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In This Issue

From the Editor –

The past few months have been busy with wrapping up summer research, commencing classes here in Pullman, and attending several conferences. In August, I had the privilege of attending the National Veterinary Scholars Symposium in Minneapolis MN with seven of our students who completed 12-weeks of summer research in various disciplines within the WSU College of Veterinary Medicine. Students from across the US were at the conference presenting research posters, highlighting the incredible talents of the next generation of clinical scientists. In September, a large contingent of 2nd and 3rd year WSU veterinary students made their way to Long Beach CA for the American Association of Bovine Practitioners conference. Two teams participated in the Quiz Bowl and did WSU proud! In addition, two of our students, Holly Hinnant and Lily Elder, gave research presentations, and the CVM Ag Club President, Tanya Weber, was awarded the prestigious Amstutz Scholarship! More recently, I attended the WSVMA Pacific Northwest Veterinary Conference and was proud to watch Rachel Claus-Walker and Olivia Riblett present their experiences and insights gained from developing Secure Milk Supply enhanced biosecurity plans in WA over the past summer. The bottom line is that we have an incredible group of veterinary students who are preparing themselves to be the next clinicians, researchers, and leaders of our profession. Of course, much of the foundation for their pre-veterinary and veterinary training comes from those of you outside of WSU CVM—so thank you all for your support and willingness to provide opportunities that ultimately strengthen our program and the caliber of future veterinary practitioners!

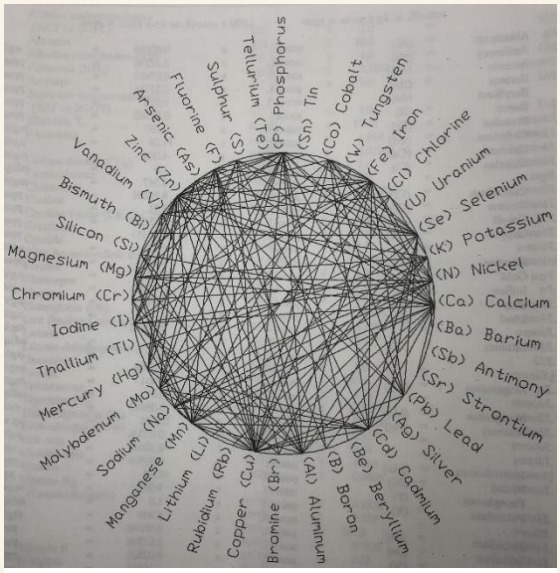
Students attending the National Veterinary Scholars Symposium

Students attending the American Association of Bovine Practitioners conference in Long Beach CA

Ruminants: Mineral Interrelationships

By CS McConnel, Veterinary Medicine Extension

At the recent Pacific Northwest Veterinary Conference, Dr. Scott Radke from Iowa State University presented a talk covering a variety of mineral and vitamin issues in ruminants. One of his opening slides touched on the interrelationships between various minerals affecting animal health, and he used the "mineral ball" figure below to demonstrate those complexities. Dr. Radke was highlighting the fact that mineral bioavailability in ruminant livestock can be affected by the chemical form of the mineral and interactions among other dietary constituents. Consequently, evaluating fluid or tissues from the animals themselves is the optimum method for determining the bioavailability of minerals in the diet. An excellent article covering some of the important considerations for evaluating mineral status can be found in Veterinary Clinics of North America: Food Animal Practice (Vol 36, Issue 3). In that article, Dr. Ensley from Kansas State University reminds us that whole blood, serum, and plasma are the most commonly used samples to analyze for mineral concentration. Important differences should be kept in mind though, such as the fact that serum contains less copper than plasma. Mineral concentrations for serum or plasma samples indicate the mineral status of the transport pool, with low to deficient mineral concentrations indicating the start of a deficiency. Serum concentrations of selenium will change within days of making a feed change, whereas whole blood and liver samples represent what the diet has been the last 30 days.



From 'Mineral Levels in Animal Health: Diagnostic Data'. Puls, R. 2nd ed. 1994

Dr. Ensley goes on to explain how to determine the number of animals to sample for mineral evaluation, and provides details related to diagnostic evaluations of deficiencies and toxicoses for eight trace minerals, cobalt (Co), copper (Cu), iron (Fe), iodine (I), manganese (Mn), molybdenum (Mo), selenium (Se), and zinc (Zn). Overall, his article serves as a nice primer for sampling protocols and outcome assessments. For example, he highlights that there is not a good correlation between liver and serum copper concentrations; even at low hepatic copper concentrations the relationship of serum to liver values is unreliable. The only reliable sample for determining copper concentration is the liver. Other nuggets of useful information are sprinkled throughout such as the fact that cattle of the dairy breeds seem to have generally lower tissue manganese concentrations than do cattle of beef breeds. This manganese deficiency may occur because of high calcium and phosphorus concentrations in dairy rations, which can be antagonistic to the bioavailability of manganese. And did you know that selenium has the smallest safety margin of the essential trace elements? That is the reason for the legal limit of selenium that can be added to feed, making selenium the only mineral with a legal limit!

To paraphrase, several summary conclusions from Dr. Ensley's article are as follows:

1. Involve several animals in production groups when determining mineral status in animals.
2. Evaluations should include a good clinical history, as well as ration and supplementation history.
3. Animal responses to supplementation of minerals is a useful means of evaluating mineral status.
4. Whole blood concentrations of selenium and iodine are useful.
5. Serum concentrations of copper, iron, and zinc are *not* adequate to determine an accurate assessment of total body mineral concentration.
6. Copper, iron, and cobalt liver biopsy samples are more sensitive measures of whole body mineral status than are serum/whole blood concentrations.

7. The removal of the serum from the clot within 2 hours of sample collection and minimization of hemolysis is critical for an accurate serum sample.
8. If trace minerals are found to be adequate in the diet, but the animals are found to be deficient, dietary or drinking water mineral antagonism may be occurring.
9. High sulfur or iron levels are examples of minerals that can cause deficiencies in copper and selenium, even though there are adequate concentrations of the latter in the diet.

As an aside, the complete Issue 3 of Volume 36 of VCNA:FAP is entitled *Toxicology* and provides thorough coverage of toxicologic topics in agriculture, such as drinking water for production animals, poisonous plants, mycotoxins, fescue/ergot toxicosis, biofuels used as co-products, and commercial and industrial hazards for ruminants. It is a complex Issue, but one that helps highlight the difference between suddenly finding an animal dead and finding an animal suddenly dying!

Dairy: Stacked Stressors and Digestive Disorders

By CS McConnel, Veterinary Medicine Extension

To continue with the theme of managing complex nutritional interactions, many of you might be interested in a recently published case series in the October issue of Applied Animal Science. The gist of the article was that "stacked stressors" likely underlie many of the gastrointestinal (GI) health challenges that we observe in dairy cattle. I doubt that comes as a surprise to most, but it nevertheless serves as a reminder that digestive challenges are believed to be multifaceted in their development and difficult to replicate within experimental studies. This current study found that intestinal disease (high motility, loose manure) coincided with increased plasma concentrations of the acute-phase protein haptoglobin as well as the microbial metabolite d-lactate, whereas the enterocyte-derived enzyme diamine oxidase (DAO) was decreased in plasma. DAO is a digestive enzyme produced by epithelial cells in the intestine, and lysed enterocytes are thought to be the primary source of DAO in the blood stream.

The authors observed that intestinal disease aligned with decreased secretion of preformed fatty acids in milk and reduced feed efficiency. A combination of suboptimal diet quality issues (mycotoxins, pathogen load, and limited physically effective fiber), compounded with seasonal heat stress, likely encouraged growth of opportunistic pathogens in the hindgut and altered gastrointestinal function. Furthermore, it is possible that the presence of mycotoxins made the cows more susceptible to heat stress and other forms of stress, potentially exacerbating inflammatory responses.

Overall, this article was focused on highlighting observations gained from spontaneous GI health challenges (i.e., without experimental exposure to a specific risk factor), and provides some grist for the mill regarding opportunities to mitigate GI disease. Various interventions were implemented in this project and the authors observed some resolution of disease biomarkers and clinical signs supportive of previous work indicating that dietary forage has a protective role in microbial stability in the gut (Lindberg, 2014), and directly contributes to slowing passage of feed through the gastrointestinal tract (Poore et al., 1990). Organic acid treatment of the silage face (particularly for an excessively dry silage) also was implemented as it has been shown to help limit fungal growth at feed-out (Kung et al., 2000; Driehuis et al., 2001). In addition, a direct-fed microbial was added to the grain mix with the intent to limit mycotoxin bioavailability, given that mycotoxin binding products are effective at binding at least some mycotoxins (Vila-Donat et al., 2018), helping to wash them out of the gut.

Clearly every operation has its own challenges that influence digestive disorders in both calves and mature cows. The important thing is to accept the reality that many issues are multifactorial and require a thorough operational assessment as opposed to focusing on a singular pathogen or treatment option. A great example of this comes from a situation we helped with as part of the Field Disease Investigation Unit here at WSU. A dairy

was struggling with GI disease in Holstein heifer calves that was routinely attributed to the classic trifecta of bovine rotavirus, coronavirus, and cryptosporidium. Aside from issues with hutch/environment cleanliness, it appeared that colostrum management was underwhelming. In fact, only approximately 1.5 liters of colostrum was being fed per calf within the first 6 hours of life. The veterinarian of record was able to get management on board with increasing colostrum to 3 liters within the first 6 hours. Oddly, there seemed to be a relatively immediate uptick in GI disease in the calves receiving the additional colostrum. Further investigation uncovered the fact that the colostrum was heavily contaminated with various coliforms due to mishandling including poor storage. Limiting the quantity of colostrum fed to the calves was actually a good thing under the circumstances! Once colostrum harvest and handling were improved the increase in colostrum intake began paying dividends to GI health.

I am certain that many if not most of you have dealt with something similar in terms of best intentions leading to unintended consequences. The "stacked stressors" are real, and it is up to each of us to keep an eye on the various factors influencing animal health.

Dairy: Feeding Calves Transition Milk

By CS McConnel, Veterinary Medicine Extension

Feeding calves transition milk is a regular topic of discussion and area of interest within our production animal group at WSU. Anecdotal evidence frequently suggests that feeding neonatal dairy calves the milk from the first few milkings after colostrum has health benefits. However, data quantifying those benefits in a meaningful manner has been somewhat sparse. A recent paper within the Journal of Dairy Science does a nice job investigating this area with a specific focus on the intestinal development of neonatal Holstein dairy calves. Van Soest et al., hypothesized that elevated nutrient levels and bioactive components in transition milk as compared to milk replacer would enhance intestinal development. Spoiler alert—they found that feeding transition milk for four days following an initial feeding of colostrum stimulated villus, mucosal, and submucosal development in all sections of the small intestine in the first few days of life and improved health and growth relative to feeding milk replacer.

This study was conducted using Holstein bull calves. Transition milk from milkings 2, 3, and 4 of cows milked two times daily was pooled by milking number and fed three times per day at 1.89 L (2 qt) per feeding. Transition milk was not pasteurized and contained 17% solids, 5% fat, 7% protein, 4% lactose, and 20 g of IgG per liter on average. Milk replacer was also fed three times per day at 1.89 L per feeding and contained 15% solids, 4% protein, 3% fat, 6% carbohydrate, and no IgG.

Previous research has demonstrated that transition milk has elevated concentrations of IgG and other bioactive compounds such as IGF-1, growth hormone, and insulin that gradually decrease as mammary secretions transition from colostrum to regular milk. Although a neonatal calves' gastrointestinal tract is relatively mature at birth there are morphological and functional changes driven by colostrum's nutrient and nonnutrient components. The hormones and growth factors within colostrum (and less so in transition milk) stimulate growth of the gastrointestinal tract and regeneration after inflammatory damage. In fact, Van Soest et al., previously found that feeding transition milk to calves following colostrum improved growth rates and decreased serum haptoglobin concentrations (Van Soest et al., 2020). This supported an earlier study in which feeding transition milk following colostrum tended to increase weight gain and improve eye, ear, and nasal health scores (Conneely et al., 2014).

In the present study by Van Soest et al., calves fed transition milk consumed 13% more solids, 30% more ME, 67% more fat, and 29% more protein than calves fed milk replacer. Calves fed transition milk, compared with milk replacer, had greater villi length, villi width, mucosal thickness, submucosal thickness, and epithelial cell proliferation in the duodenum, jejunum, and ileum. The authors could not determine whether the increased

intestinal development of transition milk calves was due to the higher solids, protein, fat, and energy content of transition milk compared with milk replacer, to the nonnutritive, bioactive components of transition milk, or to both. Furthermore, it was unclear to what extent the increased intestinal development would benefit the calf. However, calves fed transition milk had decreased lipopolysaccharide and haptoglobin concentrations compared with calves fed milk replacer; therefore, the authors suggested this indicates more effective functioning of the intestinal barrier. In addition, authors suggested that feeding transition milk instead of milk replacer in the first few days of life likely increased the ability of the calves to absorb a greater percent of their diet sooner and grow more efficiently. They went on to speculate that improved intestinal development and health should have carry-over benefits and enhance health and growth throughout the critical first 3 weeks of life of a calf. Overall, it was summarized that data from this study confirm the recent recommendation by the National Academy of Science, Engineering, and Medicine (Nutrient Requirements of Dairy Cattle: Eighth Revised Edition, 2021, p. 232) that "transition milk should be fed during days 2 and 3 if possible."

WSDA: Don't Get Rusty—Upgrade Your Practice With VSGP!

By Dr. Amber Itle WA State Veterinarian

I think it's safe to say that the most important things I've learned in life have occurred on the tailgate of a pickup truck or at the tail end of a cow. This is the third of a multi-part series, where I will sit down on a tailgate or at the tail end of a cow and talk to veterinarians and producers about important issues. Today we are going to talk about veterinary grant opportunities.

Amber and Kendra Itle

Meet my sister, Dr. Kendra Itle. I've looked up to her my entire career and she has consistently been one of my best mentors. She's one of those brilliant people that remembers the top 3 differentials for any clinical presentation you might see, even in species she doesn't work on.

She works part time in my Dad's food animal practice, that was designated as a veterinary shortage area last year. Because of our father's rigorous 80-hour work weeks, our Mom was instrumental in our early years but as soon as we were old enough my sister and I were also raised by cows, under cows and next to cows—my Dad would have it no other way.

Some of you may have had the chance to meet my Dad, Dr. Joe Itle, at the PNWVC a few weeks ago, and I'll bet you can guess that after 50 years of practice having a fancy truck was never on the top of his list. It always was about the cow, the client and the customer service and it still is. He has always been cognizant of keeping costs down, so he didn't have to pass that on to his clients. To this day, he always buys used and keeps the local mechanics in business by pushing the odometers to 350,000 (his record). His 40-year-old, old-school Bowie box has been known to be duct taped, zip tied or bungie corded together.

Meet my sister's truck, a rusty, red 1990 Ford pickup truck with 300,000 miles on the odometer. You can hear this truck rumbling down the road before you can see it. This truck is disintegrating from the bottom up from years of driving on salted winter roads. My nephews are

embarrassed to ride in it for the occasional drop off at high school. In fact, the school bus seems like the "cooler" option. Ironically, I asked my sister for a photo of it for this newsletter article and discovered that the truck is in the shop with a mechanical issue with unknown time of return! I think that speaks for itself. All of the trucks in that practice are tired just like the vets that they transport, just like many of you who are reading this.

There are two programs with USDA National Institute Food Agriculture available to help relieve some of that chronic fatigue through two different incentive programs: Veterinary Medical Loan Repayment Program and Veterinary Services Grant Program. Both of these programs are designed to attract livestock veterinarians into an area by either focusing on defraying some of their student loan debt or making practice enhancements to improve services, buy equipment, or upgrade trucks in a practice to make it both more impactful to the clients and more attractive for veterinarians looking to buy. We know that of the veterinarians who left veterinary

Shortage ID Code	State / Territory	County	Shortage Type	VMLRP Status	VSGP Status	Fiscal Year	Nomination Form
WA221	Washington	Adams, Franklin	Type I Shortage: Private Practice Food Animal Medicine	Open		2022	Nomination Form WA221.pdf (322.63 KB)
WA222	Washington	Clallam, Jefferson	Type II Shortage: Private Practice – Rural Area Food Animal Medicine	Open		2022	Nomination Form WA222.pdf (321.36 KB)
WA223	Washington	Douglas, Grant, Lincoln	Type I Shortage: Private Practice Food Animal Medicine	Open		2022	Nomination Form WA223.pdf (321.85 KB)
WA224	Washington	Asotin, Columbia, Garfield, Walla Walla	Type II Shortage: Private Practice – Rural Area Food Animal Medicine	Open		2022	Nomination Form WA224.pdf (321.86 KB)

school with loans, 82% incurred an average debt load of $194,000. We also know there are many veterinary practices that are in need of new equipment, ultrasounds, vet units or new trucks—like my sister's!

Although we have worked hard in the last year to get four new veterinary shortage areas nominated, we only received applicants for 2/4 areas (WA 221 and WA 223). Both applicants were for the VMRLP, which allows up to $25,000 of student loan forgiveness for 3 years, totaling a $75,000 award. All of the shortage areas are automatically eligible to apply for the VSGP that awards successful applicants $125,000 to upgrade services. Unfortunately, we had no applicants for the VSGP this year. I need your help to determine what areas need to be nominated this year. We will have to do a little work to renominate those areas that didn't get a good response in hopes of a stronger applicant pool next year. If you think you are in a veterinary shortage area or you know of one you would like to nominate, I encourage you to read the nomination forms posted on the website and contact me so we can put something together. **The deadline is early November, so do not delay!**

Here is a chance to put a little oil on the practice, attract some energetic but financially burdened veterinarians to enhance your practice and better serve the clients in your area. You might even get to replace that rusty truck or better yet, take a long overdue vacation. Don't get rusty, upgrade your practice!

WSDA: Should WSDA Mandate Brucellosis Vaccination

By Dr. Amber Itle, WA State Veterinarian

Background

In June of this year, Washington hosted over 70 state and federal veterinarians at the Western States Livestock Health association meeting in Bellingham. As an extension of the United States Animal Health Association (USAHA), this organization meets annually to discuss important topics around animal health, disease response, continuity of business and policy. This year, harmonizing movement regulations to ease burdens for livestock movement and promote interstate commerce was identified as a top priority. As a result, state veterinarians across the Western States are reviewing their brucellosis vaccination and testing requirements at change of ownership and for interstate movement.

In 2018, the USAHA put forth a resolution that stated: *The United States Animal Health Association (USAHA) strongly urges state animal health officials and cattle industry representatives to reconsider the need for mandated use of RB51 brucellosis vaccine except where Brucella abortus infected wildlife is a documented risk. Further, the USAHA urges state animal health officials to consider rescinding interstate requirements that may be based on brucellosis vaccination status, or documentation of vaccination status, except as determined necessary by state animal health officials for animals moving into, within, or out of the Greater Yellowstone Area*.

History

Brucella abortus (*B. abortus*, sometime called "bangs") is a species of bacteria that causes the disease brucellosis in bovines, including domestic cattle, yaks, and bison. *B. abortus* can cause abortions (usually in late gestation), birth of weak calves, decreased fertility, retained placenta, enlarged or arthritic joints and decreased milk production.

More than 80 years ago, the U.S. Department of Agriculture (USDA) began the brucellosis abortus eradication program due to public health concerns. Most people were infected from consuming unpasteurized dairy products or through direct exposure to birthing fluids. In 1947, human cases of brucellosis peaked in the United States with more than 6,000 cases per year. Now, cases are less than 0.5 cases/million. Unlike in 1947, nearly all U.S. human brucellosis cases are now caused by a different strain of the disease called *Brucella melitensis*, acquired while traveling outside the United States.

At the beginning of the program, brucellosis was widespread throughout U.S. livestock, but eradication and vaccination efforts have had dramatic results. In 1956, there were 124,000 affected herds in the U.S. By 1992, this number had dropped to 700 herds and the number of affected, domestic herds has since declined to single digits in the last decade. In 2009, all 50 states were declared "free" status by USDA.

The only remaining U.S.-reservoir of *B. abortus* infection is in the Greater Yellowstone Area (GYA). The-wildlife, specifically elk and bison, maintain the disease that sometimes spills over into domestic cattle and bison. From 2011-2021, all infected herds have come from the GYA (19 Beef herds, 7 Bison herds, 1 captive elk herd, 0 dairy herds). The U.S. herd incidence of brucellosis is 0.0002% on an annual basis. The three states around Yellowstone National Park (Idaho, Montana and Wyoming) have each created a brucellosis Designated Surveillance Area (DSA) within their respective states. Livestock that graze in or near the DSA have brucellosis

testing requirements for movement out of the region and at change of ownership. Vaccination and identification requirements are also enforced.

As a result of the decreased incidence everywhere except the DSA, most states have dropped requirements for brucellosis vaccination of beef and dairy heifers for their resident cattle and animals entering from other free states. To date, there are only 5 States other than Washington that require mandatory brucellosis vaccination in beef cattle (Idaho, Oregon, Wyoming, Nevada, and North Dakota) and 7 states requiring vaccination in dairy cattle (Idaho, Oregon, Wyoming, Nevada, North Dakota, California, and Arizona). Recent data suggests that 4 million calves are still vaccinated for brucellosis: 32% of dairy and 25% of beef operations through mandatory or voluntary programs.

Brucellosis Surveillance

With States relaxing brucellosis programs from mandatory to voluntary, many producers worry about knowing if the disease is in fact resurging. Routine testing and surveillance is done in a few different ways in Washington state to help with early detection. Accredited veterinarians submit samples on all cattle that are mature vaccinated in Washington, mostly at public livestock markets. Raw milk dairy herds in the state are also required to complete annual herd tests for brucellosis. In addition, APHIS conducts a robust surveillance program on cattle at slaughter by testing their blood for presence of *Brucella* antibodies. Around two million animals are tested annually, with 22,558 samples tested from Washington cattle alone in FY 2020. Surveillance is more than sufficient to detect one affected herd out of 100,000 herds at a confidence level of 95%.

Pros and Cons of Brucellosis Vaccination

Pros

- Since brucellosis vaccine must be administered by an accredited veterinarian, it gives the operation a built-in chance to utilize veterinary expertise to help select and prepare replacement heifers.
- Having a veterinarian on a farm each year, helps producers meet the Veterinary-Client-Patient Relationship (VCPR) requirement in order to obtain prescription antibiotics and reproductive hormones.
- Bangs vaccination automatically gives heifers a USDA official identification. Veterinarians can apply free official metal or RFID tags to your cattle. Even though brucellosis vaccination is not required to cross most state lines anymore, official identification is.
- Bangs vaccination contributes to animal disease traceability (ADT) in Washington, as brucellosis-vaccinated heifers have their official ID's recorded and sent to the state veterinarian's office for storage. The IDs captured on animal health records your vet generates for regulatory work (brucellosis, tuberculosis and trichomoniasis) can become invaluable in investigations of disease outbreaks. Having identification such as the Bang's tag number might mean the difference between an operation being under quarantine or declared "all clear."
- Bangs vaccination still holds value for many buyers of heifers and some markets report higher prices in the ring for the orange tag. The tag acts as an indicator that the heifers have been run though a chute and have at least had a chance to be examined and managed more closely than those not vaccinated against brucellosis.
- Vaccination can give producers who lived through the disease in the 1970s and 80s, some security that their animals are protected.
- If producers engage in commerce with any of the states that require the vaccine, then proactive vaccination allow for ease of interstate movement.

Cons

- Mandatory vaccination adds costs to production.
- It is an expensive way to get official identification into cattle for ADT.

- If voluntary, producers could choose to invest in vaccines that best fit their business model. Some may choose to forgo bangs vaccine to invest in vaccines for endemic diseases with economic importance such as Bovine Viral Diarrhea, Blackleg, Pinkeye, or Bovine Respiratory Disease (BRD). BRD alone costs the beef industry as much as $2 billion per year, including animal death, reduction in feed efficiency and other ill effects, as well as prevention and treatment costs. U.S. feedlots alone see up to $900 million in annual losses from BRD.
- Brucellosis vaccination is not required to cross most state lines anymore, but official identification is. Producers would be responsible for applying an official identification.
- Washington's requirement imposes cost and impedes commerce for the 90% of states that do not mandate its use and want to sell animals to Washington producers.
- The United States Animal Health Association (USAHA) urges state animal health officials to discontinue mandatory use of the vaccine except for in the GYA to promote harmonization of interstate movement regulations
- Decreased revenue stream for veterinarians and one of their few chances, or only chance, to visit client operations and establish professional relationships.
- RB-51 vaccine has been associated with human infections.

Public Health Considerations

The modified live, RB-51 vaccine must be administered between 4-12 months of age by an accredited veterinarian. Normally, the RB-51 Brucellosis vaccine strain is cleared from the blood stream within three days of vaccination and is not present in nasal secretions, saliva, or urine. As a modified live vaccine, in rare cases, vaccinated animals may not clear the vaccine promptly and shed the vaccinate strain in milk or other secretions. Because strain RB51 can be shed in the milk of vaccinated animals, all milk or milk products consumed from vaccinated animals should be pasteurized for food safety purposes. The CDC and USDA have urged State Veterinarians **not** to mandate vaccination in raw milk Jersey herds, as there have been several documented cases of people getting infected with the vaccine strain of Brucella abortus even after the 21-day withdrawal period. The vaccine strain can also be shed in placenta and birthing fluids that could cause infection in high risk, pregnant, elderly or immunocompromised producers.

RB51 Info sheet | APHIS
Vaccination of Cattle | Veterinarians | Brucellosis | CDC
Exposure to RB51: How to Reduce Risk of Infection | Veterinarians | Brucellosis | CDC

Other Relevant Articles:

Time to Rethink Calfhood Brucellosis Vaccination? | Drovers
Time to Rethink Calfhood Brucellosis Vaccination? Page 2 | Drovers
Brucellosis Vaccination: Still a Good Idea? | Bovine Veterinarian (bovinevetonline.com)
Cattle Veterinarians Have New Vaccination Guidelines | Dairy Herd

At the end of the day, WSDA is here to promote the economic vitality of the livestock industry by minimizing exposure to animal diseases and enforce the regulations that are important to you. Changes to our rules should be industry driven, so it is critical that we get your feedback to better inform these key decisions.

WSDA: Secure Food Supply Biosecurity Plans: The Who, What, Why, When, and How

By Dr. Bruce Hutton, WSDA Region 3 Field Veterinarian

Who:

Anyone who is responsible for the health and welfare of livestock should have a biosecurity plan in place. More importantly, a secure food supply enhanced biosecurity plan is essential for anyone who is engaged in the sale or movement of livestock or livestock products.

What:

The Cambridge dictionary defines biosecurity as: "the methods that are used to stop a disease or infection from spreading from one person, animal, or place to others". In essence, biosecurity plans are those steps taken to prevent the spread of disease into, within, or from an operation under our control. Proper biosecurity plans function in two ways: 1) Proactively by preventing the introduction of a disease on to premises where naïve livestock are present (bioexclusion), and 2) reactively by managing the disease once it is detected on the premises (biocontainment). Biosecurity plans are both structural and operational, meaning the facilities and equipment are in place and functional, and the personnel are trained and competent in the implementation of the plan.

Often biosecurity is more conceptional than actionable. There is no written plan in place, and if practiced at all, the biosecurity measures are haphazardly applied. People have a general idea of what should be done, but do not allow what should be done to get in the way of getting a job done. Biosecurity seems to take a back seat to almost everything else on the premises. Following biosecurity protocols is inconvenient and the benefits are difficult to appreciate. There is no pop-up alert after washing our boots telling us we just prevented a disease outbreak on the premises.

A "good" biosecurity plan should be written and regularly reviewed. All personnel should be knowledgeable of the plan and trained in the biosecurity principles outlined in the plan. Biosecurity is dynamic, and the plan should be scalable to address the current level of concern on the premises. An enhanced biosecurity plan designed to control a foreign animal disease is nothing more than a scaled-up version of a daily biosecurity plan. Even if all the components of the plan are not practiced daily, having them written down in the plan, and regularly reviewed, is beneficial as it keeps the principles fresh in our minds.

Why:

Disease outbreaks can have devastating effects. If nothing else, a biosecurity plan helps to raise awareness of disease spread and control and the producer's role in preventing them. A robust daily biosecurity plan, along with a good nutrition, health, and vaccination program helps to prevent the introduction and spread of endemic diseases throughout a premises. Additionally, in the event of a foreign animal disease outbreak, an enhanced biosecurity plan is vital to maintaining continuity of business. If a premises is in an area impacted by a foreign animal disease, the movement of livestock to and from that premise will be restricted by a permitting process. Implementation of an approved enhanced biosecurity plan will be the only pathway to obtaining a permit for movement.

When:

The USDA has developed commodity specific Secure Food Supply Plans (Secure Beef Supply, Secure Poultry Supply, Secure Milk Supply, Secure Sheep & Wool Supply, and Secure Goat, Milk & Mohair Supply) to facilitate continuity of business in the event of a foreign animal disease outbreak in the United States. These plans center around the voluntary development of an enhanced biosecurity plan. *Premises with an approved enhanced biosecurity plan in place at the time of a foreign animal disease detection will be better positioned to move their animals if they find themselves in an area where animal movement is restricted through a permitting process.*

All livestock premises regardless of their size or function should already have a daily biosecurity plan in place. Livestock producers have an obligation to maintain the health and welfare of the animals under their control. A robust daily biosecurity plan is a vital component of controlling the introduction and spread of endemic diseases. If there is not already a biosecurity plan in place, now is the time to develop one. Enhanced biosecurity plans are complex. Their development and approval take time and is not something that should be done after a foreign animal disease outbreak has occurred. If there is already a daily biosecurity plan in place, or one is being developed, now is the time to develop an enhanced biosecurity plan and present it to state animal health officials for approval.

How:

Veterinarians are uniquely qualified to provide guidance on the development of a biosecurity plan. They are knowledgeable in the epidemiology of infectious diseases, and likely know the risk assessment to clients in their territory. As such, if a veterinarian is not the biosecurity plan designer the plan's designer should seek them out for advice. Likewise, veterinarians should promote biosecurity at all levels, and encourage their clients to develop a sound written and reviewed biosecurity plan.

The first important steps are to obtain a premises identification number (PIN) and designate a biosecurity manager. The biosecurity manager is responsible for developing a premises specific, written, enhanced biosecurity plan. It will be the biosecurity manager's responsibility to oversee the training of personnel and the implementation of the plan. This plan should clearly define the scope of the operation and address the following:

1. Training of "groups of people" about biosecurity procedures.
    a. Animal caretakers.
    b. Frequent visitors.
    c. Family members.
2. Protection of livestock.
    a. Other susceptible species on the premises.
    b. Line of Separation (LOS).
    c. LOS access points.
    d. Cleaning and Disinfecting (C&D) Stations.
    e. Parking areas.
    f. Distance between livestock and adjacent premises.
3. Movement on and off the premises.
    a. Vehicles and equipment.
    b. Personnel.
    c. Animals
    d. Animal products.
4. Carcass disposal.
5. Manure/Waste Management.
6. Control of rodent, wildlife, and feral animals.
7. Feed and water sources.
8. Vector control (mosquitoes, ticks, and flies).

Finally, a map of the premises indicating the LOS, LOS access points, C&D stations, parking areas, movement pathways, and carcass disposal/pickup locations must be included in the written plan.

Resources:

https://securebeef.org/
https://securemilksupply.org/
https://www.securepork.org/

https://securesheepwool.org/
https://securegoat.org/
https://www.uspoultry.org/programs/poultry-health/biosecurity/self-assessment/ah-checklist.cfm

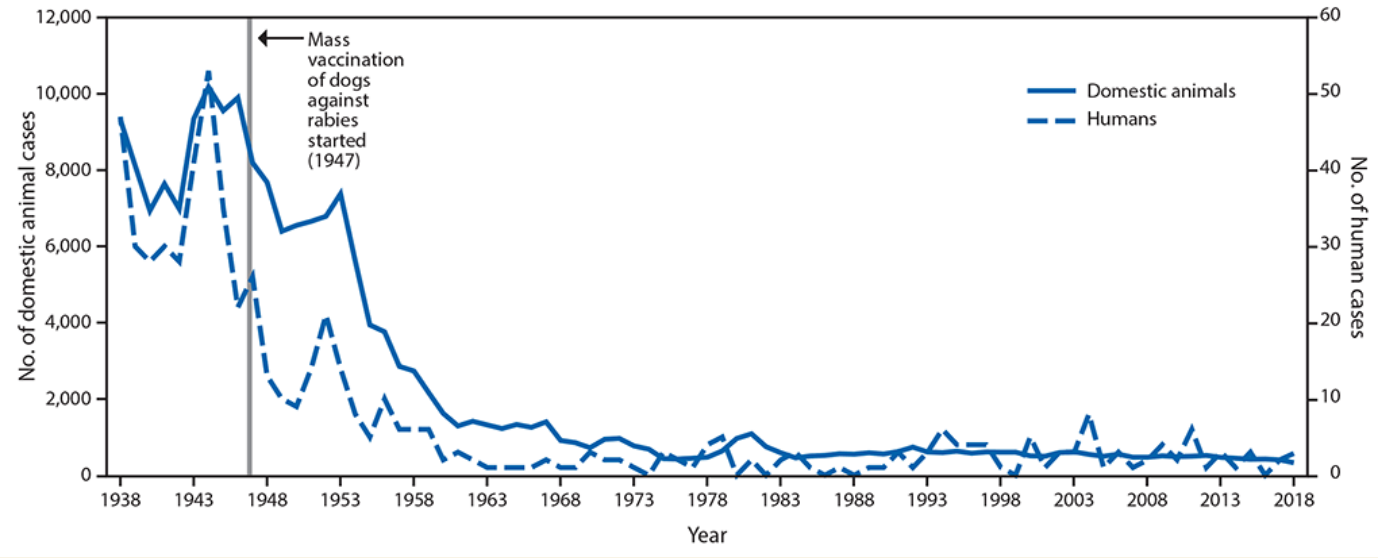
WSDA: Rabies—Review, Reporting, and WA Update

By Dr. Minden Buswell, WSDA Reserve Veterinary Corps Coordinator/Epidemiologist II

According to the CDC, more than 59,000 people die of rabies annually worldwide. The majority of these fatalities are in Asia and Africa. From 2009-2018, there were 25 cases of human rabies reported in the U.S., seven of which were contracted outside of the country. Two human cases of rabies have been reported in Washington State (WA) in the past 75 years, one in 1995 and one in 1997. Both of these cases were due to bat variant rabies virus. In a given year, the United States provides 30,000-60,000 courses of post-exposure prophylaxis (PEP) to people for rabies exposure.

In 1947, the mass vaccination of dogs in the U.S. against rabies resulted in a tenfold decrease in reported human rabies cases from 1938 through 2018 (Figure 1)[3]. In addition, one of the most important public health successes of the 20th century was the elimination of canine rabies virus variant (CRVV) in the U.S. The veterinary community should be very proud of their role in these successes.

FIGURE 1. Rabies cases in humans and domestic animals — United States, 1938–2018[3]



According to a 2019 study in JAVMA[1], a total of 4,960 rabid animals were reported to the CDC and domestic species accounted for less than 10% of those positive cases. Of the domestic species, cats represented the highest percentage at 5.2% (245) and dogs accounted for 1.4% (66). Cattle represented 0.8% (39) and horses and donkeys were 0.5% (22).

The leading cause of human rabies-caused deaths in the U.S. is exposure to bats.[1] Bats are the only known reservoir for rabies virus in WA. The percentage of bats in the wild that are infected with rabies is estimated to be very low (<1%); however, 3-10% of bats submitted for testing in WA test positive for rabies each year. In 2021, 200 bats were submitted for testing in WA and 12 tested positive.[4] During the past few decades, only a few rabies cases have occurred in animals other than bats (Table 1).

Table 1: Rabid Non-Bat Animals and Rabies Strain Type in Washington, 1986–2021

Year	Animal type (County)	Rabies Strain
2015	Cat (Jefferson)	Bat-variant
2002	Cat (Walla Walla)	Bat-variant
1994	Llama (King)	Bat-variant
1992	Horse (Franklin)	Unknown
1987	Dog (Pierce)	Unknown history of bat exposure

Maintaining canine rabies elimination in the U.S. requires ongoing, high-quality rabies surveillance, proper rabies vaccination, and timely response capabilities.[3] The private veterinary practitioner acts as the front line in identifying wildlife-mediated rabies cases and potential domestic animals infected with CRVV from outside the country. Federal and state agencies rely on your medical knowledge and reporting of suspect rabies exposure in animals.

Including rabies on your differential diagnosis is easy when you see the common signs - aggression, drooling, difficulty swallowing, staggering, and paralysis. However, the other face of rabies is much more difficult to diagnosis. Animals can become uncharacteristically affectionate. Horses and livestock consistently show non-specific signs, including depression, self-mutilation, increased sensitivity to light and impaired coordination. It is especially important to stay vigilant in your practice and remember to consider rabies as you look for a diagnosis.

Managing rabies exposure in domestic animals can be a stressful situation. The private practitioner must protect the patient, owner, veterinary staff, and themselves during this event. To help navigate this tenuous situation, it is important that you contact your local health jurisdiction. A list of all WA local health jurisdictions (LHJ) and their contact information can be found here. The LHJ will be able to help navigate tasks necessary to protect animal and public health. If the patient presents after hours, on the weekend, or if your LHJ is not available, the WA State Department of Health has a call line open 24 hours a day, seven days a week (see information below). This line is not limited to just rabies and can be utilized for other zoonotic disease concerns.

- **WA State Department of Health**
  24/7 Duty Office Line
  Phone: 206-418-5500
  Toll-free: 877-539-4344

A guide for veterinary offices on handling calls about bat encounters is available here. The Washington State Public Health Laboratory is the only laboratory in the state that performs rabies testing in animals. Guidelines on submitting specimens for rabies testing are here.

For in depth information on effective rabies response, The National Association of State Public Health Veterinarians (NASPHV) has published the "Compendium of Animal Rabies Prevention and Control, 2016"[2]. This compendium sets a standardized approach to rabies prevention and control throughout the U.S.

Although human and domestic animal rabies cases in the U.S. remain very low, it is imperative that we retain the proven animal and public health interventions that are in place. This includes the vaccination of domestic species and proper response to a suspect rabies exposure in animals or humans. Veterinarians are a vital part

of this One Health initiative, and we thank you for your continued diligence in protecting animal and public health in Washington.

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WADDL: Acute Yew (*Taxus*) Toxicity in a Washington Dairy Herd

By Gary Haldorson, Washington Animal Disease Diagnostic Laboratory

A recent submission to the Washington Animal Disease Diagnostic Laboratory (WADDL) from a veterinary practice in western Washington serves as a reminder that toxicities can affect animals in uncommon situations.

Animal intoxications are relatively common in small animals, but may be diagnosed in horses, swine, poultry, beef and dairy cattle, and virtually all other species. All veterinarians have either directly dealt with or at least heard of accidental or purposeful poisonings in dogs and cats. Nonetheless, poisonings in horses due to supplement mixing errors that include ionophores meant for cattle or any one of several plant toxins in pastures or hay are relatively common. Similarly, salt toxicity in swine, Teflon® toxicity from heat lamps in poultry houses, nitrate poisoning from plants in cattle, and copper toxicity from supplements given to sheep, among MANY others have all been diagnosed at WADDL.

Poisoning in dairy cattle may be less common due to their intensive management, but they still occur. Mixing errors in rations, fungal contamination of feed components, and urea toxicity from feed supplements have all been reported. Plant toxicities are less common in dairy cattle, likely because their housing and rations are so closely controlled, but they do occur as pastures may be used at various times in both lactation and dry periods and contamination of hay or other roughage sources are possible.

In the summer of 2022, a dairy in western Washington experienced acute death losses in large numbers of cattle that had been moved into a new pasture. Fifteen of 75 dry cows died unexpectedly overnight after the group was moved into a new (but previously used) pasture. Another two cows died while the veterinarian was on site to evaluate the animals. Most of the cows were found dead with no antemortem clinical signs. The remaining live cattle were immediately removed from the pasture.

The attending veterinarian did necropsies on two of the recently dead cows with minimal postmortem changes noted. He did identify some plant material in the rumen that was of concern, and in a walk through the pasture, he also identified a brush pile containing plant clippings and a tub of water that contained a thick layer of algae. Samples of the rumen contents, plant material from the brush pile, and water from the tub were all collected and submitted to WADDL along with fresh and fixed postmortem tissue samples from the cows.
Histopathologic examination of the tissues did not reveal a cause of death and microscopic examination of the water samples did not reveal evidence of blue green algae or cyanobacteria. Dr. Patricia Talcott, WADDL's veterinary toxicologist, identified plant material from the rumen contents and the brush pile as *Taxus* species, or yew. There are several species of yew that grow as evergreen shrubs or trees and are found both as native species in the Pacific Northwest as well exotic varieties commonly grown as an ornamental shrub.
Yew is a coniferous (evergreen with needle-like leaves) plant with dark green needles and bright red fruits or berries. Virtually all parts of the yew plant are toxic except for the fleshy portion of the red berries. This includes the seeds, leaves, branches, bark, wood, and plant roots. Toxicity does not dissipate with drying, and toxins may even become more concentrated in dried plant parts. In cattle, as little as 10 mg plant material/kg of body weight or 0.1% body weight can be lethal. This equates to just 7 grams being lethal for a 700 kg (1500 pound) dairy cow.

All species of yew contain one or more toxins known as taxine alkaloids that cause cardiotoxicity by antagonizing calcium and sodium channels in cardiac myocytes resulting in increased cytoplasmic calcium. The resultant effect is severe inhibition of cardiac conduction and A-V blockade, and ultimately cardiac arrest. This cardiotoxicity can occur within 1 to 3 hours of ingestion (though signs can be delayed for up to 38 hours in ruminants), with animals reported to breath heavily for a moment and then drop over dead. No effective treatment is known for ruminants that consume lethal doses of yew other than consideration be given to possible decontamination procedures such as activated charcoal for asymptomatic animals.

There are typically no associated postmortem changes, either gross or microscopic, in the tissues of affected animals as death occurs before anatomic changes can occur. Histopathology may be useful in ruling out other causes of acute unexpected death but will not be definitive in cases of yew toxicity. Diagnosis therefore requires identification of the plant parts in the rumen of dead cows and/or plant materials that cows were known to have been consuming. Given that the needles are quite like other coniferous species such as firs and redwoods, definitive identification typically requires examination by a trained botanist or toxicologist.

In this case, cows had access to a brush pile in an isolated part of the pasture and when removed from the pasture, death losses ceased. Ultimate identification of the cause of death in this dairy herd is owed to the astute investigation by the attending veterinarian, collection and submission of appropriate samples, and confirmatory identification of the toxic plants. The case demonstrates the importance of consideration of intoxications as a differential diagnosis in cases with multiple animals dying in a brief period. Consultation with a pathologist and/or toxicologist at WADDL is always encouraged.

Additional considerations related to the multifactorial causality underlying many suspected ruminant intoxications can be found in an article in the *Toxicology* issue of the Veterinary Clinics of North America: Food Animal Practice (Vol 36, Issue 3). This article by Dr. Evans from the University of Missouri addresses some of the emerging toxicologic diagnostic challenges. Without providing too much of a spoiler, Dr. Evans' article summarizes traditional toxicology-focused diagnostics and integrates them with a problems list–based diagnostic approach focused on the bare essentials of sample collection and analyses. The final intent of his article is to provide readily accessible, bulleted lists of (1) the basic steps in diagnosing suspected intoxications and cases of ruminant production inefficiency, morbidity, and/or mortality of initially unknown etiologies, including collection of historical information and physical examination, and development of a problem list with DAMNIT analysis; (2) the basic characteristics of circumstances most likely to involve intoxications; (3) the

attributes of an appropriate differential diagnosis for a given toxicant-induced clinical sign, with examples listed for sudden death without any premonitory signs in cattle as well as blindness in cattle; (4) a summary of critical historical information to collect and essential body systems to evaluate; and (5) confirmation of evidence of exposure to a toxicant and consistent clinical signs of that exposure as well as a list of standard diagnostic testing procedures that complement the diagnostic necropsy samples.

Public Health: COVID & Infectious Diseases Affecting Humans

By Francisco Leal-Yepes, Assistant Professor of Agricultural Animal Production & CS McConnel, Veterinary Medicine Extension

In the US, labor shortages resulting from COVID-19 caused dairy supply chain disruptions that led to an increase in milk dumping from the 0.2-0.5% recorded in the normal course of production in the US, to 2.5% of all federally regulated milk (Weersink et al. 2021). More than 91,000 workers in US meatpacking facilities, food processing facilities, and farms tested positive for COVID-19; importantly, these numbers of COVID-19 cases in the food industry are likely underestimated (Waltenburg et al. 2020). A partnership between iFoodDecisionSciences (iFoodDS) and Cornell University led to a dynamic platform of Food Industry CoVid-19 Control (FInd CoV Control) modeling tools for the food industry. FInd CoV Control is useful for labor-intensive produce farms and food processing facilities (produce, dairy, beef/pork, and poultry) as they evaluate potential risks and generate strategies to proactively manage COVID-19 risks. The tool is currently built for COVID-19 (Omicron variant) but may provide insights useful for handling future and emerging infectious diseases within your own operations.

https://www.foodcovidcontrol.com/FOODCTL/index.jsp

When do I use this? This (free!) model is a customizable tool to track COVID-19 transmission in your agricultural/food processing worker population and test out different intervention strategies. It can be used during an outbreak *but is intended to help food safety/worker health managers plan ahead so their operations are more resilient to potential threats to workforce absences and productivity*.

Why should I use this? Run numerous hypothetical scenarios to evaluate the range of possibilities that may occur given your specific operation, employee population, and community dynamics. The model provides quantitative information useful in a risk assessment – this data can be used complimentary to other tools in your decision-making process to support or inform the approach to follow. Note: the simulations take 30min-1hr which is why you will need to create a log in – you will get an email with the results are completed.

Without this model, what am I missing? Without this model, you will rely on industry guidance and other generalized data to make a single decision across your organization. You will not be able to account for specific conditions within your operations and employee populations that may alter infection transmission compared to other operations/organizations. You will not be able to assess the efficacy of intervention strategies and determine which help you best achieve your goals.

This model results from a research project entitled, "Modeling and training to enhance resilience of the US food system to COVID-19 labor shortages," funded by the National Institute of Food and Agriculture-USDA (2020-68006-32875) under the Rapid Response to Novel Coronavirus (SARS-CoV-2) Impacts Across Food and Agricultural Systems program.

WSU Ag Animal Faculty Research Updates

1. Investigation of Sperm and Seminal Plasma Candidate MicroRNAs of Bulls with Differing Fertility and In Silico Prediction of miRNA-mRNA Interaction Network of Reproductive Function. V Kasimanickam, N Kumar, R Kasimanickam. DOI: 10.3390/ani12182360

Abstract: Recent advances in high-throughput in silico techniques portray experimental data as exemplified biological networks and help us understand the role of individual proteins, interactions, and their biological functions. The objective of this study was to identify differentially expressed (DE) sperm and seminal plasma microRNAs (miRNAs) in high- and low-fertile Holstein bulls (four bulls per group), integrate miRNAs to their target genes, and categorize the target genes based on biological process predictions. Out of 84 bovine-specific, prioritized miRNAs analyzed by RT-PCR, 30 were differentially expressed in high-fertile sperm and seminal plasma compared to low-fertile sperm and seminal plasma, respectively ($p \leq 0.05$, fold regulation ≥ 5 magnitudes). The expression levels of DE-miRNAs in sperm and seminal plasma followed a similar pattern. Highly scored integrated genes of DE-miRNAs predicted various biological and molecular functions, cellular process, and pathways. Further, analysis of the categorized genes showed association with pathways regulating sperm structure and function, fertilization, and embryo and placental development. In conclusion, highly DE-miRNAs in bovine sperm and seminal plasma could be used as a tool for predicting reproductive functions. Since the identified miRNA-mRNA interactions were mostly based on predictions from public databases, the causal regulations of miRNA-mRNA and the underlying mechanisms require further functional characterization in future studies.

WSU CVM Senior Paper Highlights

Association of GI and Respiratory Disease with Differential Leukocyte Counts and Plasma Fibrinogen Levels in Holstein Dairy Heifers

By Chris Mandella (Advisor: Dr. Craig McConnel)

Summary: The utility of white blood cell (WBC) counts and plasma fibrinogen (FIB) levels for diagnosing respiratory and gastrointestinal (GI) disease in dairy calves is poorly understood. This project aimed to establish reference intervals (RI) and investigate relationships between FIB and WBCs in healthy and diseased dairy calves. Sixty Holstein calves ≤11 d of age were enrolled on two dairy farms in central WA. Blood samples were collected via jugular venipuncture bi-weekly for 11 weeks. Clinical assessments and thoracic ultrasonography scoring (TUS) were performed weekly. Total (tWBC), differential (dWBC) WBC counts, and FIB were determined using a Neubauer hemacytometer, modified Wright stain, and heat precipitation, respectively. The University of Wisconsin Calf Health Scoring Chart and WeanClean program were used to identify clinically healthy calves via rectal temperature (<39.5°C), a score of <2 in individual respiratory category, a collective respiratory score of ≤3, TUS score (<2), and fecal score (<2). Clinical GI and respiratory (CR) disease were identified via fecal score (>1), and individual respiratory category score (≥2) or collective respiratory category score (>3) respectively. RI for WBCs and FIB were established at three age ranges based on age at sampling (1-2 weeks, 3-5 weeks, 7-11 weeks). FIB increased numerically in calves with CR disease with or without TUS>2 (Mann-Whitney U test $p<0.05$) but tended to remain within the reference range. FIB levels were not elevated in calves with GI disease. tWBC and dWBC were not increased in calves with CR or GI disease. FIB, tWBC, and dWBC are poor diagnostic indicators of CR and GI disease in Holstein calves.

Effects of Heat Stress on Cattle and Management Measures

By Brie Anna Brown (Advisor: Dr. Rusty Stott)

Summary: It is predicted the U.S. dairy industry loses millions of dollars a year in revenue due to heat stress. Though dairy cattle are more sensitive to heat stress than beef cattle, both are significantly affected by influencing both milk and meat quality. Heat stress affects growth and productivity by impacting feed intake and immune function. Heat stress has a negative impact on reproductive efficiency and gestation, specifically on fertility and libido, fetal growth, and embryonic survival. Dairy cattle are most sensitive to heat stress during the neonatal period, reproduction, and lactation. Of beef cattle, those closest to the market endpoint in feedlots are most sensitive to heat stress because they are overweight. The degree of heat stress is influenced by a variety of factors such as humidity, geographical region, and breed. Cattle comfort and heat stress have been evaluated using their thermoneutral zone and temperature humidity index (THI). Heat stress is expected to continue to rise in response to gradually rising global temperatures. Valuable management measures exist to reduce heat stress in cattle and improve efficiency and productivity. Solutions include utilizing heat-tolerant breeds, heat abatement strategies, dry period cooling, and genetic engineering, which reduce THI and heat stress frequency (HSF).

Bovine Follicular Aspiration for the in Vitro Production of Embryos

By Warren Brush (Advisor: Dr. Ahmed Tibary)

Summary: Follicular aspiration is a technique used to collect oocytes from ovarian follicles. *In vitro* fertilization (IVF) is then used to produce embryos from the oocytes that can be transferred to recipient cows. Since its introduction, follicular aspiration has become a commonly used technique in bovine reproduction throughout the world. For optimal oocyte collection and quality, nutrition and health of donor cows need to be managed properly. The combination of follicular aspiration and IVF increases the number of offspring produced by genetically desirable females, allows production of offspring from multiple sires per collection, reduces labor and medication costs, and allows production of offspring from infertile cows. The initial cost for follicular aspiration equipment is approximately $23,000 and a typical charge to perform follicular aspiration is approximately $230 per cow. Oocyte aspiration can be conducted every two weeks with 15 to 30 oocytes retrieved per collection. With advances in oocyte maturation rate, fertilization rate, morula or blastocyst formation rates, and pregnancy rates after embryo transfer, the average number of pregnancies produced per follicular aspiration ranges from 0.6 to 4.8 resulting in 15 to 124 calves produced per donor per year.

Fusobacterium Spp. in Beef Cattle

By Baylie Rodenbaugh (Advisor: George Barrington)

Summary: *Fusobacterium* spp., a normally harmless, ubiquitous bacteria, results in significant economic loss in the beef cattle industry annually. The most significant pathogen, *Fusobacterium necrophorum*, can lead to detrimental production loss and potentially fatal results to beef cattle. *Fusobacterium necrophorum* may result in processes including liver abscess, foot rot, and diphtheria. Because *Fusobacterium necrophorum* is a normal inhabitant of the upper respiratory and gastrointestinal tracts of animals, it is harmless on healthy skin. The bacterium enters the skin through abrasions and other injuries to the integument. Upon entry, the bacteria develop a microenvironment making colonization for itself as well as other bacteria more ideal, further progressing disease severity and leading to necrobacillosis. Currently the most important control of *Fusobacterium necrophorum* is prevention. While some vaccines are available, few studies have shown strong efficacy. This means that environmental management is essential in mitigating infection with *Fusobacterium necrophorum*. Anti-microbials are used in treatment of *Fusobacterium necrophorum* along with supportive care. Some ionophores have positive results in easing *Fusobacterium necrophorum* infections. With current spotlight on antimicrobial resistance, pursuing new prevention and treatment of *Fusobacterium necrophorum* has been and will remain important to the cattle industry.

Bovine Embryo Transfer: Factors Affecting Ovarian Superovulation

By Jonathon Stott (Advisor: Dr. Ahmed Tibary)

Summary: Superstimulation is a critical step in both in-vivo and in-vitro production of embryos. The response to hormonal ovarian superstimulation presents high individual variability. The aim of this paper is to assist general practitioner veterinarians in understanding the basics involved in the selection of donor cows for an embryo transfer program, and more importantly, the concept of superstimulating the ovaries of donor cows. The bovine estrous cycle, as well as common protocols for ovarian superstimulation are discussed. One of the most important factors in predicting ovarian superstimulation response is circulating Anti-Mullerian hormone levels. The direction in which the bovine industry is headed regarding embryo transfer is discussed as well as introducing the concept of ovum pick-up.

Beneficial Outcomes of Animal Welfare Based Production Practices

By Veronica Martin (Advisor: Dr. George Barrington)

Summary: Within the last century, animal production systems have grown immensely in size, creating an increase in the output of products as well. With this increase, management practices used on farms have changed and evolved due to the large number of animals to care for. The public has become increasingly concerned with animal welfare on high volume factory farms, as practices involving transportation, housing, and handling of animals have been analyzed. The aim of this review is to better understand the benefits of using animal welfare-based practices in production animal farms. Specifically, using practices that have been shown to decrease stress in animals, thus increasing product quality and quantity. Handling, housing, and transportation are all areas in which evidence-based animal welfare practices can be implemented, which has been shown to create long-term gains for producers. These gains come from decreased animal losses due to disease morbidity and mortality, and increased amount and quality of end products. Benefit also comes from favorable public perception of management practices.

***Histophilus somni* Complex (Formally Known as *Haemophilus somnus*) Overview**

By Dalton Pils (Advisor: Dr. George Barrington)

Summary: Formerly known as *Haemophilus somnus*, *Histophilus somni* is a Gram-negative, rod or coccobacillus-shaped, facultative anaerobic bacteria belonging to the family Pasteurellaceae. *H. somni* is a commensal and opportunistic bacterial pathogen associated with multisystemic diseases in cattle, small ruminant, bighorn sheep, and North American bison. *Histophilus somni* disease complex starts with respiratory clinical signs followed by hematologic spread to other organ systems including nervous, circulatory and musculoskeletal system. *H. Somni* is a major bacterial participant in Bovine Respiratory Disease complex (BRD) which makes *H. somni* an economically significant pathogen. Understanding there are different bacterium that make up BRD complex that have similar clinical symptoms is important in diagnostic, treatment and prevention of infection in cattle. Disease most frequently occurs as a result from multiple factors influencing the host's immune system. Multiple clinicopathological syndromes in cattle are presume sequalae to septicemia. The major manifestations are fever, pneumonia, meningoencephalitis-myelitis, pleuritis, necrotizing myocarditis, and pericarditis. Other clinical manifestation includes abortion, conjunctivitis, arthritis-tenosynovitis, and reproductive diseases of the female and male reproductive tracts. Facet of septicemia can include nephritis, endophthalmitis, myositis, laryngitis, otis media, and intestinal necrosis. Diagnosis can be made by submitting samples from necropsy of affected cattle with sampling including lung, heart, brain, synovial fluid, and other tissues with gross lesions. Treatments include oxytetracycline, tulathromycin, ceftiofur, enrofloxacin, trimethoprim-sulfadoxine, and florfenicol. There are three approaches to control anticipated outbreaks including vaccination, mass treatment with antimicrobial agents, and vaccination of other BRD complex that predisposes to other respiratory pathogens.

Ovine Pneumonia in Bighorn Sheep: Factors Affecting Disease, Epidemiology, and Management
By Troy Mord (Advisor: Dr. Andy Allen)
Summary: Bighorn sheep (*Ovis canadensis*) are an iconic North American species, recognizable to scientists, recreators, and the casual observer alike for their charismatic appearance. Historically, they once held a vast range, making them a staple of the western North American landscape. However, expansion proved to be detrimental to their sustenance, and factors such as hunting and land use changes hampered their numbers, leaving their current population a fraction of what it once was. While management has aided in partial recovery of Bighorns, a new adversary against them has emerged in the form of infectious bronchopneumonia. A complex disease with many contributing pathogens, the effects on both individuals and populations can be catastrophic and difficult to predict. In this paper, past research will be reviewed to evaluate the evidence for *M. ovipneumoniae* as a necessary infectious agent of ovine pneumonia in wild sheep populations. Additionally, the nature of pneumonia as pathogen and an epizootic will be analyzed to highlight the dynamic nature of the disease, and its deadly capacity to spread through populations and metapopulations of bighorn sheep, strangling conservation and restoration efforts. Finally, past management efforts at mass vaccination, genetic augmentation and diversification to build immunity, and others will be described to put the state of understanding toward pneumonia into context.

The U.S. Veterinary Corps and WSU's Relationship to its Heritage
By Wilton Ashton (Advisor: Dr. George Barrington)
Summary: The United States Veterinary Corps has been serving the armed forces for over one hundred years. Since the Corps' formation, Washington State University's College of Veterinary Medicine (WSU CVM) has been ever present and has made a mark on its heritage and legacy. From its humble beginnings with George Washington, its official recognition in 1916, and its global involvement today; the Veterinary Corps has served to protect the warfighter and support the national military strategy by providing veterinary public health. This paper will discuss the U.S. Veterinary Corps' development and its role in both world wars, the Korean and Vietnam wars, and present-day conflicts through the lens of WSU alumni. It will also discuss the participation of WSU alumni in each stage of the Veterinary Corps' development.

Continuing Education

Veterinarians

1. WSU CVM Veterinary Continuing Education Fall Conference. Large and small animal tracks. 9 a.m. – noon, Saturday October 29, 2022.
2. Academy of Dairy Veterinary Consultants, Fall Meeting. Dairy Cull Cattle Economics and Welfare. November 4 & 5, 2022. Canyon, TX & Virtual Meeting.

Producers

1. Washington State Sheep Producers Convention 2022. November 4-5, 2022, Spokane, WA.
2. 2022 WCA & WCW Convention & Tradeshow. November 10-12, 2022, Wenatchee, WA.
3. Washington State Dairy Federation 2022 Annual Dairy Conference. December 5-7, 2022, Great Wolf Lodge, Centralia, WA.

GUESS THAT BREED!

The Answer will be posted on the VME Homepage, under Newsletters:
https://vetextension.wsu.edu/

Visit our website for information on current research projects and outreach materials for veterinarians and producers! http://vetextension.wsu.edu/

Send newsletter comments to the Editor: ***ag animal health***
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