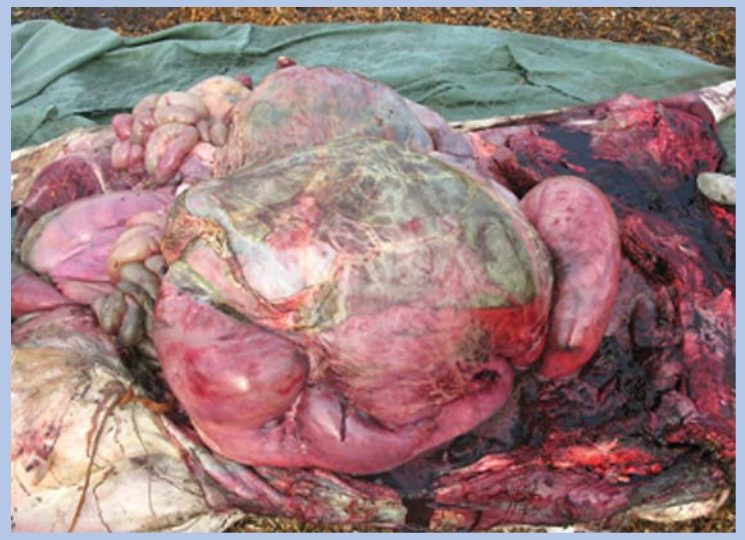


Taking great samples is key - because acute death often means no gross findings

Images of gross necropsy 12 - 48 hours post-mortem

12 hours

24 hours



36 hours

48 hours

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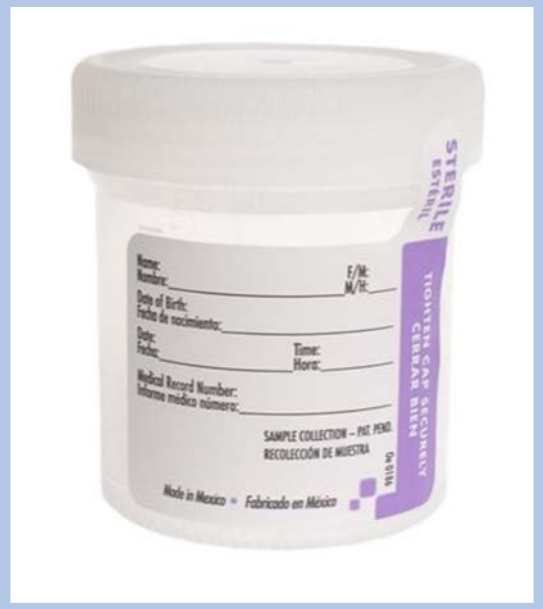
Tips for bovine sudden death

- FIX EVERYTHING
  - Histo $160 for field necropsy regardless of # of tissues
  - Always fix the lesion / organ system involved

- Fixed tissue set:
  - Lung (section from each lobe)
  - Liver (section from each lobe)
  - Spleen
  - Kidney
  - Lymph nodes
  - Forestomachs
  - Jejunum, ileum, cecum and colon
  - Skin
  - Skeletal muscle
  - Heart
  - Brain
  - Uterus
  - Mammary tissue

Tips for bovine sudden death

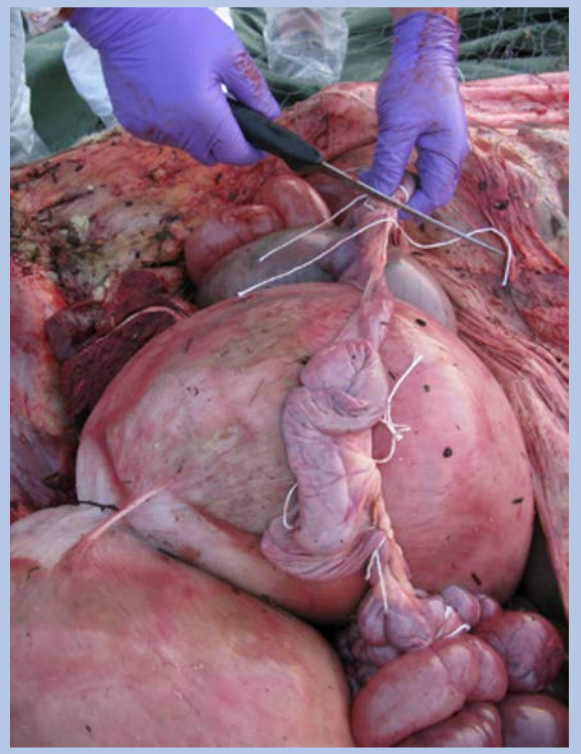
- Fresh tissue set in individual containers
- Freeze until shipment

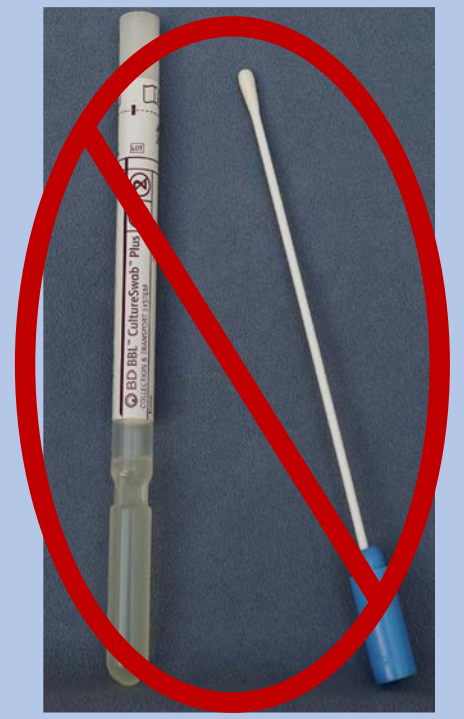


- Lung
- Liver
- Kidney
- Spleen
- Intestine (ligated)
- Lymph node
- Heart muscle
- Skeletal muscle
- Feces/colon contents
- Aqueous humor
- Rumen contents
- Heart blood (serology!)
- Urine
- Brain

Anaerobic culture

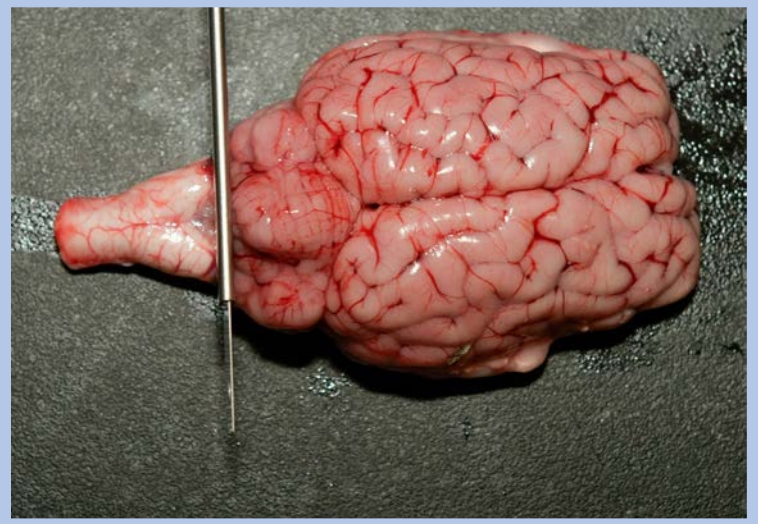
1. Swab in Anaerobic transport media- sear, stab, swab
    - Room temperature
2. 3 cm cubed piece of tissue
    - Freeze
3. 8” tied off loop of intestine
    - Freeze





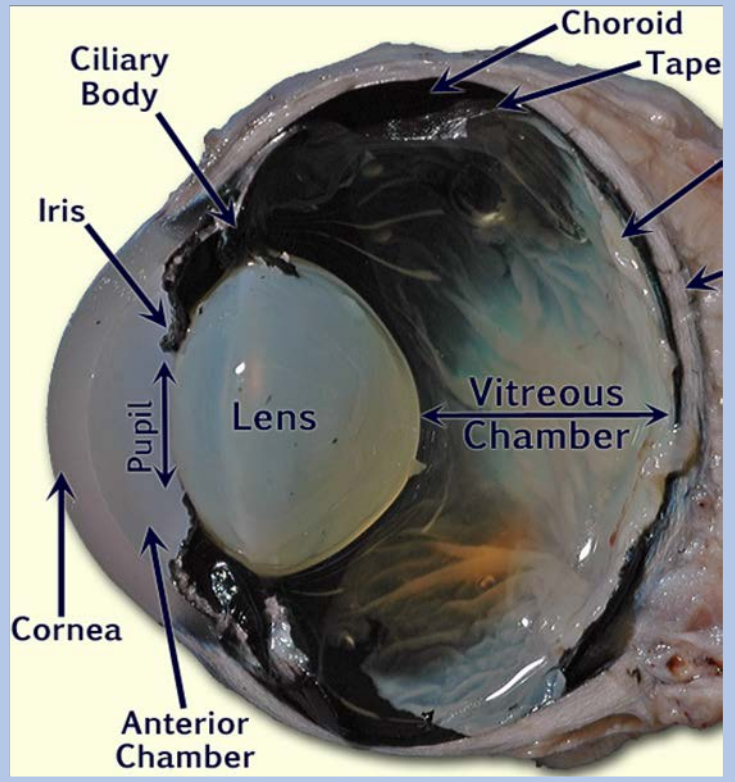
Special samples to consider for sudden death

- Rumen contents = toxins
- Liver = toxins
- Skeletal muscle (cardiac too)= Clostridium
- Brain = fresh and fixed cerebrum, cerebellum and brainstem
- Aqueous humor
- TMR / hay / grain / additives



Aqueous humor sampling

- DO NOT send an entire eyeball fresh!
- Use 18 gauge 1” needle
- Pull off ASAP after death
- Red top tube
  - Refrigerate for:
    - Nitrates
    - Magnesium
  - Freeze for:
    - Ammonia

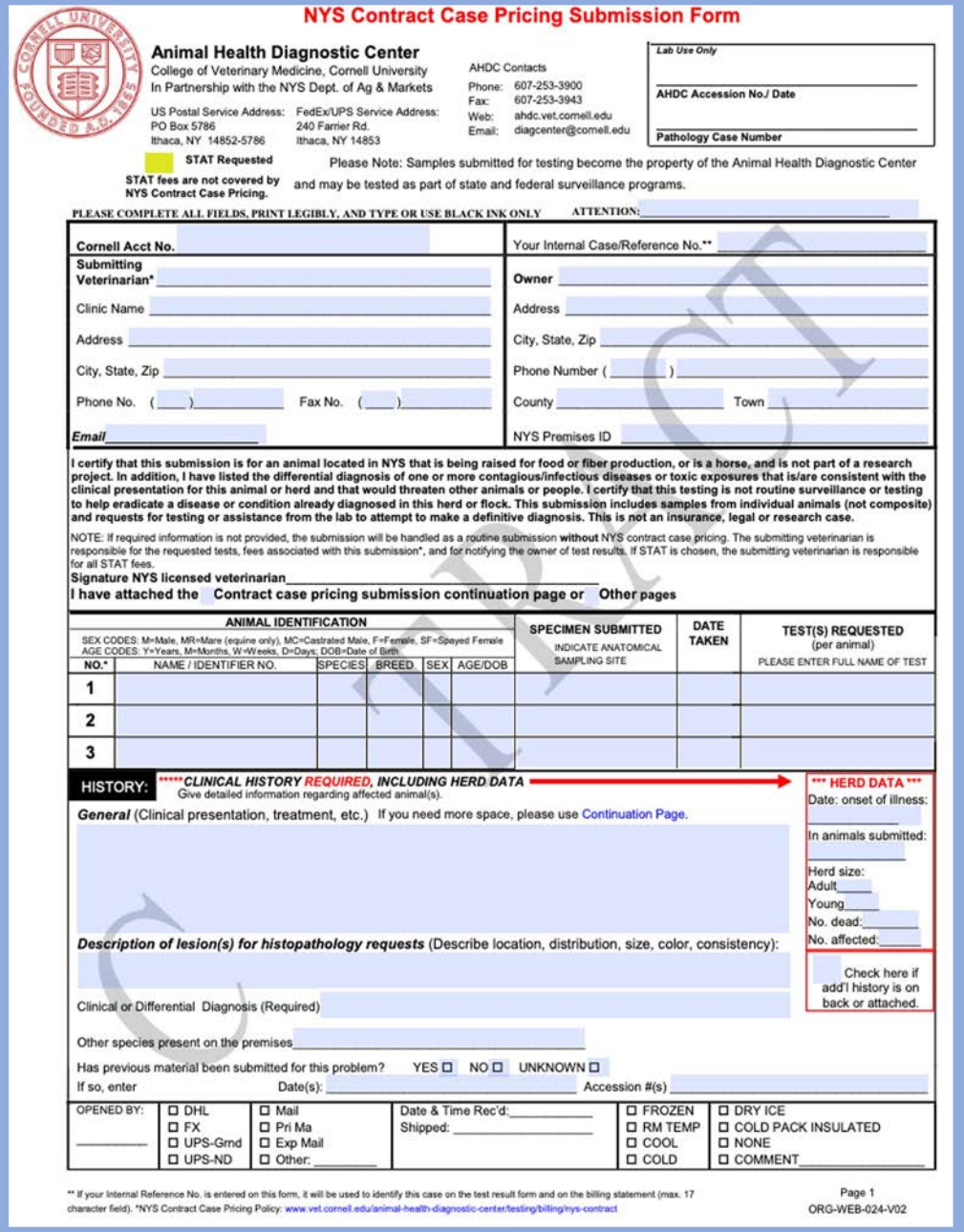


Submitted samples- Always ok to call VSS before sampling

- Antemortem: Serum for chem panel, EDTA whole blood for CBC, PCR testing
- Postmortem (ideally):
  - Full set fixed tissues
  - Fresh tissues in individual containers

NY Contract Subsidy

- Food, fiber, or horse
- Infectious dz or toxin
- No surveillance or monitoring
- Fill out contract submission form with history!
- Up to 3 animals on 1 submission
  - Vet pays first $150
  - Next $150 subsidized
  - When AHDC bill reaches $300, vet starts paying again



NYS Contract Case Pricing Submission Form

Animal Health Diagnostic Center
College of Veterinary Medicine, Cornell University
In Partnership with the NYS Dept. of Ag & Markets

US Postal Service Address: PO Box 5786, Ithaca, NY 14852-5786
FedEx/UPS Service Address: 240 Farrier Rd. Ithaca, NY 14853

AHDC Contacts
Phone: 607-253-3900
Fax: 607-253-3943
Web: ahdc.vet.cornell.edu
Email: diagcenter@cornell.edu

Lab Use Only
AHDC Accession No./ Date
Pathology Case Number

STAT Requested
STAT fees are not covered by NYS Contract Case Pricing.

Please Note: Samples submitted for testing become the property of the Animal Health Diagnostic Center and may be tested as part of state and federal surveillance programs.

PLEASE COMPLETE ALL FIELDS, PRINT LEGIBLY, AND TYPE OR USE BLACK INK ONLY ATTENTION:

Cornell Acct No. | Your Internal Case/Reference No.**

Submitting Veterinarian* | Owner
Clinic Name | Address
Address | City, State, Zip
City, State, Zip | Phone Number ( ) | County | Town
Phone No. ( ) Fax No. ( ) | NYS Premises ID
Email

I certify that this submission is for an animal located in NYS that is being raised for food or fiber production, or is a horse, and is not part of a research project. In addition, I have listed the differential diagnosis of one or more contagious/infectious diseases or toxic exposures that is/are consistent with the clinical presentation for this animal or herd and that would threaten other animals or people. I certify that this testing is not routine surveillance or testing to help eradicate a disease or condition already diagnosed in this herd or flock. This submission includes samples from individual animals (not composite) and requests for testing or assistance from the lab to attempt to make a definitive diagnosis. This is not an insurance, legal or research case.

NOTE: If required information is not provided, the submission will be handled as a routine submission **without** NYS contract case pricing. The submitting veterinarian is responsible for the requested tests, fees associated with this submission*, and for notifying the owner of test results. If STAT is chosen, the submitting veterinarian is responsible for all STAT fees.

Signature NYS licensed veterinarian
I have attached the Contract case pricing submission continuation page or Other pages

ANIMAL IDENTIFICATION (SEX CODES: M=Male, MR=Mare (equine only), MC=Castrated Male, F=Female, SF=Spayed Female; AGE CODES: Y=Years, M=Months, W=Weeks, D=Days; DOB=Date of Birth)						SPECIMEN SUBMITTED (INDICATE ANATOMICAL SAMPLING SITE)	DATE TAKEN	TEST(S) REQUESTED (per animal) (PLEASE ENTER FULL NAME OF TEST)
NO.*	NAME / IDENTIFIER NO.	SPECIES	BREED	SEX	AGE/DOB			
1								
2								
3								

HISTORY: *****CLINICAL HISTORY REQUIRED, INCLUDING HERD DATA** Give detailed information regarding affected animal(s).

General (Clinical presentation, treatment, etc.) If you need more space, please use Continuation Page.

*** HERD DATA ***
Date: onset of illness:
In animals submitted:
Herd size:
Adult
Young
No. dead:
No. affected:

Description of lesion(s) for histopathology requests (Describe location, distribution, size, color, consistency):

☐ Check here if add'l history is on back or attached.

Clinical or Differential Diagnosis (Required)

Other species present on the premises

Has previous material been submitted for this problem? YES ☐ NO ☐ UNKNOWN ☐
If so, enter Date(s): Accession #(s)

OPENED BY:					
	☐ DHL ☐ FX ☐ UPS-Grnd ☐ UPS-ND	☐ Mail ☐ Pri Ma ☐ Exp Mail ☐ Other:	Date & Time Rec'd: Shipped:	☐ FROZEN ☐ RM TEMP ☐ COOL ☐ COLD	☐ DRY ICE ☐ COLD PACK INSULATED ☐ NONE ☐ COMMENT

** If your Internal Reference No. is entered on this form, it will be used to identify this case on the test result form and on the billing statement (max. 17 character field). *NYS Contract Case Pricing Policy: www.vet.cornell.edu/animal-health-diagnostic-center/testing/billing/nys-contract

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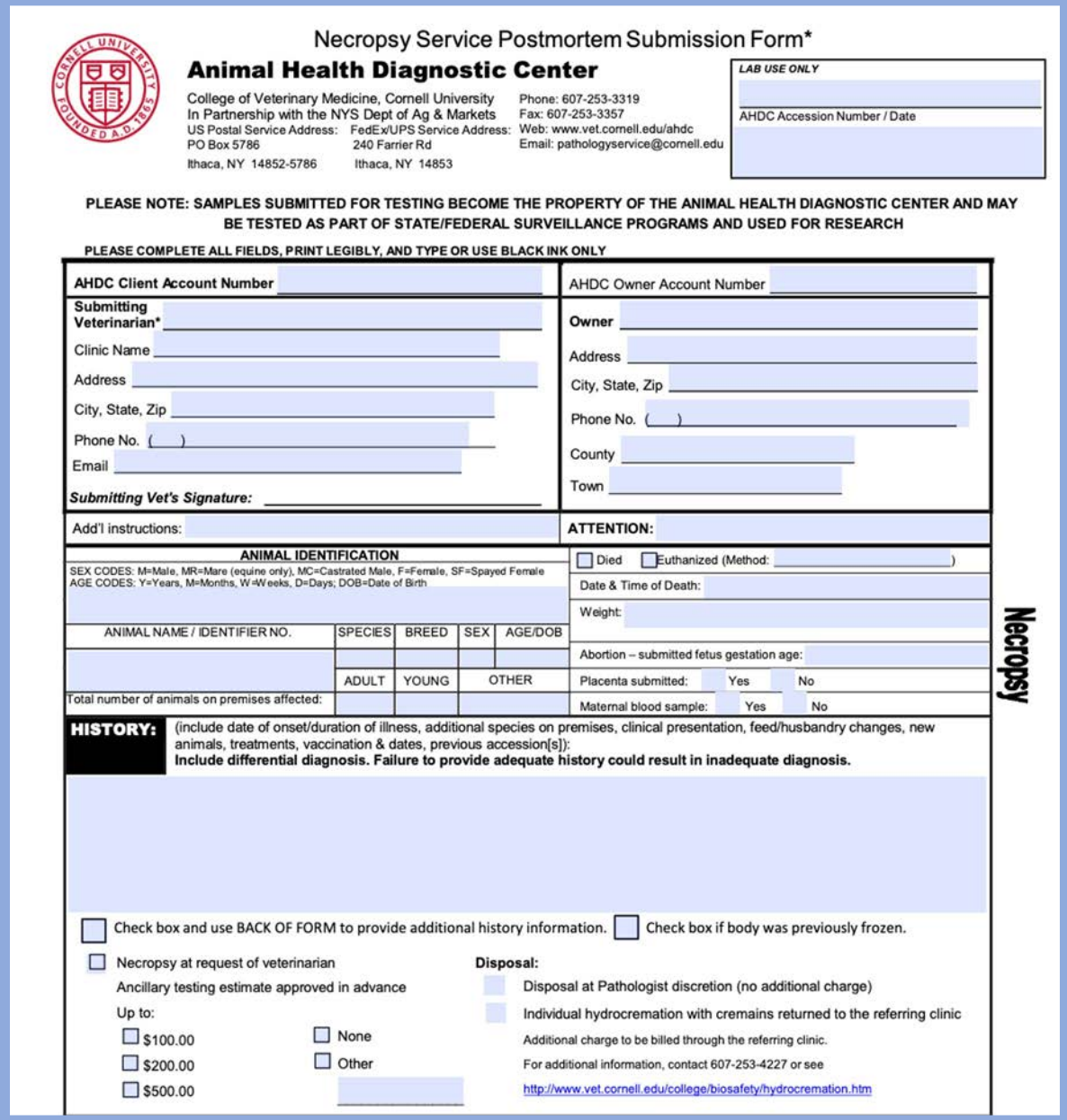
NY Contract Subsidy

- Necropsy at the AHDC
  - 1 animal per contract
  - Necropsy, histo and all ancillaries capped
    - $100 if < 40 lbs
    - $225 40 lb- 500 lbs
    - $350 >500 lbs



Necropsy Service Postmortem Submission Form*

Animal Health Diagnostic Center

College of Veterinary Medicine, Cornell University
In Partnership with the NYS Dept of Ag & Markets
US Postal Service Address: PO Box 5786 Ithaca, NY 14852-5786
FedEx/UPS Service Address: 240 Farrier Rd Ithaca, NY 14853
Phone: 607-253-3319
Fax: 607-253-3357
Web: www.vet.cornell.edu/ahdc
Email: pathologyservice@cornell.edu

LAB USE ONLY
AHDC Accession Number / Date

PLEASE NOTE: SAMPLES SUBMITTED FOR TESTING BECOME THE PROPERTY OF THE ANIMAL HEALTH DIAGNOSTIC CENTER AND MAY BE TESTED AS PART OF STATE/FEDERAL SURVEILLANCE PROGRAMS AND USED FOR RESEARCH

PLEASE COMPLETE ALL FIELDS, PRINT LEGIBLY, AND TYPE OR USE BLACK INK ONLY

AHDC Client Account Number
Submitting Veterinarian*
Clinic Name
Address
City, State, Zip
Phone No. ( )
Email
Submitting Vet's Signature:

AHDC Owner Account Number
Owner
Address
City, State, Zip
Phone No. ( )
County
Town

Add'l instructions:
ATTENTION:

ANIMAL IDENTIFICATION
SEX CODES: M=Male, MR=Mare (equine only), MC=Castrated Male, F=Female, SF=Spayed Female
AGE CODES: Y=Years, M=Months, W=Weeks, D=Days; DOB=Date of Birth

ANIMAL NAME / IDENTIFIER NO.	SPECIES	BREED	SEX	AGE/DOB

ADULT YOUNG OTHER
Total number of animals on premises affected:

Died Euthanized (Method:)
Date & Time of Death:
Weight:
Abortion – submitted fetus gestation age:
Placenta submitted: Yes No
Maternal blood sample: Yes No

Necropsy

HISTORY: (include date of onset/duration of illness, additional species on premises, clinical presentation, feed/husbandry changes, new animals, treatments, vaccination & dates, previous accession[s]):
Include differential diagnosis. Failure to provide adequate history could result in inadequate diagnosis.

Check box and use BACK OF FORM to provide additional history information. Check box if body was previously frozen.

Necropsy at request of veterinarian
Ancillary testing estimate approved in advance
Up to:
$100.00 $200.00 $500.00 None Other

Disposal:
Disposal at Pathologist discretion (no additional charge)
Individual hydrocremation with cremains returned to the referring clinic
Additional charge to be billed through the referring clinic.
For additional information, contact 607-253-4227 or see
http://www.vet.cornell.edu/college/biosafety/hydrocremation.htm

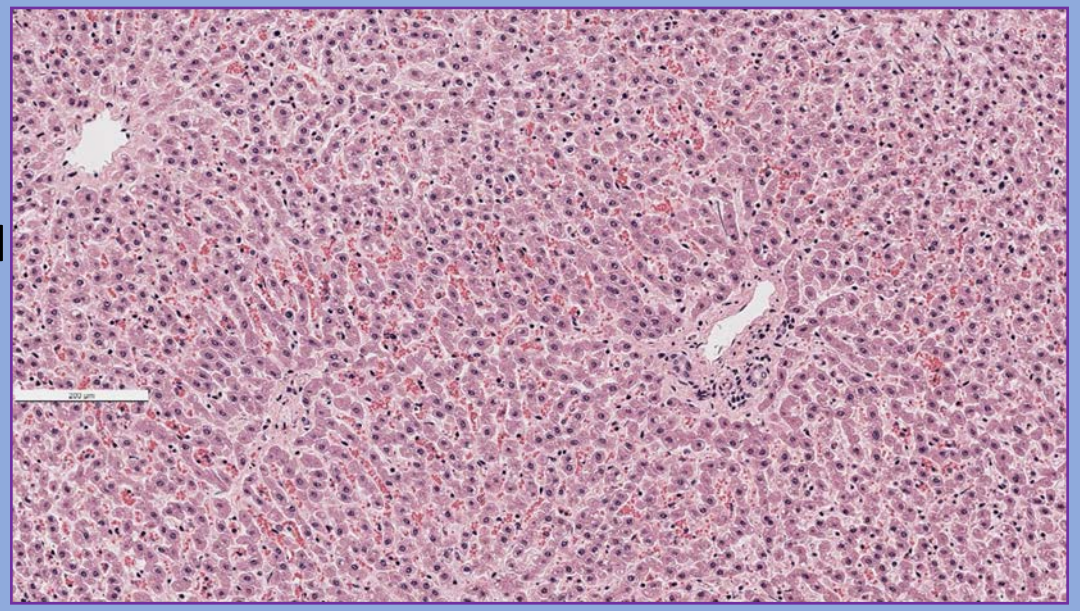
Diagnostics at the AHDC Antemortem chem panel:

Test Name	Result		Reference Interval	Units
Blood, Whole, Clotted - 07/05/2022				
Albumin	3.9		3.3 - 4.3	g/dL
Globulin	3.7		2.8 - 5.4	g/dL
A/G Ratio	1.1		0.6 - 1.6	
Glucose	76		57 - 79	mg/dL
AST	1038	(H)	54 - 135	U/L
SDH	>250	(H)	8 - 48	U/L
GLDH	>350	(H)	14 - 141	U/L
GGT	200	(H)	17 - 54	U/L
Total Bilirubin	2.1	(H)	0.0 - 0.1	mg/dL
Direct Bilirubin	0.4	(H)	0.0 - 0.0	mg/dL
Indirect Bilirubin	1.7	(H)	0.0 - 0.1	mg/dL
Creatine Kinase	567	(H)	88 - 292	U/L
Iron	342	(H)	64 - 224	ug/dL
TIBC	350		320 - 490	ug/dL
FE saturation	96	(H)	18 - 54	%
Lipemia	11		See Comment	

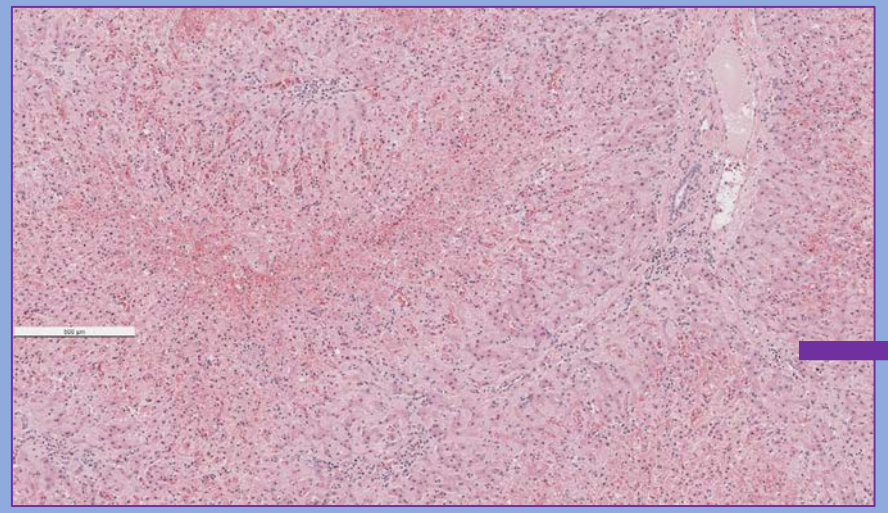
Never request a CBC or Chemistry on EDTA whole blood or serum collected post-mortem!

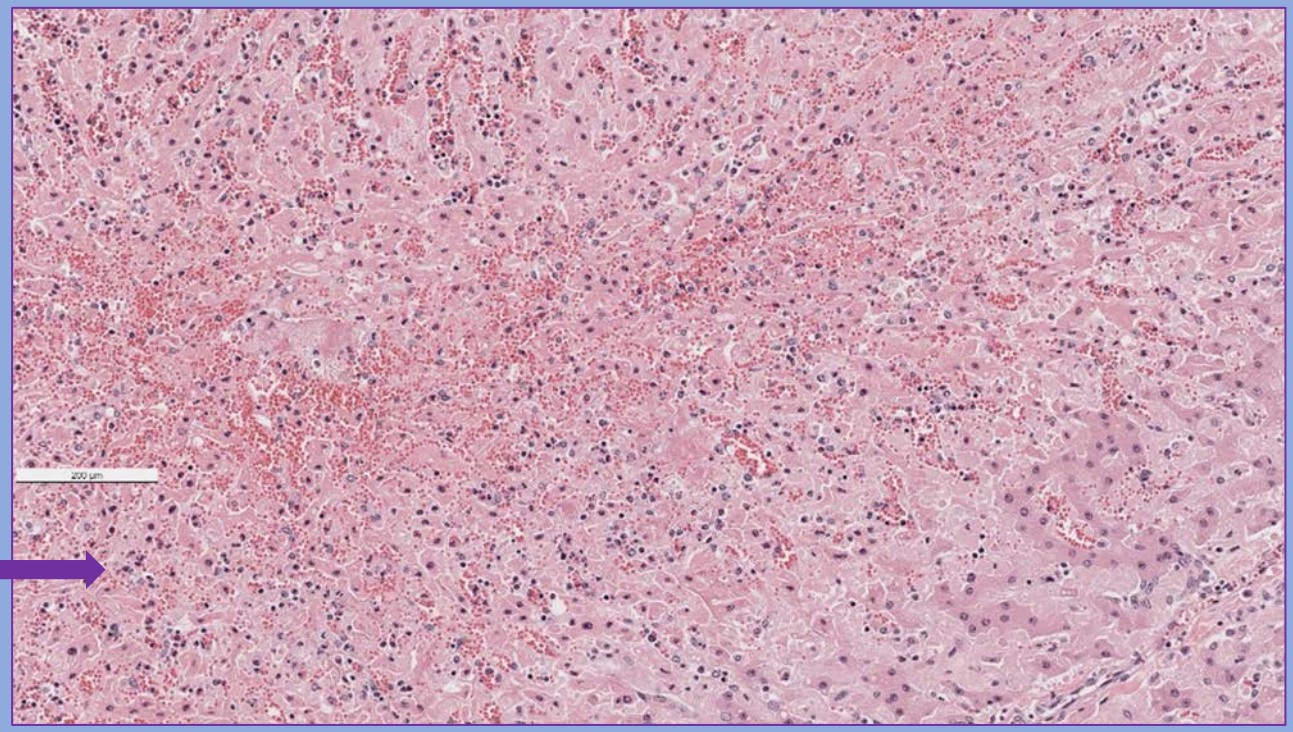
Histopathology:massive hepatic necrosis

Normal liver



Hepatic necrosis





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Diagnostics at the AHDC:

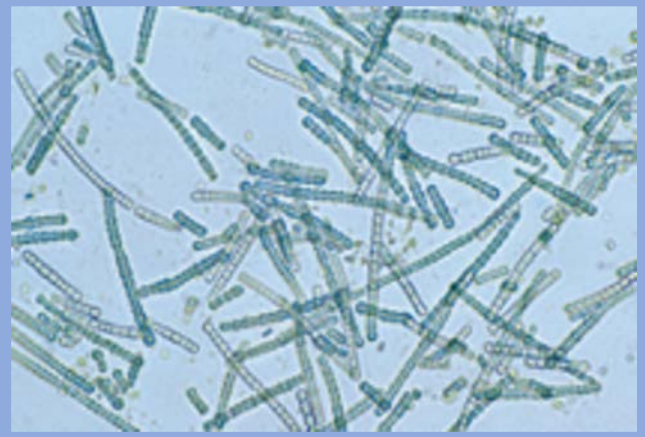
- Heavy metal testing on liver
- Clostridial testing liver, kidney
- Bacterial cultures multiple organs
- Lepto PCRs

Liver - 07/05/2022	
Anaerobic Bacterial Culture	No growth
Clostridium chauvoei FA	Negative
Clostridium novyii FA	Negative
Clostridium septicum FA	Negative
Clostridium sordellii FA	Negative

Arsenic:	<0.025 ppm
Cadmium:	<0.025 ppm
Lead:	<0.025 ppm
Thallium:	<0.025 ppm
Mercury:	0.06 ppm
Selenium:	0.11 ppm

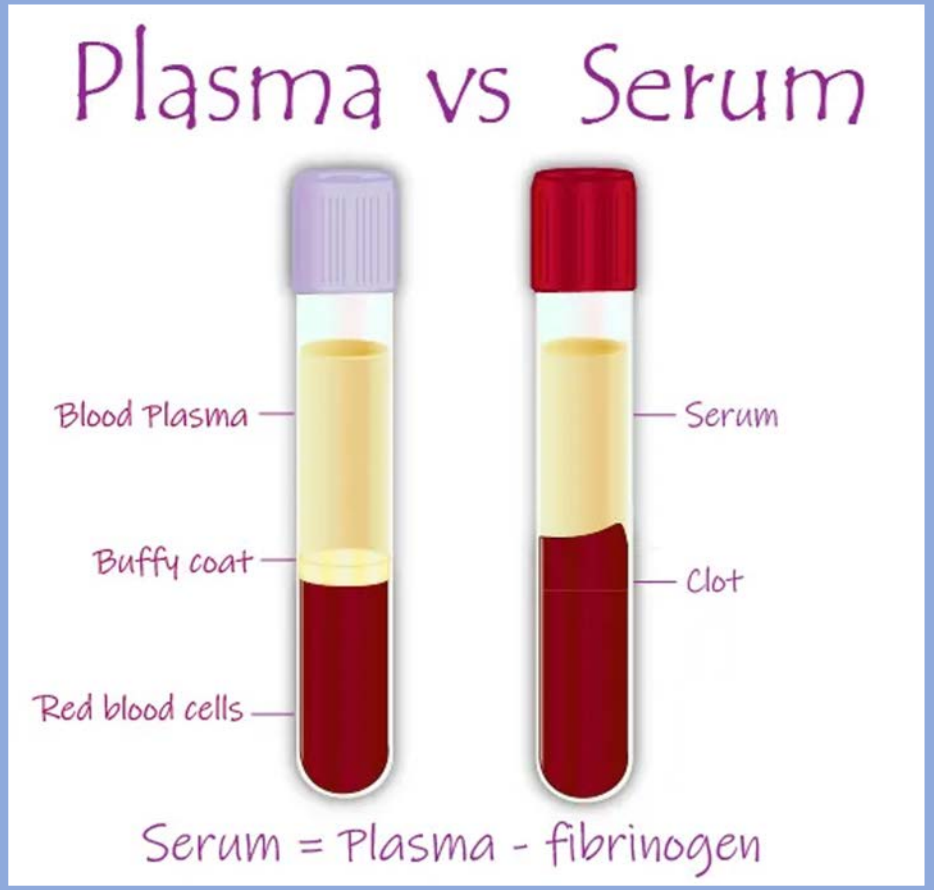
Ancillary diagnostic results negative…

- Mycotoxin testing on feed negative
- Blue green algae?
  - Town water, waterers cleaned weekly
  - Sent rumen contents to K State for microcystin ELISA – negative



7/11: Cow 4 (3rd necropsy):

- 5th LACT, 6 yr old, 90 DIM, 120 lbs, BCS 1/5
  - No rumen movement
  - Tachycardic, pale mm
- Collected EDTA whole blood and serum antemortem
  - Blood watery and dark
- Necropsy findings:
  - Icteric
  - Spleen large and friable
  - Liver enlarged
  - Dilated heart with large ventricles

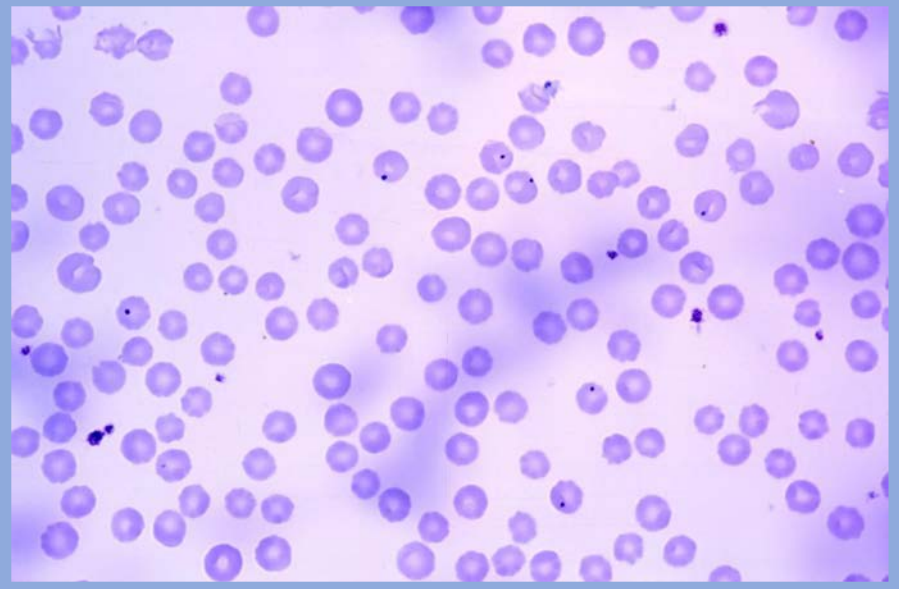


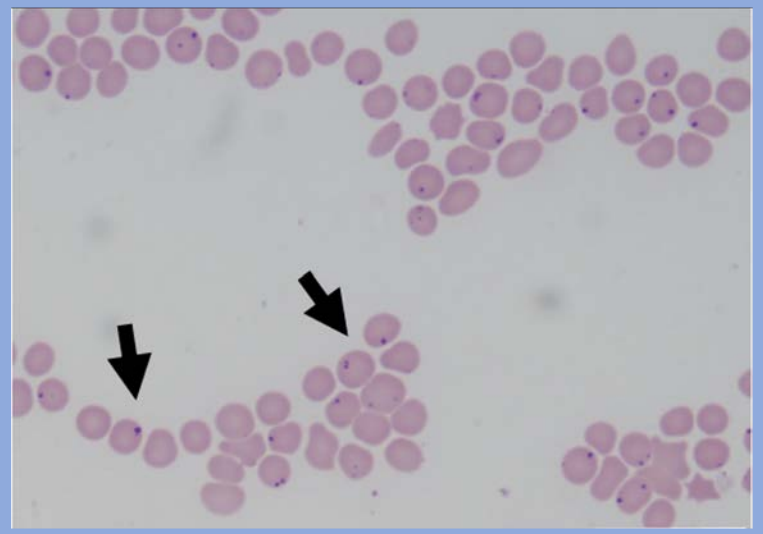
CBC Results from Cow 4 (3rd necropsy)

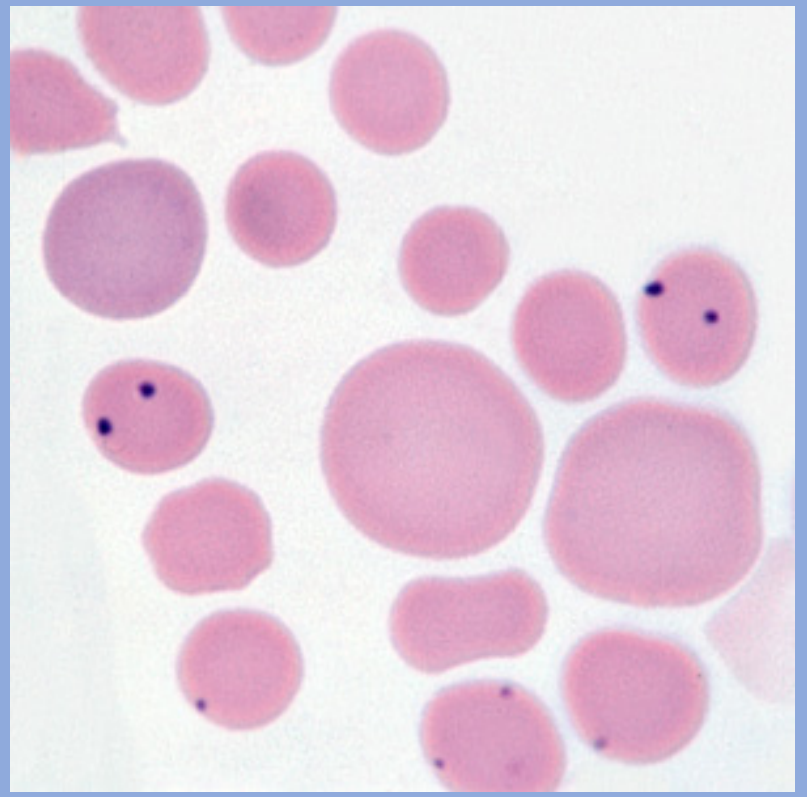
Test Name	Result		Reference Interval	Units
Blood, Whole, EDTA				
Hematocrit	9	(L)	25 - 33	%
Hemoglobin	3.0	(L)	8.7 - 12.4	g/dL
RBC	1.6	(L)	5.0 - 7.2	mill/uL
MCV	57	(H)	38 - 51	fL
MCH	18		14 - 19	pg
MCHC	32	(L)	34 - 38	g/dL
RDW	28.2	(H)	15.0 - 19.4	%
Nucleated Red Blood Cells	12	(H)	0 - 0	/100 WBC

Many *Anaplasma marginale* on blood smear!

Blood smears of *Anaplasma marginale*







Searching for hemoprotozoa

- Cows 1 and 2 were *Anaplasma marginale* PCR positive on spleen
- Cow 4 was coinfected with *Anaplasma marginale* and *Theileria orientalis* (both PCR positive on spleen)

Tissue, Fresh	
Anaplasma marginale PCR	**HIGH POSITIVE**
Theileria orientalis PCR	**LOW POSITIVE**

Outcome

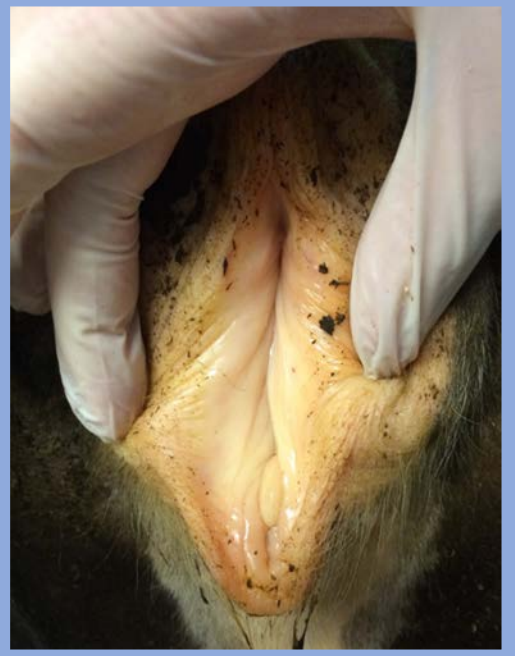
- Total of 15 cows died
- *Theileria orientalis* was sent to Virginia Tech and was found to be genotype **Ikeda**
- Pathogenicity: Ikeda>Chitose>Buffeli
- Many reactive lymphocytes on blood smears
- Lymphocyte counts elevated as well
- 17/18 additional herdmates positive on BLV ELISA

BLV ELISA results:

Result
POSITIVE 91%
POSITIVE 93%
POSITIVE 94%
POSITIVE 92%
POSITIVE 95%
POSITIVE 95%
POSITIVE 95%
Negative 0%
POSITIVE 94%
POSITIVE 94%
POSITIVE 93%
POSITIVE 94%
POSITIVE 95%
POSITIVE 95%
POSITIVE 95%

Anaplasma marginale

- Intracellular rickettsial bacteria
- Transmission:
  - Ixodidae ticks (*Dermacentor* spp)
  - Needle sharing, blood-contaminated equipment, biting insects
  - Vertical (rare)
- Incubation period = 7-60 days
- Clinical signs
  - Fever – transient
  - Profound regenerative anemia (PCV <10%), weakness, icterus, may abort
  - Mortality varies (up to 50%)



Anaplasma marginale

- **Unlikely to see signs in cattle <1 year of age**
  - Persistent infection - Recovered animals can become carriers
  - Older cattle = Severe disease
- Diagnosis
  - Blood smear - During acute phase
  - PCR - EDTA or fresh spleen
  - ELISA - Serum; can detect carriers, herd screening
- Treatment
  - Oxytetracycline (extended therapy needed for clearance)
  - Cleared cattle = Susceptible

Theileria orientalis aka Bovine piroplasmosis

- Agent of bovine infectious anemia
- Protozoan erythroparasite
- Spread by:
  - *Haemophysalis longicornis* aka Asian Longhorn Tick
    - different than A. marginale
  - Biting flies
  - Lice
  - Needles
- 8 genotypes
  - Ikeda>Chitose>Buffeli
- Dz in NZ, Australia, Japan
  - 25% of Australian cattle affected

- First found in VA in 2017
  - Endemic in the southeast now
  - 13.7% of 1,359 tested in VA, 85% were Ikeda
- This is first incursion in NY (previously found in VT in 2020)

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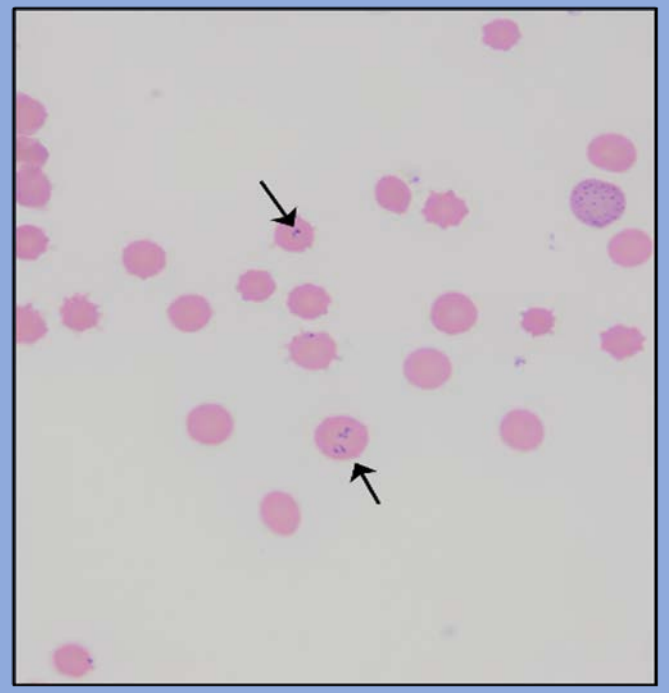
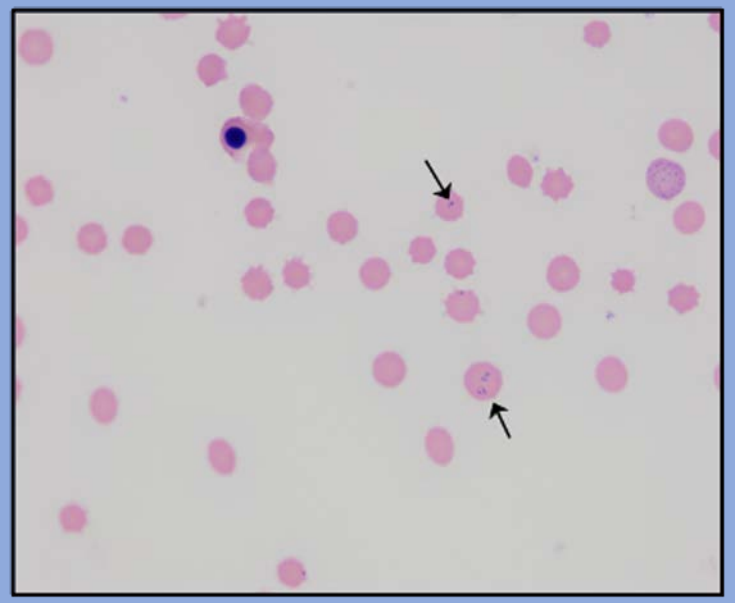
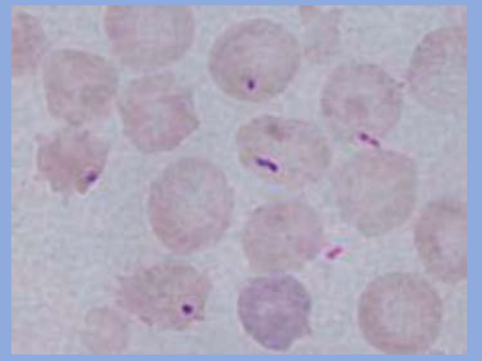
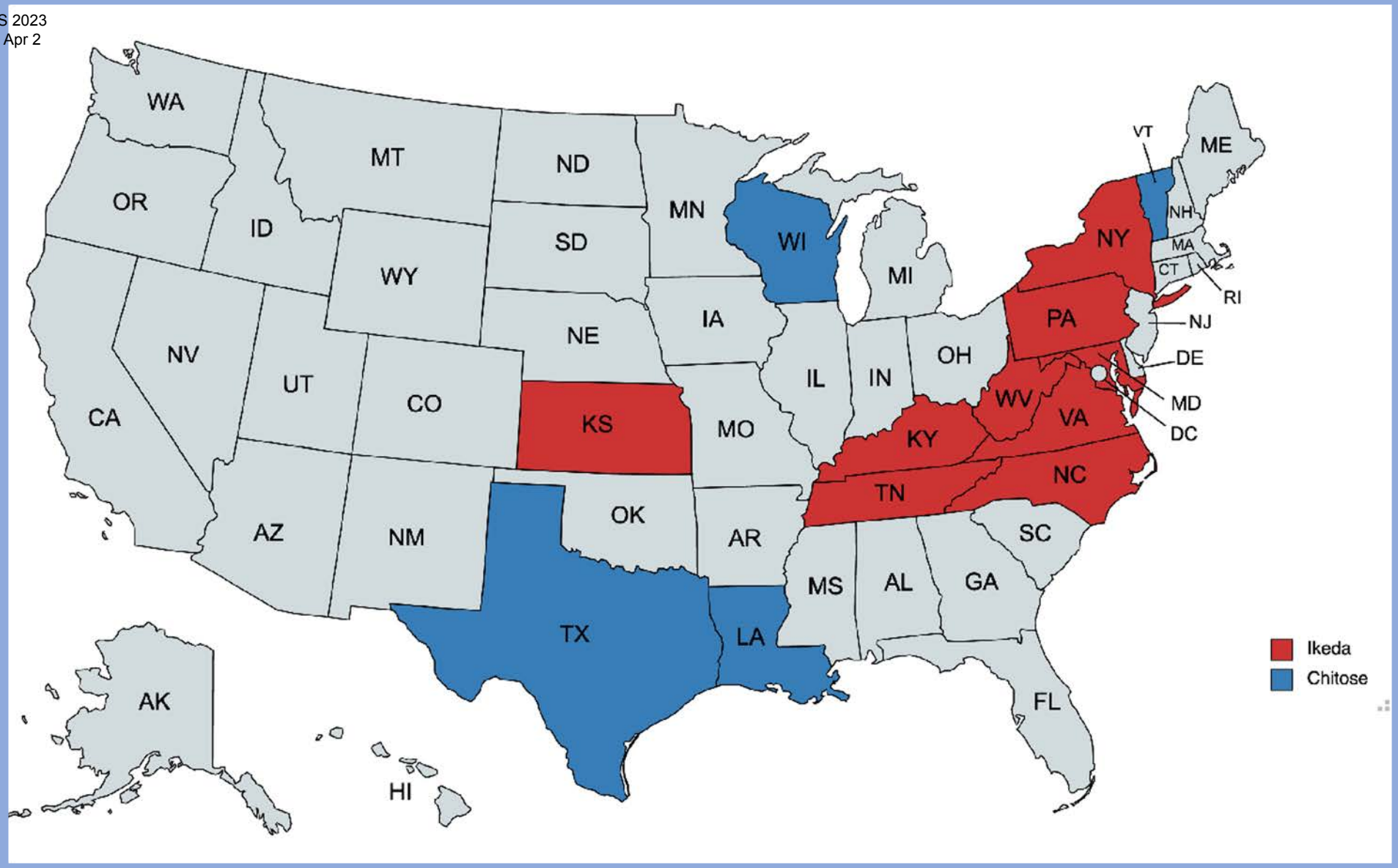
Blood smears of *Theileria orientalis*







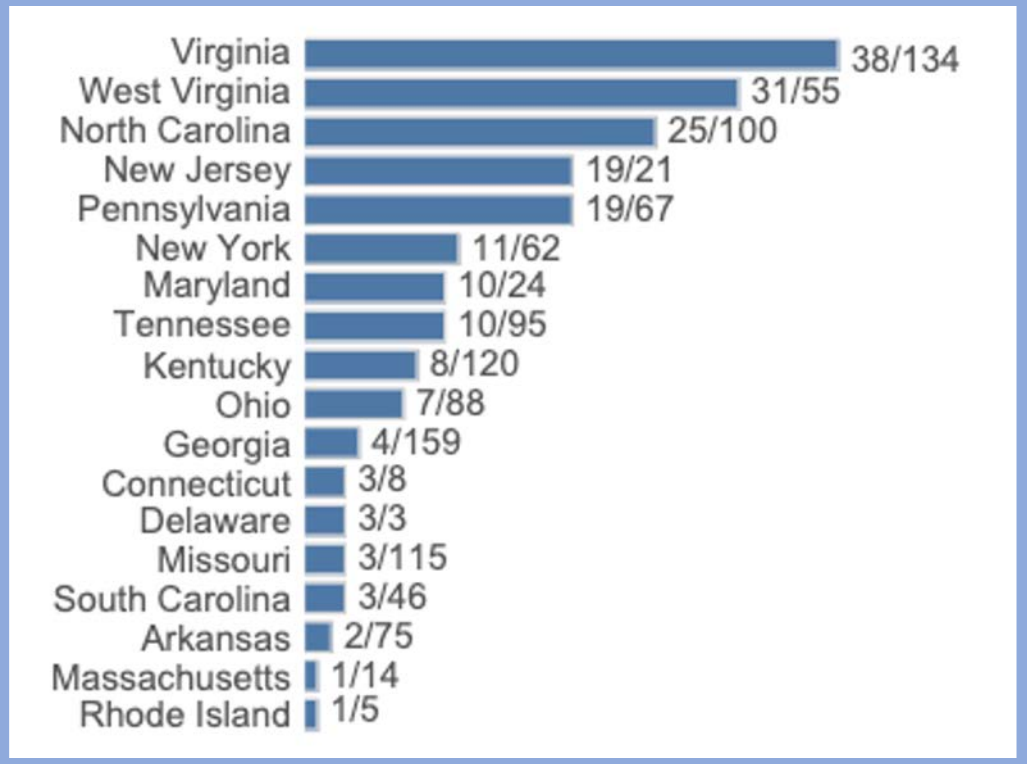


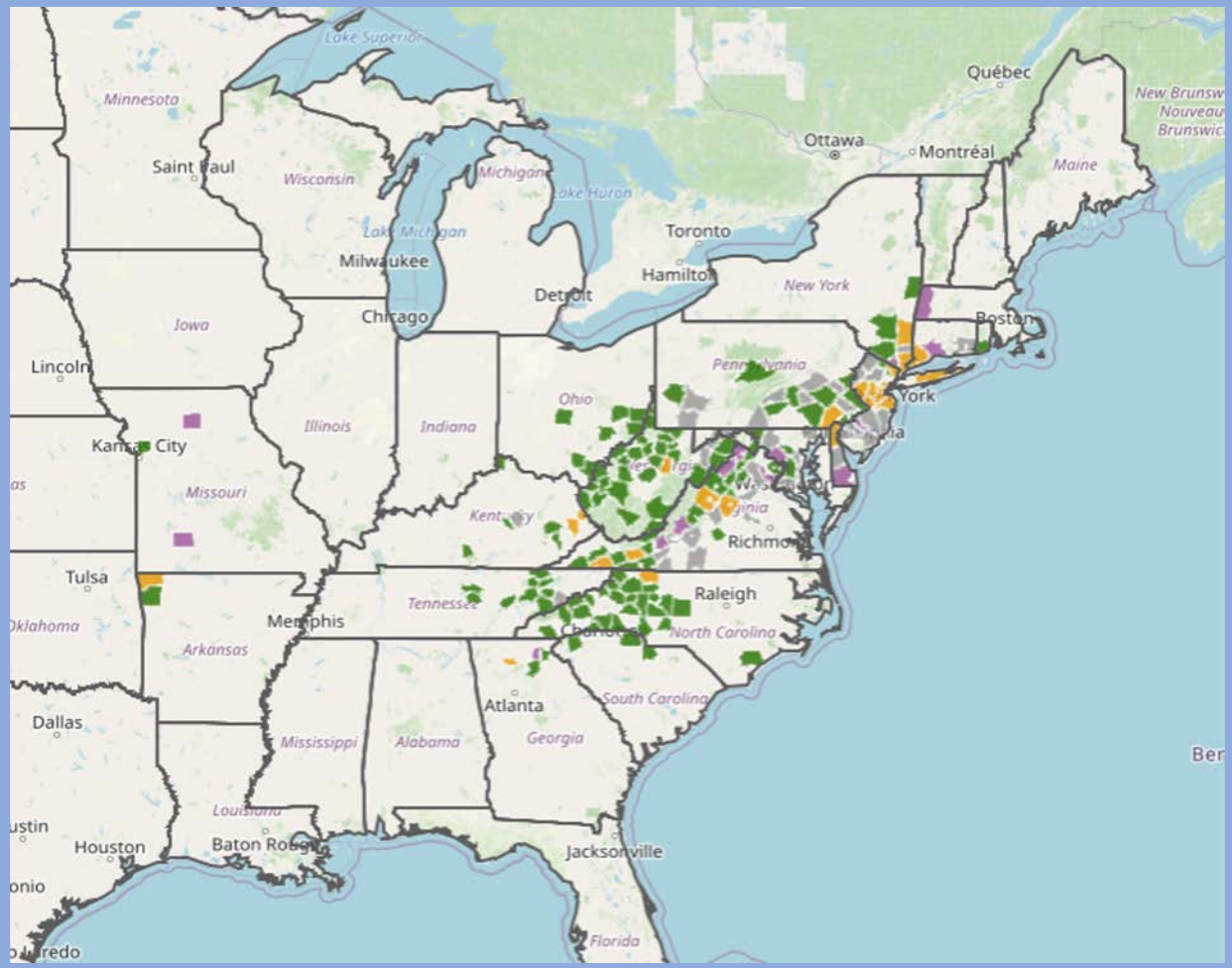
Map image from Dr. Kevin Lahmer's presentation to NCBA 8/23/22

Theileria orientalis and the Asian Longhorn Tick

- *Haemaphysalis longicornis* in NJ
  - August 2017
- Subsequently detected in 17 more states (Feb 2023)
  - Back dated to 2010
- Parthenogenetic
  - Explosive populations
  - Can exsanguinate
- Confirmed that VA *T. orientalis* strain was transmitted by ALT in 2021

States with confirmed ALT:





USDA-APHIS National *Haemaphysalis longicornis* (Asian Longhorned Tick) Situation Report. Available online: https://www.aphis.usda.gov/animal_health/animal_diseases/tick/downloads/longhorned-tick-sitrep.pdf. (last updated 2/27/23)

https://www.aphis.usda.gov/aphis/maps/animal-health/asian-longhorned-tick (last updated 2/27/23)

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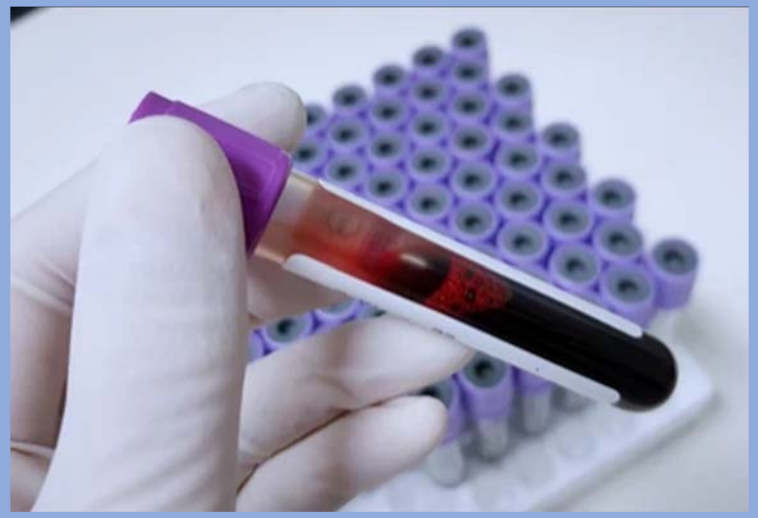
Clinical signs of *T. orientalis*

- 1-8 weeks after infection
- Weakness
- Pallor (PCV ranges from normal to 8%)
- Pyrexia
- Late term abortion
- ↑HR and RR
- **Calves susceptible**
- Pathogenicity: Ikeda>Chitose>Buffeli

- "Banana cows"

T. orientalis

- 1-5% death loss with Ikeda
  - Beef herds 80-90% infected
  - Dairy 30-40% infected
- Deaths during stress
- Persistent infection, carrier state
- Diagnosis: PCR of EDTA whole blood or spleen
- **No treatment**
- Perera et al (2014) showed decreased milk production in clinical cattle in Australia



What caused the severe icterus and deaths?

- *T. orientalis* on RBC - massive hemolysis - severe anemia - macrophages phagocytose infected RBC, and inflammatory cytokines- go to liver.
- Severe anemia causes oxygen deprivation affecting liver
- Hepatotoxin we never found?
- other …?

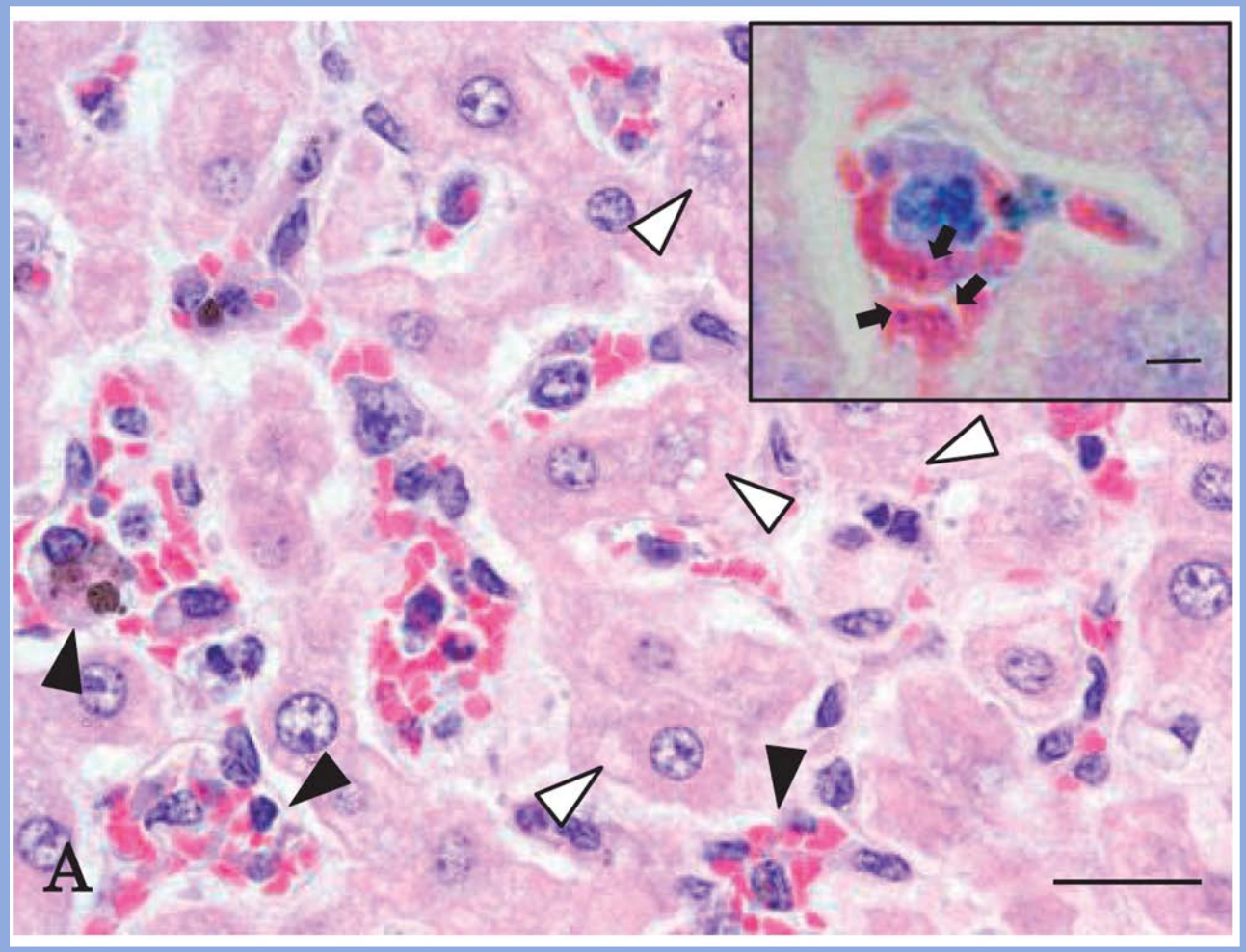
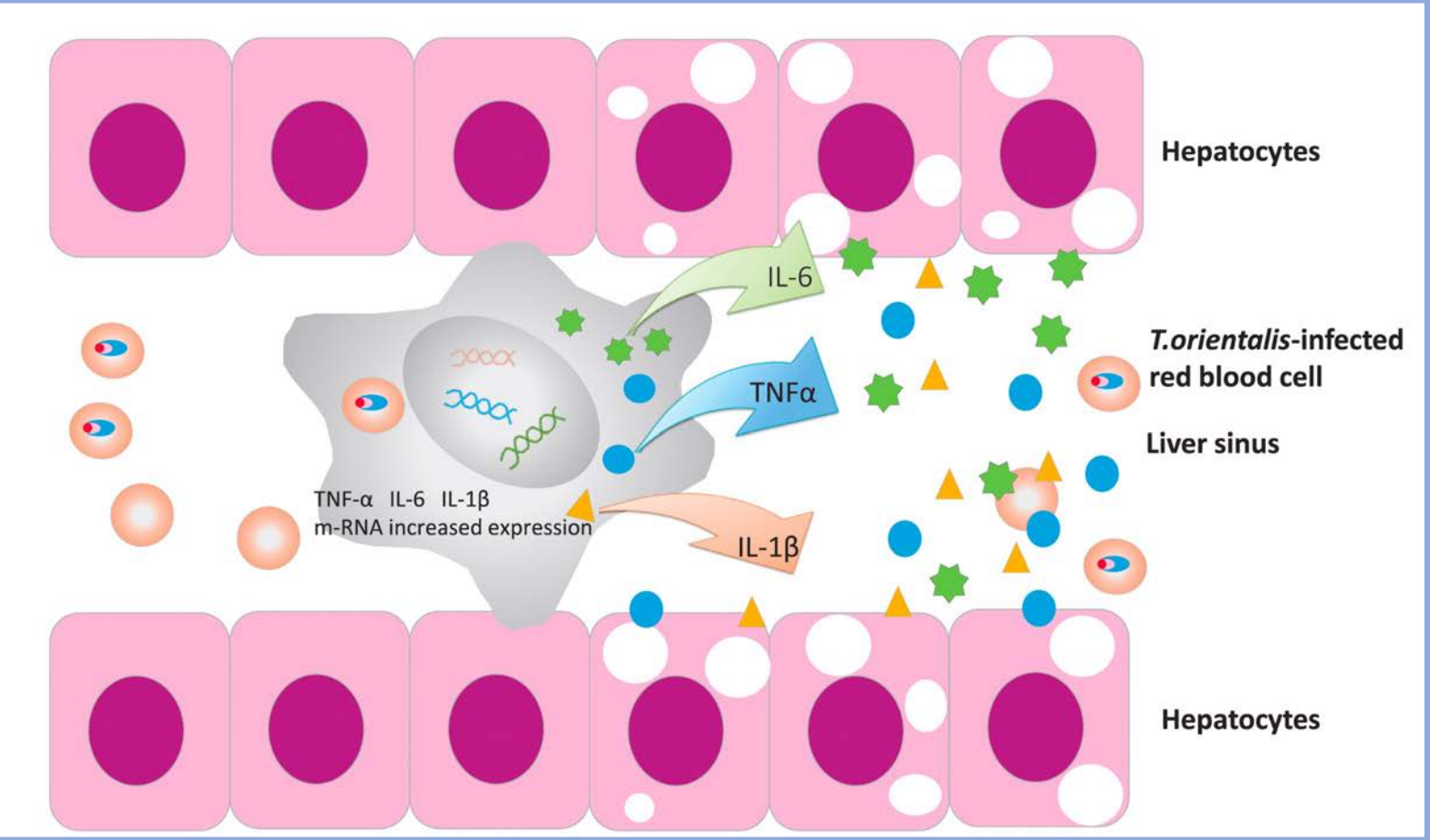


Diagram of hepatocellular injury from *T. orientalis*



Ogihara K, et al. Pathogenesis of liver lesions in *Theileria orientalis*-inoculated cattle and severe combined immunodeficiency mice with bovine erythrocyte transfusion. Biomed Res. 2020

Regulatory implications for *T. orientalis*

- Anaplasmosis & Theileria: Similar regulatory implications
- Goal = Prevent spread of the diseases to other herds
- **Clinically affected and test-positive cattle are quarantined**
  - **NOT ENTIRE HERD**
  - i.e., deceased cattle with diagnosis on PM = no quarantine (deceased)
- Quarantined cattle required to have official identification
- Quarantine release by NYSAGM:
  - Anaplasmosis: A single negative C-ELISA or PCR test result
  - Theileria: Theoretically negative test can clear them, but rarely occurs.
    - Animal is quarantined until owner elects to send to slaughter.
    - Slaughter must be verified and department notified.

Major Differences: Anaplasma vs. Theileria

	Anaplasma	Theileria
Etiology	Rickettsial (bacteria)	Protozoal
Clinical signs	Transient fever	Continuous fever; disease may be less aggressive; spleens less distended versus anaplasmosis; may have ventral edema
Presentation	Cattle usually >1 year old	Calves and pregnant heifers more common
Tick vector	NOT ALT; Dermacentor, Ixodes and Rhipicephalus	Ixodid tick spp. H. longicornis (ALT)
Diagnosis	Blood smear, PCR, ELISA	Blood smear, PCR
Treatment	Extended therapy with tetracyclines	None available in US

Practical guidance for affected herds

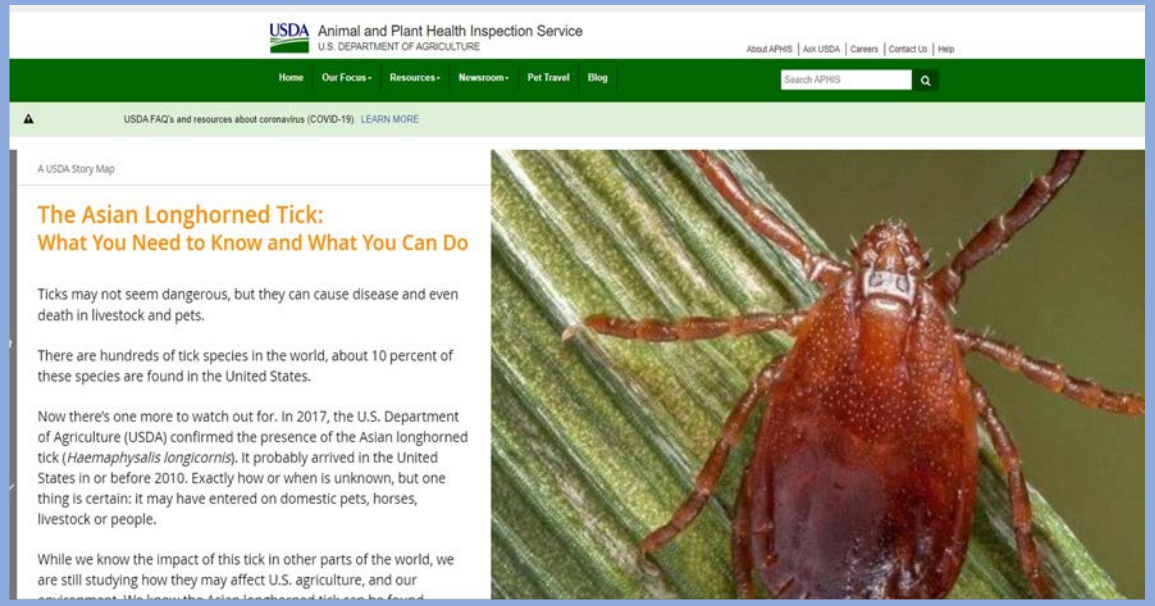
- Education: Disease transmission
  - Management of ticks if suspected
  - Iatrogenic transmission - fomites (needles, tattooers, dehorners, hoof knives etc) - including off-site facilities, ex. heifer raisers
- Best management practices:
  - Minimize stress on affected animals (and optimize nutrition)
  - Inspect poor doing animals for ticks; if found, consider testing
  - Treat animals and environment for ticks
  - If a positive, clinical animal is found, assume environment is contaminated
    - Pasture management for ticks
    - Keep cattle out of woods
  - Monitor new cattle additions for ticks or signs of disease before introduction
- Culling is highly recommended for positive, symptomatic animals

References - Ticks

https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/animal-disease-information/cattle-disease-information/cattle-vector-borne-diseases

https://www.aphis.usda.gov/aphis/maps/animal-health/asian-longhorned-tick

https://storage.googleapis.com/wzukusers/user-27355591/documents/5b64ac8c8295e1hQaF2J/Pesticides%20for%20ticks%20on%20cattle%20and%20sheep.pdf



Pesticides Registered in New York State for Treatment of Ticks on Cattle and Sheep
Prepared by: Michael Helms, Pesticide Management Education Program (PMEP), Cornell University

Notes:

- *Data collected from the New York State Department of Environmental Conservation's online product registration system (http://www.dec.ny.gov/nyspad/products) using the pesticide use category "livestock" and the pest "ticks". All products listed can be used in Nassau and Suffolk Counties as of the date prepared (July 27, 2018).*
- *Before purchasing or using a pesticide, always check that it is currently registered with the Department of Environmental Conservation and that the pest you wish to control and the animal you're treating are listed together on the label.*
- *Follow all label directions.*

Product Name	Active Ingredient(s)	Registered for use on	Restricted-Use Pesticide?[1]	EPA Registration Number
Agrisel Zone-Plus Termiticide/Insecticide with Permethrin for Turf and Ornamental Use	permethrin	Lactating and non-lactating dairy cattle and goats, beef cattle, and sheep	Yes	72159-9
Atroban 11% EC	permethrin	Lactating and non-lactating dairy cattle and goats, beef cattle, and sheep	No	773-59
Boss Pour-On Insecticide for Cattle and Sheep	permethrin	Lactating and non-lactating dairy cattle, beef cattle, and calves	No	773-82
Brute Pour-On for Cattle	permethrin	Dairy cattle (lactating and non-lactating) and beef cattle.	No	39039-7
Clear Zone Double Impact Farm Fly Spray	pyrethrins, permethrin, piperonyl butoxide	Non-commercial cattle	No	499-320
Co-Ral Fly and Tick Spray {Bayer Healthcare}	coumaphos	Beef and non-lactating dairy cattle	No	11556-115
Country Vet Farmgard Permethrin Concentrate	permethrin	Dairy or beef cattle, sheep	Yes	4-350-10807
Delaval Applicator Fly Spray	permethrin	Lactating and non-lactating dairy cattle, beef cattle, and calves	No	47000-150-11388
Durvet Dairy Bomb 55-Z	pyrethrin, piperonyl butoxide	Beef cattle, dairy cattle, other livestock.	No	47000-97-12281
Durvet Screw Worm Aerosol	permethrin	Beef cattle, dairy cattle, sheep	No	47000-100-12281
Evercide Permethrin 10% EC 2784	permethrin	Beef cattle, dairy cattle, sheep	Yes	1021-1736
Evergreen Pro 60-6	pyrethrins, piperonyl butoxide	Livestock	No	1021-1770
Fly Zap Aerosol	pyrethrins, piperonyl butoxide	Beef cattle, dairy cattle, and other livestock	No	47000-97-40940
Gardstar 40% EC Livestock and Premise Insecticide	permethrin	Lactating and non-lactating dairy cattle, beef cattle, sheep	Yes	39039-8
Gordon's Livestock Backrubber & Pour-On	permethrin	Beef cattle, dairy cattle, sheep	No	2217-861

References - Theileria and Anaplasmosis

https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/animal-disease-information/cattle-disease-information/cattle-vector-borne-diseases

Cattle Theileriosis Fact Sheet

Asian Longhorned Tick Fact Sheet

ALT Response Plan

ALT Situation Report (Feb 2023)

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USDA Animal and Plant Health Inspection Service
U.S. DEPARTMENT OF AGRICULTURE

Pest Alert

Veterinary Services

Asian Longhorned Tick (*Haemaphysalis longicornis*)

The Asian longhorned tick (ALHT) is an invasive pest that poses a serious threat to livestock. While not normally found in the Western Hemisphere, this tick was reported for the first time in the United States in 2017. It has since been found in numerous Eastern States. ALHT can reproduce without a male, so a single tick can create a population in a new location; one female can lay up to 2,000 eggs.

Distribution

ALHT is native to eastern China, Japan, the Russian Far East and Korea. It is an introduced and established exotic species in Australia, New Zealand and several island nations in the Western Pacific Region. In late 2017, ALHT was found in New Jersey, marking the first confirmed detection of this pest in the United States. To date, ALHT has been confirmed in the following States: Arkansas, Connecticut, Delaware, Georgia, Kentucky, Maryland, Missouri, New Jersey, New York, North Carolina, Ohio, Rhode Island, South Carolina, Pennsylvania, Tennessee, Virginia, and West Virginia.

The widespread establishment of a new tick species in the United States is rare. After the 2017 detection, animal health officials examined how and when the tick arrived in the United States. It remains unknown how the ALHT first entered the country, but it likely arrived here in or before 2010. Possible routes of entry include imports of domestic pets, horses, or livestock or people unknowingly carrying the tick back to the United States after traveling abroad.

Hosts

ALHT has been found feeding on a number of hosts, including sheep, goats, dogs, cats, horses, cattle, chickens, black bears, foxes (red and grey), coyotes, groundhogs, striped skunks, white-tailed deer, elk, opossums, raccoons, Canada geese, barred owls, great horned owls, brown boobies, *Peromyscus* mice, and red-tailed hawks. The tick has also been found on people.

Description

ALHT is light brown in color. The adult female grows to the size of a pea when full of blood. Male ticks are rare. Other stages of the tick are very small, about the size of a sesame seed or even smaller.

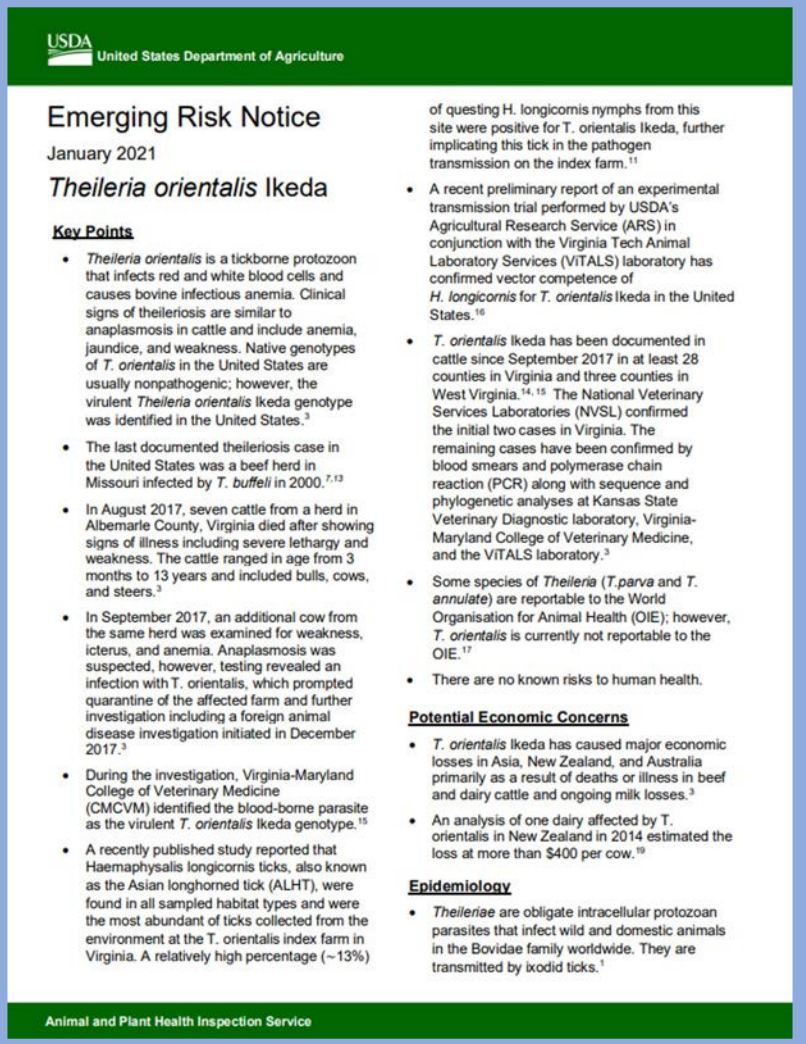
Asian longhorned tick, adult female dorsal view (James Gathany, CDC)

This tick is about the size of a sesame seed. (Michael Greenwood)

Impact

ALHT is mainly a pest of concern in livestock. This tick often forms large infestations on one animal, causing great stress and reducing growth and production. A severe infestation can even kill the animal due to blood loss.

Disease spread is another threat. In other countries, ALHT is known to transmit the agents of several livestock and human diseases, including anaplasmosis, babesiosis, ehrlichiosis, theileriosis, and rickettsiosis.



USDA United States Department of Agriculture

Emerging Risk Notice

January 2021

Theileria orientalis Ikeda

Key Points

- *Theileria orientalis* is a tickborne protozoon that infects red and white blood cells and causes bovine infectious anemia. Clinical signs of theileriosis are similar to anaplasmosis in cattle and include anemia, jaundice, and weakness. Native genotypes of *T. orientalis* in the United States are usually nonpathogenic; however, the virulent *Theileria orientalis* Ikeda genotype was identified in the United States.[3]
- The last documented theileriosis case in the United States was a beef herd in Missouri infected by *T. buffeli* in 2000.[7,13]
- In August 2017, seven cattle from a herd in Albemarle County, Virginia died after showing signs of illness including severe lethargy and weakness. The cattle ranged in age from 3 months to 13 years and included bulls, cows, and steers.[3]
- In September 2017, an additional cow from the same herd was examined for weakness, icterus, and anemia. Anaplasmosis was suspected, however, testing revealed an infection with T. orientalis, which prompted quarantine of the affected farm and further investigation including a foreign animal disease investigation initiated in December 2017.[3]
- During the investigation, Virginia-Maryland College of Veterinary Medicine (CMCVM) identified the blood-borne parasite as the virulent *T. orientalis* Ikeda genotype.[15]
- A recently published study reported that Haemaphysalis longicornis ticks, also known as the Asian longhorned tick (ALHT), were found in all sampled habitat types and were the most abundant of ticks collected from the environment at the T. orientalis index farm in Virginia. A relatively high percentage (~13%) of questing H. longicornis nymphs from this site were positive for T. orientalis Ikeda, further implicating this tick in the pathogen transmission on the index farm.[11]
- A recent preliminary report of an experimental transmission trial performed by USDA's Agricultural Research Service (ARS) in conjunction with the Virginia Tech Animal Laboratory Services (ViTALS) laboratory has confirmed vector competence of *H. longicornis* for *T. orientalis* Ikeda in the United States.[16]
- *T. orientalis* Ikeda has been documented in cattle since September 2017 in at least 28 counties in Virginia and three counties in West Virginia.[14,15] The National Veterinary Services Laboratories (NVSL) confirmed the initial two cases in Virginia. The remaining cases have been confirmed by blood smears and polymerase chain reaction (PCR) along with sequence and phylogenetic analyses at Kansas State Veterinary Diagnostic laboratory, Virginia-Maryland College of Veterinary Medicine, and the ViTALS laboratory.[3]
- Some species of *Theileria* (*T.parva* and *T. annulate*) are reportable to the World Organisation for Animal Health (OIE); however, *T. orientalis* is currently not reportable to the OIE.[17]
- There are no known risks to human health.

Potential Economic Concerns

- *T. orientalis* Ikeda has caused major economic losses in Asia, New Zealand, and Australia primarily as a result of deaths or illness in beef and dairy cattle and ongoing milk losses.[3]
- An analysis of one dairy affected by T. orientalis in New Zealand in 2014 estimated the loss at more than $400 per cow.[19]

Epidemiology

- *Theileriae* are obligate intracellular protozoan parasites that infect wild and domestic animals in the Bovidae family worldwide. They are transmitted by ixodid ticks.[1]

Animal and Plant Health Inspection Service

College of Veterinary Medicine | Animal Health Diagnostic Center

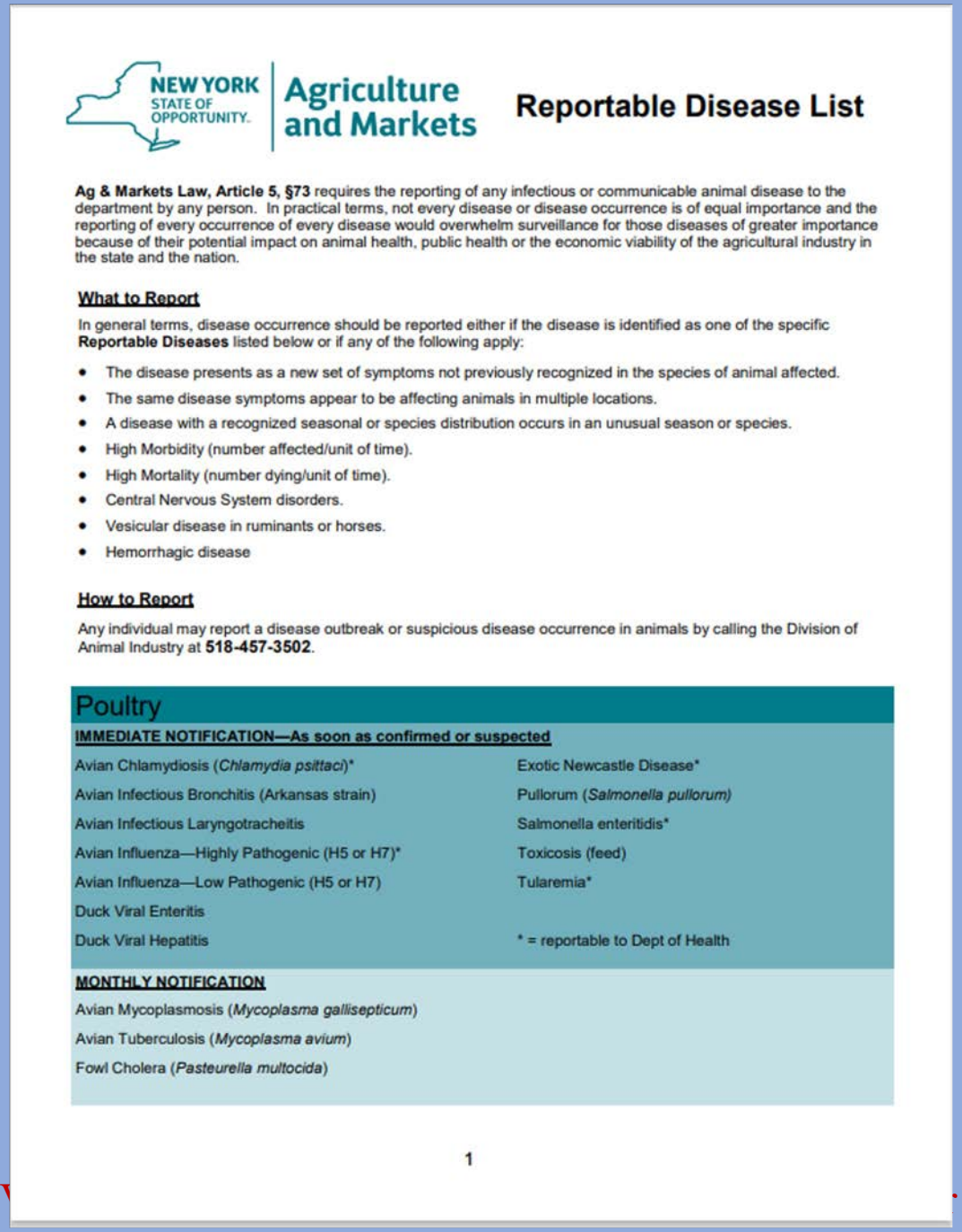
References - Reportable Diseases in NY

https://agriculture.ny.gov/animals/animal-disease-reporting

- Downloadable list
- Recently updated
- (518) 457-3502

https://www.vet.cornell.edu/animal-health-diagnostic-center/programs/nyschap

- Up to date list of NYSAGM field veterinarians



NEW YORK STATE OF OPPORTUNITY. Agriculture and Markets

Reportable Disease List

Ag & Markets Law, Article 5, §73 requires the reporting of any infectious or communicable animal disease to the department by any person. In practical terms, not every disease or disease occurrence is of equal importance and the reporting of every occurrence of every disease would overwhelm surveillance for those diseases of greater importance because of their potential impact on animal health, public health or the economic viability of the agricultural industry in the state and the nation.

What to Report

In general terms, disease occurrence should be reported either if the disease is identified as one of the specific **Reportable Diseases** listed below or if any of the following apply:

- The disease presents as a new set of symptoms not previously recognized in the species of animal affected.
- The same disease symptoms appear to be affecting animals in multiple locations.
- A disease with a recognized seasonal or species distribution occurs in an unusual season or species.
- High Morbidity (number affected/unit of time).
- High Mortality (number dying/unit of time).
- Central Nervous System disorders.
- Vesicular disease in ruminants or horses.
- Hemorrhagic disease

How to Report

Any individual may report a disease outbreak or suspicious disease occurrence in animals by calling the Division of Animal Industry at **518-457-3502**.

Poultry

IMMEDIATE NOTIFICATION—As soon as confirmed or suspected

Avian Chlamydiosis (*Chlamydia psittaci*)*	Exotic Newcastle Disease*
Avian Infectious Bronchitis (Arkansas strain)	Pullorum (*Salmonella pullorum*)
Avian Infectious Laryngotracheitis	Salmonella enteritidis*
Avian Influenza—Highly Pathogenic (H5 or H7)*	Toxicosis (feed)
Avian Influenza—Low Pathogenic (H5 or H7)	Tularemia*
Duck Viral Enteritis	
Duck Viral Hepatitis	* = reportable to Dept of Health

MONTHLY NOTIFICATION

Avian Mycoplasmosis (*Mycoplasma gallisepticum*)
Avian Tuberculosis (*Mycoplasma avium*)
Fowl Cholera (*Pasteurella multocida*)

1

Summary

- Perform a complete necropsy when faced with bovine sudden death
- Take a full set of fresh and fixed tissues
  - aqueous humor
  - ligated loop of intestine frozen
  - rumen contents
  - skeletal muscle

- *Theileria orientalis* is an emerging disease in the northeast
  - Reportable
  - spread by ALT and needles
  - Causes severe anemia and icterus
  - mimics *Anaplasma marginale*
- Don’t reuse needles!

References

- https://www.youtube.com/playlist?list=PLzf8tGKj10zxT-YTqLfHpDM7a6WxCkM7m Bovine necropsy videos done by Cornell pathologists
- K State VDL youtube videos –tons of bovine diagnostic procedures

1. Dinkel, K.D., Herndon, D.R., Noh, S.M. *et al.* A U.S. isolate of *Theileria orientalis*, Ikeda genotype, is transmitted to cattle by the invasive Asian longhorned tick, *Haemaphysalis longicornis*. *Parasites Vectors* **14**, 157 (2021). https://doi.org/10.1186/s13071-021-04659-9
2. Hammer JF, Jenkins C, Bogema D, Emery D. Mechanical transfer of *Theileria orientalis*: possible roles of biting arthropods, colostrum and husbandry practices in disease transmission. Parasit Vectors. 2016;9:34. https ://doi.org/10.1186/s1307 1-016-1323-x.
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9. Perera, P.K., Gasser, R.B., Firestone, S.M. *et al.* Oriental theileriosis in dairy cows causes a significant milk production loss. *Parasites Vectors* **7**, 73 (2014). https://doi.org/10.1186/1756-3305-7-73
10. Tabor, Alicja e. Anaplasmosis in ruminants. The Merck veterinary manual. Whitehouse Station, NJ :Merck & Co., Inc. https://www.merckvetmanual.com/circulatory-system/blood-parasites/anaplasmosis-in-ruminants
11. Telionis A, Lahmers K, Todd M, Carbonello A, Broaddus CC, Bissett CJ, Hungerford LL. Distribution of *Theileria orientalis* in Virginia Market Cattle, 2018-2020. Pathogens. 2022 Nov 15;11(11):1353. doi: 10.3390/pathogens11111353. PMID: 36422604; PMCID: PMC9695988.

Questions / Comments?

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- Jennifer Nightingale: jennifer.nightingale@agriculture.ny.gov (518) 918-8187