

## VMS 361 Agricultural Animal Health

### Bovine Health Section

Dr. John Gay, DVM PhD DACVPM  
Associate Professor, FDIU

#### Clinical Epidemiology and Evidence-based Medicine:

- [Clinical Epidemiology & Evidence-Based Medicine](#)
- [Guidelines for Assessing Professional Information](#)
- [Veterinary Medicine and the Philosophy of Science](#)
- [Web Epidemiology and Evidence-based Medicine Sources for Veterinarians](#)

#### Epidemiology Modules:

- [Introduction to Epidemiology](#)
- [Epidemiology Concepts for Disease in Animal Groups](#)

#### Course Materials:

##### VMS 361 Agricultural Animal Health

- [Introduction to Herd Production Medicine](#)
- [Bovine Paratuberculosis](#)
- [Epidemiology Concepts for Disease in Animal Groups](#)
- [Bovine Herd Salmonellosis, Including DT104: Eleven Characteristics to Keep in Mind](#)
- 2006 Class
  - [Conditions for Producers' Use of Livestock Drugs](#)
  - [Sanitation in the control of livestock infectious diseases](#)
  - [Introduction \(pdf\)](#)
- 2005 Class
  - [Avian Influenza](#) - information links
  - [AI Presentation \(pdf\)](#)
  - [Conditions for Producers' Use of Livestock Drugs](#)

Google "jmgay", open page if at WSU, click on "home" in upper left of header to this index page

### Result of the consumer being the end of the chain:

- FDA is a large player in the agricultural animal VCPR.
  - Regulation emphasis is on products used in animals producing human foodstuffs
- OTC (Over-the-Counter) Drugs
  - Legal for use by producer **only** according to label instructions.
- Prescription (Rx, Legend) Drugs
  - purchase only from pharmacies by [prescription](#) or from veterinarians
- ELU (Extra-label use)
  - Legal **only** when animal's **health** is in danger, with a veterinarian's complete **Z-point** instructions on the container label, with valid VCPR and no labeled drug is effective

### Common but *illegal* Drug Use:

- Producer use of OTC drug "off label"
- Producer / veterinarian
  - Adding antibiotics to milk replacer
  - "Extra-label" use in feed is *illegal!*
  - Using special list drugs "off label" (ELU)
    - Bayer Baytril, Pfizer A180
- Consequence of abuse – removal of product from market

### Beef Quality Assurance – *Important!*




Proper injection site (neck),  
route and amount

### Opposition to Conventional Agriculture




Readily accessible  
to consumers!

### Animal Welfare CCP and Audits



**Emerging requirement from food sellers**




### Dr. Temple Grandin's Web Page

[www.grandin.com](http://www.grandin.com)  
Google "grandin"



Livestock Behaviour, Design of Facilities and Humane Slaughter

- Who is Dr. Temple Grandin?
- Behaviour of cattle, pigs, bison and antelope during handling and transport
- Design of stockyards, lairages, corrals, races, chutes, and loading ramps
- Design of restraining systems
- Humane Slaughter
- Stress and Meat Quality
- Ritual Slaughter (Kosher and Halal)
- Research Articles
- Guidelines for Auditing Welfare in Slaughter Plants, Beef Feedlots, and Dairies

Heading on down the path  
Snippy on Turtle Draw

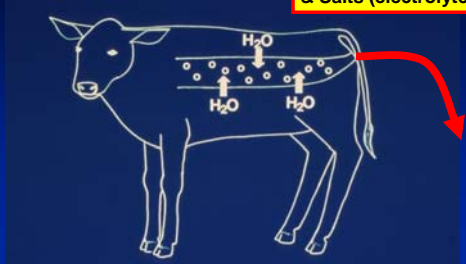
### Calf Scours

- How big of a problem is it?
- What is it and how it "works"?
- What I as a veterinarian will recommend to:
  - Treat a calf with the problem
  - Prevent the problem from occurring again

### How big of a problem is it?

% of Annual Deaths	Beef Calves	Beef Cows
Dystocia	33%	26%
Calf Scours	17%	
Calf Pneumonia	10%	

From USDA NAHMS Beef Cow-calf Health and Health Management Practices

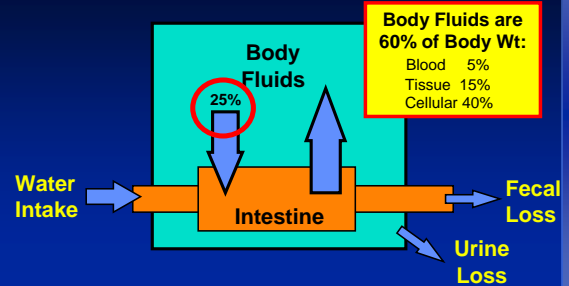


**Diarrhea: Loss of Water & Salts (electrolytes)**

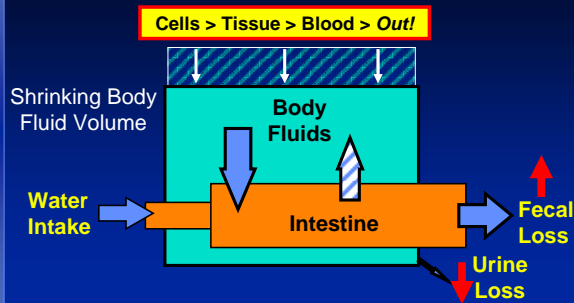
## Physiology of Diarrhea

- Normal cycling of body water into and out of intestinal tract is disrupted.
  - 25% of body water cycles thru intestinal tract daily
- Two forms:
  - Normal secretion into intestine, reduced (**malabsorption**) back out
    - Most infectious diarrheal agents
  - Excess secretion (**hypersecretion**) into intestine, normal reabsorption back out
    - E. coli K99, cholera

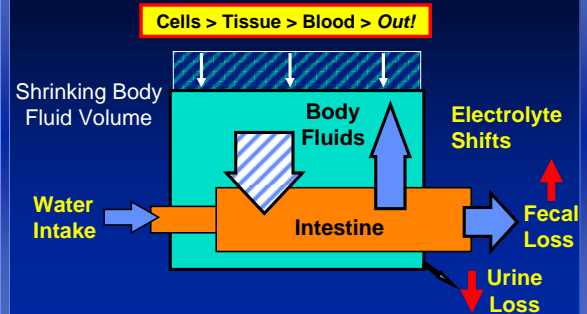
## Normal Fluid Balance



## Diarrhea Imbalance - Malabsorption



## Diarrhea Imbalance - Hypersecretion



## Results of Diarrhea

- **Body fluid loss => Dehydration**
  - Skin "tents", mouth isn't slick, limbs and ears are cold, eyes sink and a gap appears between the eyeball and inner lid.
  - Urine output **drops and stops if severe**
- **Body electrolyte (salts) loss and imbalance**
  - Heart and skeletal muscle function affected
    - If shifts are **severe enough, heart stops**
  - **Depression occurs**

Most Important Treatment?

### Most Important

- Detect scouring calf before fluid loss becomes profound so oral replacement is still effective
- Replace lost body fluid (water) and electrolytes (salts) in **large enough quantity often enough** that loss does not become profound

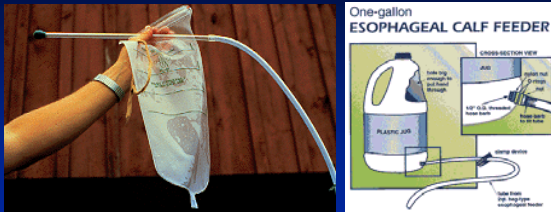
### High Energy Electrolytes w/ glycine



Entrolyte H.E.

Resorb

### Esophageal Feeder



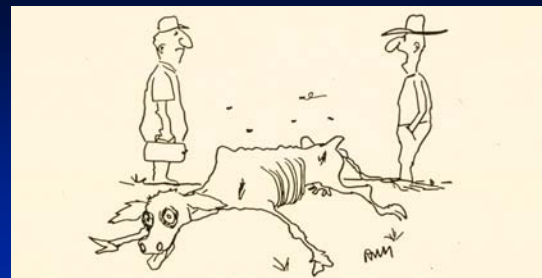
Get fluids into calf's stomach safely without suckling

Least Important (but too common) Treatment?

### Least Important – antibiotics!

- Antibiotics, particularly OTC oral antibiotics!
  - Antibiotic-containing milk replacer
- Agents that cause calf scours are:
  - Viruses or protozoa that antibiotics have no effect on
  - Bacteria that are usually resistant to the OTC antibiotics

### Intervention Must Be Early!



"You're too late!"

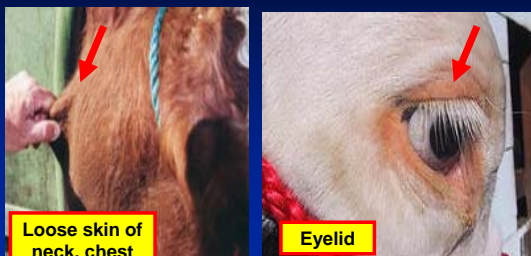
### Three fluid loss categories:

- Degrees of dehydration
  - Early <5% Body Wt
  - Moderate 7% Body Wt
  - Severe > 9% Body Wt
- Key to determining how to treat calf

### Early Fluid Loss (<5% BW)

- Calf is:
  - standing
  - skin "tents" for 4 seconds or less
  - eyes are bright
  - oral membranes are moist
- Calf will suckle electrolyte solution from a bottle
- Leave calf on milk and add several 2 quart electrolyte feedings per day until scouring slows
  - **Reason:** If calf doesn't have adequate fat reserves, feed removal can cause **death by starvation** before scours stop

### Dehydration Sign – skin "tenting" pinch test



### Moderate Fluid Loss (7% BW)

- Calf is:
  - dull and lying down but upright
  - skin "tents" for 5 secs
  - eyes are sunken slightly with a slight gap.
  - limbs are cold
  - oral membranes are warm but sticky
- **RX:** to survive 1/2 gallon of warm special high energy electrolyte solution (Enterolyte HE) by stomach tube twice several hours apart
- Move to warm area where it can be monitored

### Severe Fluid Loss (>9% BW)

- Calf is:
  - lying flat in a coma.
  - skin stays "tented"
  - eyes are deeply sunken with a big gap
  - oral membranes are cold, pale and dry to touch
- **RX:** Only 1 gallon of special fluids by **IV drip** will save the calf
  - SQ and oral fluids won't be absorbed because circulation is too poor
- Unless you can do IV's, take calf to veterinary clinic



### Fluid Replacement

- Enough balanced electrolyte fluids must be given to:
  - **Replace** % of body weight (BW) lost
  - **Meet** maintenance requirements (50 ml / kg BW per day)
  - **Keep up** with ongoing loss of 1 to 4 Liter per day in the diarrhea
- For a 7% dehydrated 80 lb calf, this is **6 to 9 quarts** of electrolyte solution the first day
  - 1 Enterolyte H.E. pack is only 2 quarts! -> **4 packages**

### Commonest Infectious Diarrheal Agents

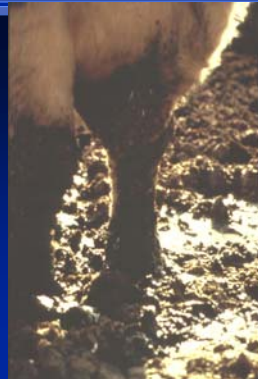
- **Bacteria**
  - *Escherichia coli* (E.coli) strains
  - Salmonella serotypes dublin, typhimurium, and others
- **Viruses**
  - Rotavirus
  - Coronavirus
- **Protozoa**
  - Cryptosporidia
  - Coccidiosis

### Key *E. coli* Characteristics

- **Normal gut flora of all mammals so *E. coli* is ubiquitous (everywhere).**
- Three disease forms:
  - Colisepticemia - any strain:
  - Enterotoxigenic - specific strains.
  - Enteropathogenic - specific strains.
- A most common cause of calf death
- **OTC antibiotics are usually not effective**

### Colisepticemia – *Any E. coli*

- Spreads through calf's body to cause abscesses in the brain, eyes, kidneys, and joints
- Occurs when calf ingests manure, mud or other material before or along with colostrum
- Virtually impossible to treat successfully
- Prevented by calving in clean, dry areas, cows having clean udders and keeping colostrum clean and refrigerated



***E. coli* are everywhere in manure-contaminated mud!**



**Bad conditions > Calf gets mouthful of *E. coli*!**



Low density, no mud > Excellent conditions!



Calving on Winter Feedground

High density, lots of manure > Very poor conditions!

### Enterotoxigenic *E. coli* (ETEC)

- **Specific strain (K99)** attaches to intestinal cells and causes a hypersecretory diarrhea.
  - Toxin turns on cell's fluid pump.
- Almost the only diarrhea that **occurs within first 3 days of life**, often in first day.
- Prevented by feeding colostrum containing K99 antibodies
- Cow vaccine available

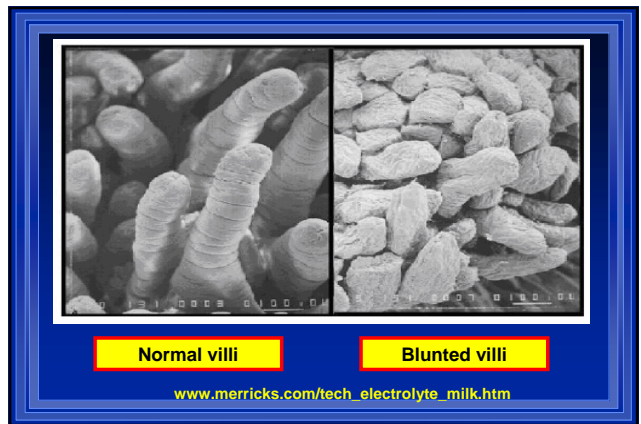
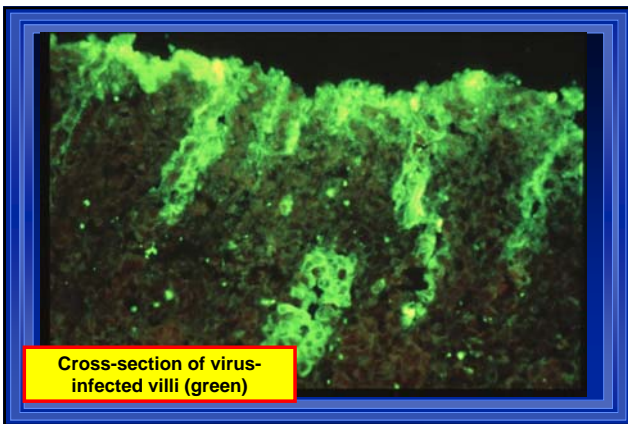
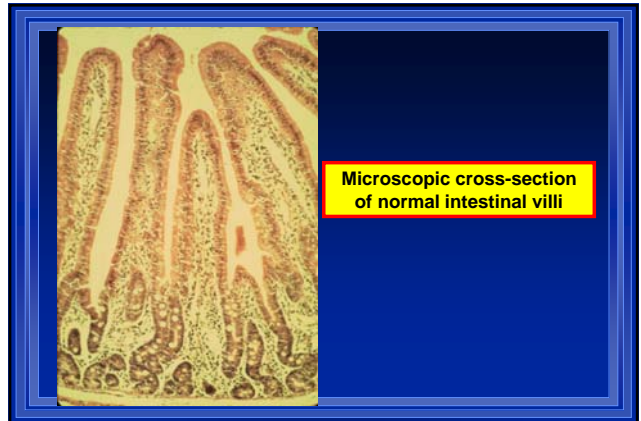
Effective only against specific *E. coli* strains

### Enteropathogenic *E. coli* (EPEC)

- *E. coli* strains attach to gut wall and secrete toxins
- Cause both excess secretion and malabsorption as well as general systemic effects on the calf
- No vaccine

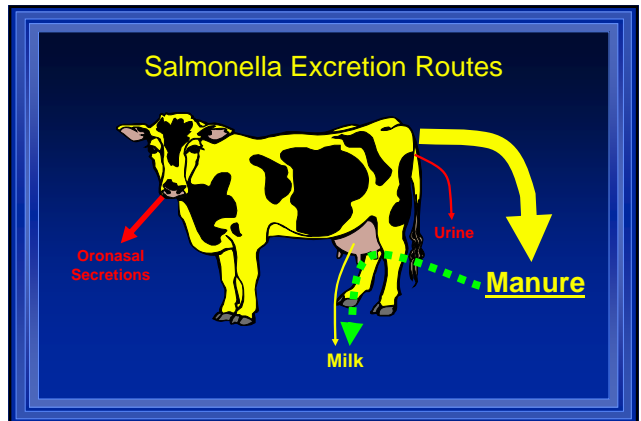
### Corona & Rotaviral Diarrhea

- Virus kills cells of intestinal villi, causing malabsorption diarrhea
- Calf begins **shedding  $10^{11}$  virus per gram of feces 3 days after infection.**
- **Carrier cows** shed low numbers of virus
- **Virus survives in the environment for weeks**
- Vaccines available
- Antibiotics are ineffective (virus)



### Salmonella Diarrhea

- Calves can shed it in feces, urine, **saliva and nasal secretions**, contaminating everything they touch and **everything that touches them** (hands, esophageal feeders, nipples, ...).
- Salmonella survive in the environment for **months**  
Only **direct sunlight** kills it in the environment
- Usually resistant to OTC antibiotics





## Salmonella Diarrhea

- Antibiotics:
  - Depress the normal bacterial flora, making the animal more susceptible to infection and prolonging the diarrhea.
  - May be required if infection is systemic;
- Vaccines of questionable effectiveness
- This is a **zoonotic disease**, meaning that humans get it!



## Cryptosporidial Diarrhea

- Ubiquitous organism that survives for **months** in the environment
- **No** practical antibiotics are effective
- **Not killed by most disinfectants**
- Killed by complete drying
- This is a **zoonotic** disease, particularly for the immunocompromised.

## When do these occur in calf's life?

<i>E. coli</i> K99+	< 3days
Rotavirus	5-14 days
Coronavirus	5-21 days
Cryptosporidium	> 5 days
<i>Salmonella</i>	> 1 week
<i>Cl. perfringens</i>	> 1 week
Coccidiosis	> 21 days

## Calf Mortality - Beef and Dairy Herd NAHMS Studies

- Total Calf Mortality (death) prior to weaning
  - 6% Beef
  - 11% Dairy
- Scours as reason for Mortality:
  - 18% Beef
  - 60% Dairy

## Given:

- Most diarrheal agents:
  - Are ubiquitous
  - Survive well in the environment
  - Infections aren't curable with drugs
  - Establish carrier states in herdmates

How do you reduce / prevent disease?

**Reality - Farm Level**

**The Most Important Question**

*Earth, Endemic agent*

**NON-EXPOSED**      **EXPOSED**

**0!**

*If almost all herds have the infectious agents, why do few herds have sick calves?*

**All infected  
Some sick, some well**

DDH

**When doesn't clinical disease occur?**

Innate Resistance

Exposure Dose

**Vicious Cycle of Outbreaks**

Less Susceptible Hosts Affected

Higher Exposure

Heavier Environmental Contamination

Clinical Disease

Factor Change?

Highly Susceptible Host

Low Exposure

Subclinical Infection

Moderate Contamination

**Major Transmission Cycle**

**Bug focus keeps us stuck in a rut!**

Vaccinate it!

The Animal Host

The Disease Agent

The Environment

Kill with antibiotics!

**Infection Transmission Chain**

Infected Host

Sheds Agent in oral & nasal secretions, urine, feces

Contaminated Environment

Agent survives at Infectious Dose

Susceptible Host

Becomes



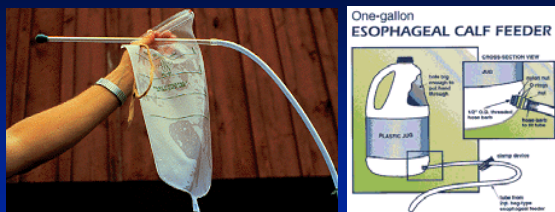
### Colostrum Antibody Absorption

- Available antibodies cross the gut wall into the blood stream
- Occurs best during the first hours of the calf's life, stops completely after the first day.
- **Note:** Anything else in colostrum (bacteria) is also absorbed indiscriminately.

### Maximizing Absorption

- Calf must get **clean, high concentration** colostrum **within 2 hours** of birth.
  - Holsteins - **4 quarts** minimum
- For calves that won't suckle that amount, use a **sanitized** esophageal feeder to tube feed it

### Esophageal Feeder



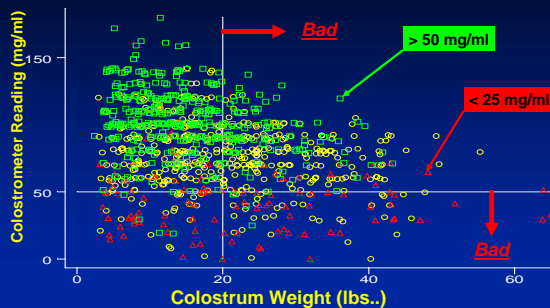
### Holstein Colostrum Concentrations

Antibody Level	Number	Category
< 25 ma/ml	12%	Deficient
25 – 50 ma/ml	48%	Marginal
> 50 ma/ml	40%	Adequate

### Select High Concentration Colostrum!

- Bovine Colostrum Quick Test
  - \$3.75 / test
- Midland Bioproducts Corporation
  - (800) 370-6367

### Selecting Adequate Colostrums – Old Way



### Antibody Controlling Bacteria



Only happens in the calf!

### Handling Colostrum - Dairy

- Colostrum must be handled like grade A milk.
  - Disease causing bacteria will grow just as well in it as in milk.
  - These bacteria are transferred with the colostrum into the blood stream.
- Harvest it into sanitized containers and refrigerate or freeze it if not used immediately.
- Don't pool - BLV, Salmonella, and Johnes are transferred by colostrum.



### Reducing Exposure - Beef

- Move cows and heifers to separate calving area several weeks before calving.
  - Skin and hair of cows on winter feed and bed ground will have infectious agents shed by carrier cows.
  - Heifers have poorer colostrum.
  - Heifers need more supervision.

### Reducing Exposure - Beef

- 1 Day after calving, move pair to large pasture area to spread out.
  - Exposed calf takes about 3 days to begin shedding agent in large numbers.
- If scours develops in a group, leave all of that group in place but turn out new pairs to a new pasture.
  - Many calves will be subclinical shedders.

### Beef Calving System

"The Sandhills Calving System"

- Nebraska
- Dr. David Smith

### Reducing Exposure - Dairy

- Within first day, move calf to a cleaned individual hutch that isolates the calf from contact with and the air space of other calves.
- Sanitize anything that contacts the mouth of a calf prior to that contact (nipples, esophageal feeders, pill guns, hands).

### Reducing Exposure - Dairy

- After weaning from milk, group by age in progressively larger groups
  - 1 to 7 to 14 to 28
- **DO NOT** hold back calves on the basis of small size; these are often carrier animals that will infect younger groups.
  - Group poor doers separately.

### Cleaning & Disinfection

- Thorough rinsing and cleaning is the first step, whether hutch, hands, or nipples.
- Remove all organic matter (feces, blood, milk, milk stone, milk fat, saliva).
  - Protects infectious agents from action of disinfectants (chemical or direct sunlight).
- Soap, water, and scrubbing are the most important; mechanically removing the agents.





### Chemical Disinfection

- Use a disinfectant with labeled effectiveness against target agents.
  - Many are not effective, such as Pinesol.
  - Environmental surfaces - One Stroke, Environ.
  - Tissue contact - Nolvasan or tamed iodine.
- Allow adequate contact time (temperature dependent) at sufficient strength.
  - Organic material (milk, manure) inactivates most disinfectants, especially chlorine-based ones.
  - Chlorine begins evaporating when mixed.




### The House Fly *Musca domestica*





**Mouth Parts**

2/3 of "fly spots" are regurgitation of previous meal



**Puparium (Pupal Case)**



### References - Calf Scours

- Hunt, E (ed.). Symposium on Calf Diarrhea. *The Veterinary Clinics of North America: Food Animal Practice*. 1(3), 1985. WB Saunders Co.
  - A volume of 13 papers reviewing calf diarrhea, its causes, treatment and prevention, including one on milk replacers and their components.
- Roy, JHB. **The Calf**, 5<sup>th</sup> ed. Vol. 1 Management of Health. 1990, Butterworths. 258 pp.
  - Detailed description of calf immunity and post-natal disease, particularly diarrhea.

**Reading Assignment for next time:**

**Basic Concepts for Cow-Calf Herd Health Programs**

Linked off of index page at:  
<http://www.vetmed.wsu.edu/courses-jmgay/VMADPproducerDrugs.htm>