Class PowerPoints & materials are on-line

http://people.vetmed.wsu.edu/jmgay/courses/

Scenario: Youngstock manager on a large operation

As manager, you must know the "why's" sufficiently to:
- Solve and prevent youngstock problems (value to owner)
- Hire, train, motivate, monitor and evaluate employees (1st problem)
- Develop standard operating procedures (SOPs) for youngstock
- Empower employees with sufficient understanding to reduce 'protocol drift' away from these SOP's

What do you need to know to:
- Find reliable resources for solving problems?
- Manage employees?
- Explain the ‘Nuts & Bolts’?

Figuring out what do you need to know

Continually generate questions to identify your knowledge gaps:
- Ask ‘5 why’s’, What if's
- Identify and question your assumptions
- Apply Feynman technique

Most reliable information – Comparative empirical studies:
- Product suppliers
- Research papers
- On-farm studies

Employees respond to incentives (‘skin in the game’)
- Challenge is figuring out a good incentive system, particularly for employees critical to calf health but outside your supervision
  - Example – colostrum harvesting and feeding

What are the biggest calf health problems?

Understanding mortality numbers is first step to determining calf health management strategy:

- **Total Mortality (death) prior to weaning – USDA NAHMS**
  - 3.6%  Beef (Beef 2007–08 Part IV)
  - 6.4%  Dairy (Dairy 2014 Health and Management Practices)

- **Scours as reason for Calf Mortality:**
  - 23%  Beef
  - 56%  Dairy

- **Tracking on this operation**
  - What you don’t routinely measure, you can’t manage!
Calf Scours: Identifying current information sources

1. Read background such as “Diarrhea in Neonatal Ruminants”
2. Use ‘Cornell Consultant’ to identify current review papers:
   • Select species of interest
   • Enter ‘diarrhea’ or disease name (e.g. ‘salmonellosis’) in Diagnosis
   • Select syndrome of interest

Diarrhea: Gut physiology disruption

- Body water cycles into and out of intestinal tract as part of digestion
  - ~25% of body water cycles thru intestinal tract daily
- Disruption occurs in two forms:
  - Normal secretion into intestine, reduced (malabsorption) back out
    • Most infectious diarrheal agents
    • Fermentative diarrhea
  - Excess secretion (hypersecretion) into intestine, overloaded reabsorption back out
    • E. coli K99, cholera (human)

Diarrhea results in dehydration and electrolyte imbalance

- Body water loss => Dehydration
  - Circulation reduced - Skin “tents”, sticky mouth, cold limbs and ears
  - Urine output drops and stops if severe (important clue)
- Body electrolyte (salts) loss and imbalance
  - Depresses CNS (central nervous system)
  - Reduces heart and skeletal muscle function
    • Heart stops when shift is severe enough, => Rx is time critical

What is it? (the really simple but key version)

Diarrhea: Loss of body water & salts (electrolytes)

Balanced intake and output are essential to normal fluid balance

Malabsorption causes diarrheal imbalance

Imbalance = Shrinking Body Fluid Volume

Electrolyte Shifts
Hypersecretion causes diarrheal imbalance

- Cells > Tissue > Blood > Out!
- Shrink Body Fluid Volume
- Water Intake
- Intestine
- Body Fluids
- Electrolyte Shifts
- Fecal Loss
- Urine Loss
- Maximum

Most important treatment is enough replacement fluids

- **Detect** scouring calf before fluid loss becomes so profound that oral replacement does not work
  - Severe – Fluid is not absorbed from stomach or SQ
- **Replace** both lost body fluid (water) and electrolytes (salts) in **large enough quantity often enough** that loss does not become profound
  - Enough – Calf urinates

What to Use: Oral rehydration solutions (ORS) have 4 key ingredients besides water

- Dextrose (glucose) – for energy
- Glycine – for absorption
- Salts - potassium chloride, salt, dicalcium phosphate, magnesium sulfate
- Sodium bicarbonate – buffer for acidosis

2.3% glycine and 44 grams dextrose (glucose)
  - “high energy” label – required to fuel absorption
  - Caution: Still only ½ the energy of milk!

Feeding only fluids too long leads to death by starvation / hypothermia

Two Examples: High energy electrolytes with glycine

Entrolyte H.E. - Re-sorb

Note separation to prevent component reaction

Use esophageal feeder to treat quickly

Insert carefully

Advantage of elevation

Sanitize between calves!

Antibiotics are the least important treatment!

- Agents that cause calf scours are often:
  - Viruses or protozoa that antibiotics have no effect upon
  - Bacteria resistant to OTC antibiotics
- Antibiotics, particularly OTC (over the counter) oral antibiotics, are usually ineffective!
  - Antibiotics in scour boluses
  - Antibiotic-containing milk replacer
  - Antibiotic-containing starters
- Result of general but unnecessary antibiotic use is the spreading of antibiotic resistance and expense
For success, treatment must be early!

Classification of scoursing calf into one of three dehydration categories to determine treatment:

- Degree of dehydration:
  - Early (< 5% Body Wt): supplemental oral fluids work
  - Moderate (7% Body Wt): high energy oral fluids work
  - Severe (> 9% Body Wt): only emergency IV fluids work

- 5 classification components - LobeS:
  - Limbs
  - Oral membranes
  - Body position
  - Eyes
  - Skin

Key to successful treatment!

Early Fluid Loss (<5% BW)

- Signs:
  - Limbs: warm (circulation is still good)
  - Oral membranes: moist
  - Body position: bright, standing (can’t catch easily)
  - Eyes: bright, no gap
  - Skin: “tents” for < 2 seconds

- 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/hypothermia before scours stop
- Don’t have to use expensive HE electrolyte solutions

Dehydration Sign – skin “tenting” pinch test

Loose skin of neck, chest

Eyelid

Moderate Fluid Loss (7% BW)

- Signs:
  - Limbs: cold
  - Oral membranes: warm but sticky
  - Body position: dull, lying down but upright
  - Eyes: sunken slightly with a slight gap
  - Skin: “tents” for 2 - 5 secs

- RX: To survive 1/2 gallon of warm special “high energy” electrolyte solution (Enterolyte HE) by esophageal feeder twice several hours apart
- If winter, move calf to warm area for monitoring

Severe Fluid Loss (>9% BW)

- Signs:
  - Limbs: cold (circulation is severely compromised)
  - Oral membranes: cold, pale and dry to touch
  - Body position: lying flat in a coma
  - Eyes: deeply sunken with a big gap
  - Skin: stays “tented”

- RX: Only 3 gallons of special electrolyte fluids by IV drip will save the calf
  - SQ and oral fluids won’t be absorbed because circulation is too poor
- Unless you or your employees can do IV’s safely and humanely, take calf to veterinary clinic
Fluid volume must replace loss and keep up with continuing losses
- Enough balanced electrolyte fluids must be given to:
  - Replace % of body weight (BW) lost (2.2 lb = 1 kg = 1 L)
  - 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% (moderate) dehydrated 80 lb (36.4 kg) calf, this is 6 to 9 quarts of electrolyte solution the first day
  - 1 Enterolyte H.E. pack is only 2 quarts! -> 4 packages
  - ‘An ounce of prevention is worth a pound of cure’
  - Not giving enough to save money is common error

Commonest Infectious Diarrheal Agents
Three Agent Types:
- Bacteria
  - Escherichia coli (E. coli) strains
  - Salmonella serotypes dublin, typhimurium, newport and others
- Viruses
  - Rotavirus
  - Coronavirus
- Protozoa
  - Cryptosporidia
  - Coccidia

To succeed your disease control strategy must be systematic and be integrated across the production system
Use HACCP (hazard analysis and critical control points) approach:
- List the common agents of concern
- Identify their characteristics that:
  - Enable them to escape a particular control method
  - Render them uniquely susceptible to a control method
- Use these to design multiple control points to block them in your production system
- Establish monitoring system to evaluate and record control points
Additional information source:
- Center for Food Security and Public Health
  http://www.cfsph.iastate.edu/

The Grade ‘A’ Pasteurized Milk Ordinance (PMO) is an example of an systematic integrated approach
Considering time vs. temperature thermal death curves for pasteurizing target organisms is just one control point in milk PMO
**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
- Some very effective ones are illegal to use!

**Aside:** Baytril cannot be used off-label, even by veterinarians

“Federal law prohibits the extra-label use of this drug in food-producing animals”

A complete veterinarian’s label doesn’t protect you both from prosecution by the FDA

**Colisepticemia is caused by 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
  - Harvesting colostrum cleanly and keeping refrigerated or frozen
  - Feeding 4 qts of high quality colostrum within 4 hours of birth

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

Bad conditions > First mouthful is *E. coli!*

Low density, no mud > Excellent 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
  - Calf can die of dehydration before diarrhea appears!
- Prevented by feeding colostrum containing K99 antibodies
- Cow vaccine available

**Corona & Rotaviral Diarrhea**

- Virus kills cells of intestinal villi, causing malabsorption diarrhea
  - Calf begins shedding $10^{13}$ virus per gram of feces 3 days after infection
  - Carrier cows continually shed low numbers of virus
- Virus survives weeks in the environment
- Vaccines available
- Antibiotics are ineffective (virus)

**3 Keys to Management and SOP's**

**Scanning EM of normal intestinal villi**

**Microscopic cross-section of normal intestinal villi**
Cross-section of virus-infected villi (green)

Sandhills Beef Calving System

“The Sandhills Calving System” was developed to reduce viral diarrhea in beef herds
- Developed in Nebraska by Dr. David Smith and colleagues
  - http://www.rangebeefcow.com/powerpt/smith.pps

Cryptosporidial Diarrhea

- Ubiquitous organism that survives for months in the right environment
- No practical antibiotics are effective
- Not killed by most disinfectants at practical concentrations
  - Exception: Chlorine dioxide
- Killed by complete drying
- This is a zoonotic disease, particularly for the immunocompromised

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, ...)
  - The reason for sanitizing esophageal feeder between calves
- Salmonella survive in the environment for months
  - Only direct sunlight kills it in the environment
- Usually resistant to OTC antibiotics

The major Salmonella transmission cycle is typical of most enteric pathogens: fecal-oral with fecal exposure being the major risk
Most are unaware of the other Salmonella transmission routes and exposure risks

Salmonella can be transmitted via every body orifice

- Manure
- Milk
- Dust & Aerosol Inhalation
- Oronasal Secretions!
- Urine

Infect the Unwary!

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; use legend injectable
- Vaccines of questionable effectiveness
- This is a zoonotic disease, meaning that humans get it!
  - Practice careful personal sanitation with hands, boots, clothes

Salmonella Diarrhea

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  - Practice careful personal sanitation with hands, boots, clothes

Low level Salmonella contamination causes problems

- Cross-Contamination?
- Weather, misters?
- Summertime, enclosed barn?

Low-level Salmonella Contamination

Favorable Environmental Temperature

REPLICATION

Sufficient Time

Infectious Dose!

Salmonella has superb survival abilities, surviving well under common farm environmental conditions

- Salmonella survives for months in materials that dried without heating, such as fecal pats and dust
  - Killed by exposure to direct sunlight
- Salmonella survives well in water
  - Slowly removed by microbial predators in water
- Salmonella replicates in moist environments (< 85% dry matter) even with scarce nutrients
  - Salmonella will grow on a wet board!
    - ’What if’ Questions – effect of painting? Pressure washing? Different surface?
  - Moist feedstuffs
- Salmonella replicates in the intestinal tract of every species in the farm environment
  - Livestock, humans, domestic pets, vermin, wild animals

For more information, Veterinary Clinics of North America are an excellent review series

Each issue has ~10-15 review papers by invited authors focused on a theme

Available on-line through WSU Libraries!
Background to explain the ‘why’s’ of calf scour PX, DX, and RX:
Veterinary Clinics of North America: Food Animal Practice

25(1), March 2009 - Bovine Neonatology
- Pathophysiology of Diarrhea in Calves
- Treatment of Calf Diarrhea: Oral Fluid Therapy

34(1), March 2018 – Digestive Disorders of the Abomasum and Intestines
- Diagnosis and Treatment of Infectious Enteritis in Neonatal and Juvenile Ruminants

Undifferentiated Bovine Respiratory Disease Complex (BRD)

Aka:
- “Shipping Fever” - beef industry
- Enzootic Calf Pneumonia - dairy industry
- Bovine Pasteurellosis – technical, old name

Google “Mannheimia haemolytica”

BRD: Identifying current information sources
1. Read background, starting with as “Bovine Respiratory Disease Complex”
2. Use ‘Cornell Consultant’ to identify current review papers:
   - Select species of interest
   - Select signs – ‘dyspnea’ and ‘abnormal lung sounds’
   - Yields 81 syndromes with these two signs
   - Enter ‘pneumonia’ (limited) or ‘bovine respiratory disease complex’ in Diagnosis
   - Links 24 2018 & 8 2019 papers

http://consultant.vet.cornell.edu/

BRD is one of the most costly cattle diseases
31% of US cattle deaths

BRD causes a significant % of pre-weaning calf deaths

<table>
<thead>
<tr>
<th>Cause</th>
<th>Beef</th>
<th>Dairy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calving Problems</td>
<td>18%</td>
<td>14%</td>
</tr>
<tr>
<td>Scours</td>
<td>17%</td>
<td>32%</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>16%</td>
<td>14%</td>
</tr>
</tbody>
</table>

Beef: Mortality of Calves and Cattle on US Beef Cow-calf Operations, May 2010
Dairy: Calf Note 203 – Pre-weaning morbidity and mortality in the US

BRD causes a higher % of post-weaning calf deaths (USDA NAHMS)

<table>
<thead>
<tr>
<th></th>
<th>Beef Feedlot</th>
<th>Beef Replacement</th>
<th>Dairy Replacement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digestive</td>
<td>13%</td>
<td>7%</td>
<td>14%</td>
</tr>
<tr>
<td>Respiratory</td>
<td>64%</td>
<td>7%</td>
<td>45%</td>
</tr>
</tbody>
</table>

Beef: Mortality of Calves and Cattle on US Beef Cow-calf Operations, May 2010
Dairy: Calf Note 203 – Pre-weaning morbidity and mortality in the US
BRD is caused by a sequence of events

- Interaction between pathogens, environment and the bovine host
  - Complex set of causal factors (ammonia, dust, stress, . . .)
- Final stage:
  - Pneumonia – acute, severe lung bacterial infection
  - Normal host flora in the wrong place

A disease of Man(agement) with clinical signs in the bovine

What is it? (the really simple but key version)

Stress + mucocilliary damage (virus) + host bacteria = BRD

Five steps lead to BRD occurrence:

1. Stress and upper respiratory ciliary damage
2. Growth of normal bacteria in upper airways
3. Failure of mucocilliary mechanism to clear the ventral lung (gravity)
4. Proliferation of normal nasal bacteria (*Mannheimia hemolytica* A1) out of place in ventral lung
5. Vicious cycle of infectious inflammation in dependent ventral lung

*Mannheimia hemolytica* is the most common BRD pathogen

Bacteria *Mannheimia (Pasteurella) hemolytica* serotype A1
- Normal bacterial flora in tonsillar crypts
- Spreads easily between calves
- Proliferates when:
  - Animal is stressed (weaning, trucking, mixing)
  - Viral upper respiratory infection (IBR, PI3, . ..)
  - Certain feeds are fed (silage)

The mucociliary clearance mechanism removes particles from lungs

Based on Cilia waves:
- Moves mucous from respiratory tract to throat
  - swallowed
- Moves at 1.5 cm / min with 1,500 waves / min
- Clears 90% of bacteria in 4 hrs
- Damaged by infectious agents, dust and fumes
  - IBR, PI3 virus (commingled salebarn calves)
  - Ammonia (enclosed dairy calf barns)
  - corral dust, diesel smoke (weaned beef calves)
Normal Cilia (Electron Micrograph)

Ciliary damage slows or stops the clearance mechanism

IBR “Sewer pipe” Trachea

In BRD normal bacteria proliferate, move to lung, are not cleared, and cause inflammation

BRD lung damage is due to a vicious cycle of inflammation

- Normal bacteria proliferate in Nasal Cavity
- Bacteria are inhaled
- Bacteria release toxins, attracting WBCs
- Lungs

- M. hemolytica attracts white cells from bloodstream
- M. hemolytica grows in the accumulating tissue fluid
- M. hemolytica leukotoxin kills the white cells
- White cell components cause lung damage, releasing tissue fluid and attracting more white cells

Animal's natural response causes the lung damage!
Old whole antigen bacterins make the problem **worse** by attracting more white cells.

---

What does classic BRD look like in the dead animal?

Necropsies are important for diagnosis and monitoring. Train employees to do these.

---

Pneumonia is in the ventral lung due to mucociliary clearance mechanism failure and gravity.

Normal: pink-colored area

Abnormal: purple-colored area

---

In chronic cases, abscesses form that contain pus.

---

What are the best ways to deal with herd infectious disease problems?

Given that most infectious agents remaining as problems (we’ve gotten rid of the easy ones):

- Are ubiquitous (*holoendemic*)
  - If they haven’t been found on a farm, they likely haven’t been looked for hard enough.
- Are opportunists
- Survive well in the environment, often months
- Aren’t reliably curable with drugs
- Establish carrier states in herdmates who then shed it
- Vaccines are not 100% effective (if even available)
- Often co-evolved with their bovine host

What is the best approach and what is needed for that approach?
Vaccination program recommendations are local and herd specific

"Vaccine Program Recommendations" in:
Basic Concepts for Cow-Calf Herd Health Programs
http://people.vetmed.wsu.edu/jmgay/courses/FDIUCowCalfHH.htm
TAMU Ranch to Rail: Value Added Calf (TexVAC)
Vaccination Management Guidelines

The disease "Iceberg" means most diseased animals are not detectable visually

- Most infections are subclinical
  - Typically > 10:1
- Can't identify every infected animal easily
- Important because some animals are more susceptible than normal
  - Neonates
  - Animals with other diseases

Goal: Separate the susceptible from the potential subclinical

The economic loss in a herd from subclinical disease is usually greater than from clinical disease

469 steers followed from birth to feedlot to slaughter
- 35% (164) treated for BRD
- Pulmonary lesions at slaughter:
  - 78% (128) of treated steers
  - 68% (207) of untreated steers (subclinical)
  - 0.2 lb ADG reduction
  - 46 lb slaughter weight reduction

Prevention is key to preventing production loss!

Clinical cases are the “tip of the iceberg” red flags

Consider clinically affected animals Red Flags!
They indicate the presence of a serious herd problem
They are not the full extent of the problem

Reduce infection transmission between infected and susceptible in a herd

- Reproductive Ratio ($R_0$) is the number of secondary infections due to each infection
  - > 1: Infection spreads
  - = 1: Infection is stable
  - < 1: Infection dies out
- Hard to reduce in intensive management
  - agents co-evolved and survived with hosts when they were extensive, free-ranging

Goal: Get $R_0$ less than 1 so agent disappears from herd

Infection transmission occurs in two forms

- Vertical
- Horizontal

Vertical transmission can occur:
- In utero – born infected!
- During birth
- Infected colostrum
- Suckled milk

Goal: Get $R_0$ less than 1 so agent disappears from herd
Infectious agents get out and in many ways

Transmission has 3 Attack Points – Escape, Environmental survival, and Infection

Looking at the question another way

Production systems are dynamic relationships between animals, infectious agents, and their environments

We construct overly simplified mental models of how the world works and then apply our favorite solution

Learn biosafety habits that reduce infection transmission!
A particular infectious dose results in differing severity in a herd

Clinical disease doesn’t occur when resistance is high relative to exposure dose

Pattern of Host Resistance - Calves

Pattern of Host Resistance - Cows

Most vaccines provide marginal protection but not absolute protection

Clinical disease outbreaks result from a breakdown that initiates a vicious cycle
Albert Einstein’s more relevant quotes:

- The significant problems we have cannot be solved at the same level of thinking we were at when we created them
- Insanity: doing the same thing over and over again and expecting different results

We do this a lot in disease problems like calf scours and bovine respiratory disease

Focus on the entire husbandry system rather than individual diseases

Disease severity is determined by many factors

<table>
<thead>
<tr>
<th>Lower Severity</th>
<th>Higher Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Dose</td>
<td>Higher Dose</td>
</tr>
<tr>
<td>Middle Aged</td>
<td>Neonate or Elderly</td>
</tr>
<tr>
<td>Lower Stress</td>
<td>Higher Stress</td>
</tr>
<tr>
<td>Adequate Cu, Se, Vitamins A, E</td>
<td>Deficient Cu, Se, Vitamins A or E</td>
</tr>
<tr>
<td>No other diseases</td>
<td>Other diseases, co-infections</td>
</tr>
<tr>
<td>Higher social dominance</td>
<td>Lower social dominance</td>
</tr>
<tr>
<td>Lower producing</td>
<td>Higher producing</td>
</tr>
<tr>
<td>Higher specific immunity</td>
<td>Lower specific immunity</td>
</tr>
</tbody>
</table>

Horizontal Transmission Chain

- Infected Host
- Sheds Agent in oral & nasal secretions, urine, feces
- Contaminated Environment
- Agent survives at Infectious Dose
- Hands, Thermometers, Equipment, Feed, Water, Boots, . . .
- Becomes Susceptible Host

Block infectious agent flow through the transmission chain links at multiple control points

- Isolate
- Reduce shedding level
- Remove contaminated materials
- Increase agent death rate
- Increase Resistance
- Isolate to minimize infectious dose

This flow will eventually occur if the agent isn’t present now but the risk factors are!

Herd “Hardening” is applying strategies that reduce dose and shift the curve

- Take advantage of increasing resistance with age
- Separate groups with high shedding risk from those with high acquiring risk
- Decrease survival opportunities of agents
- Attack all the agent transmission routes

The greatest weakness of most strategies is the failure to address all the transmission routes
Apply the general principles to the entire farm system

The neonatal calf is the most susceptible animal on most farms
- Maximize the calf’s natural resistance and acquired immunity
- Delay and minimize the infectious dose the calf is exposed to
  - Because these agents are ubiquitous, calf must eventually acquire the infection and develop an active immunity

Know key characteristics of the prevalent infectious agents

Example - Corona & Rotoviral 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 continually shed low numbers of virus
- Virus survives weeks in the environment
- Vaccines available, labeled “aid in preventing”
- Antibiotics are ineffective (virus)

3 Keys to Management

Maximize passive transfer by routinely monitoring it

Passive antibody level vs. scour episodes

Number & Severity of Scour Episodes

Absorbed Passive Antibody Level

Anything that you can easily monitor but don’t you likely aren’t doing well

Handle colostrum and liquid calf feed like grade A milk for sale

- Disease-causing bacteria grow just as well in colostrum as in milk
- These bacteria are transferred with the colostrum into the bloodstream
- Harvest into sanitized containers and refrigerate or freeze it if not used immediately
- Don’t pool!
  - BLV, Salmonella, and Johnes are transferred by colostrum

Avoid food (or feed) temperature abuse

Minimize time liquid feed is between 140°F and 41°F after cooking (< 6 hrs)
- Thaw in refrigerator
- Rapid heating
- Rapid cooling
  - In freezer or refrigerator
  - In shallow pans
  - Sufficient air space

These practices apply to farm situations, such as colostrum management!
There is nothing magic about animal feeds compared to human foodstuffs
Low level Salmonella contamination is very common

Cross-Contamination?
- Low-level Salmonella Contamination
- Moist Foodstuff
- Favorable Environmental Temperature

REPLICATION
- Sufficient Time

Infectious Dose!

Good food handling practices apply everywhere

Colostrum refrigerator on large farm

- See anything wrong here?
- When was the temperature last checked?
- Appliances are often cast-offs from the house

Colostrum was not cooling quickly, resulting in excessive bacterial counts

Develop cleaning and sanitizing criteria that employees can use to judge their own performance

General Rules:
1. Look Clean
2. Feel Clean
3. Smell Clean

If it doesn’t, it ain’t

Agents die by exponential decay in the environment

Agents shed into Environment

- Half Life Curve

Number of Infective Particles

- Time to ½ Level = Half Life

Clinical Disease

- Clinical Infection Threshold

Subclinical Infection

- Subclinical Infection Threshold

No Infection

Time reduces exposure dose, reducing exposure consequences

Proper sanitation breaks the half-life curve

Goal: Reduce agent level below infectious dose for typical susceptible animal
For sanitation success doing each cleaning and disinfection step is critical

- **First Step**: Thorough rinsing and cleaning, 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

People often want to skip this step because of the "elbow grease" often involved

Chemical disinfection requires an effective agent at concentration with full contact time

- Use a disinfectant with **labeled** effectiveness against target agents
  - Many are not effective, such as Pinesol
  - Environmental surfaces – 1-stroke Environ, chlorine dioxide
  - Tissue contact - Nolvasan or tamed iodine
  - General use - Virkon S
- Allow adequate contact time (**temperature dependent**) at sufficient concentration
  - Organic material (milk, manure, blood) inactivates most disinfectants, especially chlorine-based
  - Chlorine begins evaporating when mixed (detectable odor)
  - People often use a solution too long, use too little, and don't allow sufficient contact time

VirkonS is one of the best overall disinfectants

- 1.3 ounces of Virkon S per gallon of water
- One gallon treats 135 square feet
- ~$70 per 10 lbs
- Hazardous to humans and animals; protection recommended
- Chlorine dioxide is an emerging disinfectant

For more information, see CFSPH "Disinfection 101" at http://www.cfsph.iastate.edu/BRM/resources/Disinfectants/Disinfection101.pdf

The final step of full drying is critical!

- **'Why'**: Some agents are not killed by common disinfectants, only full drying
- Low levels of other agents will likely remain that can begin replicating later
  - **Fact**: Salmonella will grow on a wet board!
  - Consider the management questions prompted by this simple fact

Assumption Trap: A common error is leaving the items in the final tank with the disinfectant, assuming they will be more sterile when removed

When hands are not visibly soiled, alcohol-based rubs are more effective than soap and water

- Alcoholic-based handrub (62% ethanol)
- Antimicrobial soap (4% Chlorhexidine)
- Plain soap


Groups with effective hand sanitation programs had 50% as many respiratory and GI episodes as others!

Most important is cleaning hands frequently and effectively

To wash hands:
- **Wet hands** (avoid HOT water – dries skin -> cracking)
- **Apply soap**
- **Rub hands together for at least 15 seconds**
- **Cover all hand surfaces**
- **Rinse with water and dry thoroughly**
- **Use a paper towel to turn off faucet**
Proper hand washing is the single biggest weapon against transmission of common human infectious diseases.

Why all the fuss about Hand Washing?

- CDC estimates proper hand washing reduces foodborne illness by 50%
- Proper hand washing reduced respiratory illness 45%
- Infections acquired in dense settings (classrooms, offices, daycare)
- Infections acquired in healthcare

Basic Personal Hygiene for Humans

The Far Side by Gary Larson

Although 92% of people say they washed their hands, only 66% of men and 88% of women do (www.washup.org)

The House Fly Musca domestica is a dangerous transmitter of infectious agents

- Mouth Parts
- Puparium (Pupal Case)

½ of “fly spots” are regurgitation of previous meal

Flies transmit infectious agents everywhere!

What do you suppose the calf ingests besides water when drinking?

Colostrum cooling on the parlor floor

Dead Flies!

Damp straw bedding is a fantastic fly incubator

Parasitic wasp raisers grow their flies in damp straw!
Most of all, avoid PPM!

Bad Management overwhelms the Best Vaccine every time!

General Livestock Food and Water Safety Rule

If you wouldn't eat off of it or drink out of it, don't expect a cow or calf to either!

DD Hancock