Bovine herpes mammillitis, Ulcerative mammillitis ***

Mk 664; C3T 419; IM 1419; BR-hb 434, BR 1136; Br 321; DC 276; Derm 106

- High incidence of 2° mastitis
- Bovine herpesvirus 2

Herpes virus
CS: Teat ulcers; 2° mastitis
Dx: Hx, CS, Histo, Virus isolation
Tx: Segregate; Cannulate

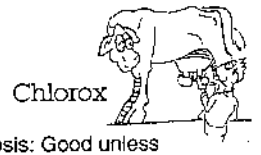
- Acute, swollen, tender teats
- Vesiculation & sloughing
- **Severe ulcerations** of teat
- **Dark brn/blk scab** (crack & bleed)
- M/ involve teat canal (predisposes to mastitis)
- ↓ Milk production

- **Sequela:**
  - **Mastitis**

- History, CS
- Histopath. or virus isolation from early plaques

- Segregate
- M/ have to cannulate to remove milk

- Antibacterial ointments
- Iodophor solution for spread
- Predip w/ Chlorox®



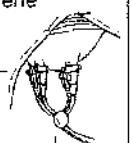
Prognosis: Good unless teat sphincter involved

Impetigo, Udder acne

Mk 667; C3T 895; BR-hb 235; BR 541, 617; DC 256, 278; Derm 121

**

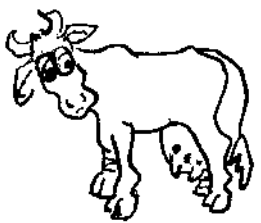
- Impetigo: pustular dermatitis that doesn't affect the hair follicle
- ***Staph. aureus*, Staph spp.**
- Highly contagious, spread by milkers
- Herd problem; bad hygiene



Contagious, Milkers spread
CS: Pustules, Denuded areas
Tx: AB ointment, Clean & Dry
Px: Good **Control: Teat dip**

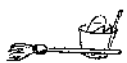
- **Pustules** on udder & teat (often on udder near base of teat)
- Break open, leaving denuded areas
- Pruritus & pain rare
- 2° infection
- M/ spread to teats, ventr. abd, thighs, perineum & tail

- CS, usually treat w/out culture



- **Keep udder dry**
- Scrub area w/ chlorhexidine or iodophor
- Antimicrobial ointment BID (chlorhexidine or sulfathiazole)
- Lesions heal in 1 wk

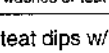
Prognosis:
- Resolves easily if treated daily w/ antibacterial scrubs

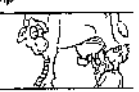


Control spread
- Iodophor or chlorhexidine
  - Udder washes or teat dip

Teat chapping & cracking *** due to frequent washing & drying, wind; antiseptic udder ointment (chlorhexidine or iodophores, teat dips w/ iodophores & glycerine

Mk 666; Br 324; DC





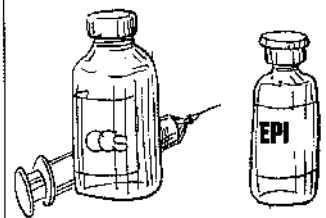
Mammary tumors (BR 617; DC 260): rare in cattle

Udder abscesses: Incise & drain when near surface & chronic; Beware! (vessels); pack wound w/ gauze containing a counterirritant (iodine) for 2 days, then daily washing w/ antiseptic solutions

Mk 666; DC 255
***

Skin

SKIN - EYE - MAMMARY

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Hives, Urticaria, Nettle rash Mk 867; IM 1405; C3T 900; BR-hb 235, 240; BR 532, 542; Br 685; DC 233 *** 	• **Wheals:** transient swellings in skin or mucous membranes (plaque-like eruptions) **- Localized edema in dermis** • **Angioedema: swelling of SQ** • **Type I hypersensitivity** • Cause - **Drugs:** (pen & sulfas, oxytetracycline, chloramphenicol, neomycin, diethylstilbesterol, carboxymethylcellulose) - Biologicals (Vaccines & toxoids, Lepto, B abortus 19, F&M diz, shipping fever, Salm.) - Physical trauma, hypodermiasis - **Feeds** (pasture plants, moldy hay, potato) - Stinging nettles - Milk allergy (unique to cattle) (see below) - Insect bites blamed, but rarely cause • **Precipitating** or intensifying factors - Pressure, sunlight, heat, exercise, psychological stress, genetic abnorm. • **Pathophysiology** (see box)	• **Wheals** or plaques appear few min or hr w/in exposure to agent - Elevated, distinct shapes (round, serpentine), flat-topped, m/b depressed in center - Neck, body & upper limbs • Angioedema • Variable pruritus • Variable exudation • Severe, m/b preceded by fever, anorexia or dullness • Advanced - plaques on mucous membranes of mouth, nose, conjunctiva, rectum & vagina • **Gen. disappear as rapidly as appear** (w/in few hours) 	• **Wheals, Cold** • **Pit w/ pressure, DDx from other nodular dizs** • Intradermal skin testing in horses  **DDx** • Other nodular dizs (they don't pit on pressure) - Infec. granulomas - Neoplasia - Cysts - Dermatophilosis (p 183)	• **Spontaneously recover w/o Tx** • **Avoid allergen** - Change feed & see if better • **Short acting corticosteroids** (CCS) - Prednisone or prednisolone (2 mg/kg IM/IV) - Dexamethasone (0.1 mg/kg IV/IM) • Antihistamine rarely valuable • **Epinephrine if life threatening**  **Px** • Good - most spontaneously recover
Develop & Suddenly disappear **CS: Wheals, ± Exudation, ± Resp.** **Dx: Hx, CS, Pit w/ pressure** **Tx: Spontaneous recovery, Steroids, Epinephrine**		• **Pathophysiology** - Wheals result from vasodilation & leakage of fluids from small vessels - Immunological & nonimmunological factors trigger release of mediators from mast cells & basophils that cause wheals - Immunological Type I hypersensitivity (IgE) most common immunological cause	**Angioneurotic edema** - life threatening variation of urticaria - Diffuse SQ edema often localized to head, limbs & perineum	
Milk allergy IM 1406; BR-hb 625; BR 1622; Br 685 ** 	• **Unique to cattle** • During drying off period • Cause? Genetic predisposition to engorgement of udder (Channel Island breeds [Jersey]) - Milk protein into circulation - Type I hypersensitivity 	• **Urticarial rash**, localized or general • Muscle tremors • Ataxia, restlessness • Dullness • Mania • Resp. distress in some cases 	• History, CS • Engorged udder • Interdermal injection of cow's milk - edematous swelling	• **Milk out udder** • Antihistamine early • Cull bec. likely to recur  **Prevention** • Avoid milk retention during drying out period

Food hypersensitivity : Rare, wheat, soybean, rice bran, clover hay • CS: pruritic skin diz, w/or w/o wheals • Dx: hypoallergenic diet 4 wks then re-administer original diet: CS in 1-7 ds • Tx: Avoid offending foodstuffs

C3T 901 ★

Atopy (C3T 901): genetic pruritic dermatitis due to hypersensitivity to inhaled allergens, presumptively Dx in Suffolk sheep

Contact dermatitis

IM 1411; C3T 903; DC 234; Derm 68

★★★

- **Irritant & allergic forms**
- **Irritant more common**
  - **Urine & feces**, wound secretions, caustic substances (acids, alkalis), crude oil, diesel fuel, turpentine, parasiticides, irritant plants, wood preservatives, bedding, filthy environment

- Erythema, edema & vesicles
- Erosion, ulceration & crusting
- Lichenification & hyperpigmentation
- Dist. extremities, muzzle & ventrum (contact areas)

- **History, CS**
- **Provocative exposure test**
  - Remove from all possible sources for 7-10 days, clears up
  - Expose to suspected agent & look for dermatitis
  - Repeat for positive ID

- **Eliminate possible exposure**
- **Wash gently** w/ water until clears up

Vesicles - Ulcerations - Lichenification - Hyperpigmentation

Nutritional, endocrine & keratinization abnormalities (C3T 911; Br 220)

Starvation (C3T 911): Total starvation (marasmus), near total protein defc. (kwashiorkor), low protein intake - cachectic, susceptible to infec., dull, dry, brittle hair coats

High fat milk replacement diet (C3T 911): calves, 15-20% fat, alopecia, scaling dermatosis (muzzle, eyes, ear, limbs) • Tx: reduce fat to 10% & Vit E suppl. cures

Vit. C defc (C3T 911; BR-hb 550; BR 1449; DC 250): rare, calves in fall & winter; Healthy; severe scaling, crusting, alopecia, erythematous, pruritic legs • Tx: 1-2 SQ injections of ascorbic acid

Vit. A defc (IM 1064; C3T 911; BR-hb 548; BR 1442; Br 220; DC 189): Uncommon, poorly supplemented concentrates w/ little greens • CS: Ocular, CNS, Repro, skin (rough, dry, faded < shaggy hair coats; widespread seborrhea; overgrown, dry, brittle, cracked hooves

Selenium/Vit. E defc (Br 222): See pg 78; eye alopecia, dull, dry, brittle coat, generalized dry, flaky seborrhea • Tx: Vit E/Se injection cures in 2-4 wks, biannual injection

Cobalt defc. (C3T 912): rough, faded, hair coats

Copper defc/Molybdenosis (C3T 912; DC 250): See pg 89; rough, dry, lightened hair coats, exfoliative pododermatitis w/ heel cracks; masked or spectacled appearance • Tx: copper suppl.

Zinc defc (C3T 912; Br 224; DC 250, 508t; L 411): prone to infec. (pododermatitis), dull, rough, faded coat w/ scaling, crusting, alopecia (face, ears, neck, mucocutan. junction, dist. limbs)

Hypothyroidism (C3T 912): only endocrine dermatosis; genetic, 1° or 2° iodine defc, mortality in neonates, born weak, generalized hypotrichosis, alopecia, diffuse hyperkeratosis, puffy, thick skin

Mercury, Arsenic, Chlorinated naphthalene, Polybrominated & polychlorinated biphenyl (C3T 904) See Tox. All have dermatologic CS

Skin Disorders

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment

Cutaneous neoplasia (C3T 915): ★★ In descending order of incidence: Papilloma, squamous cell carcinoma, melanoma, mast cell tumor

Warts, Papillomatosis, Papillomavirus, Verrucae

Mk 1417; C3T 916; BR-hb 430; BR 556; DC 232

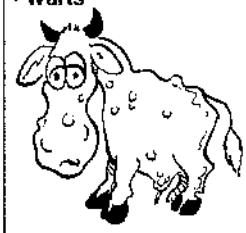
★★★

- **Virus - Papovaviridae.** not proven for interdigital papillomatosis
- Infectious
- Transmission:
  - Direct contact, fomites & possibly insects
- **Different types of warts**
  - **Spontaneously regress - typical warts on animals < 2 yr**
  - **Do not regress - atypical, "rice grain" & interdigital - all ages**

Virus: Diff. types, ± Spontaneous regression
CS/Dx: Typical warts
Atypical: "Rice grain", Interdigital warts
Tx: Some self limiting; Sx, Topical (DMSO)
Vaccine for some

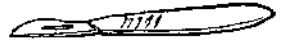
- **Typical warts (fibropapillomas)**
  - Head, neck, shoulder & back, abd.
  - Teats & penis, vagina
  - Problem on penis of young bulls
  - Dystocia if on vaginal mucosa
- **Atypical warts:** Low, flat, circular & nonpedunculated
  - Delicate, frond-like projections
- Papillomas in GI tract
- **"Rice grain" warts** on teats - all ages
- **Interdigital papillomatosis**
  - Chronic problem of housed dairy cattle
  - Interdigital space, esp. hindlimb
  - Assoc. w/ pain, lameness, wt. loss, ↓milk, ↓estrus detection

- **Warts**



Vaccinate w/ suspension of ground wart tissue, virus killed w/ formalin
- Good for prevention, not Tx of common warts
- Not for atypical & "rice grain" warts & interdigital papillomas

- **Papillomas of teats, penis, head, neck & dew lap spontaneously regress**
- **Atypical & "Rice grain" warts & interdigital papillomas do not spontaneously regress**
- **Surgical removal** when maximum size so doesn't stimulate recurrence & growth
- Topical agents: podophyllin
- Isolate affected
- Disinfect environment (formaldehyde or lye)



Prognosis:
- **Good**
- Poor if > 20% of body affected

Squamous cell carcinoma, (SCC)

Mk 849; IM 1432; C3T 917; BR-hb 243; BR 556; DC 232

★★

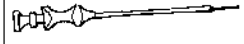
- Malignant neoplasia
- Cause?
  - UV light on light skin
  - Viral warts or follicular cysts
  - Hot branding
- Adults to aged cattle
- Breeds: Herefords & Ayrshire (poorly pigmented)

- **Nonpigmented skin at muco-cutaneous junctions**
  - Periocular
  - Vulva

- Ulcerative &/or proliferative
- Metastasis is not common

Uncommon, Malignant, Poor pigmentation
CS: Mucocutaneous junction
Tx: Radical excision

- **History, CS**
- **Biopsy/histology**



- **Radical excision TOC**
- Radiation therapy
- Cryosurgery
- Hyperthermia
- Radiation therapy

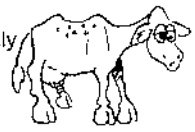
Melanoma

IM 11436; C3T 917; BR-hb 243; BR 557 ★

- **Rare**, < 2% of all bovine tumors, **Dark-haired** predisposes (**Angus**), usually young cattle, m/b a congenital lesion
- CS: Usually **benign** (but can metastasize), well-differentiated, solitary or multiple, black to gray, freq. ulcerative, subQ, anywhere (head, neck, dist. limbs)
- Tx: Surgical excision, if feasible

Mast cell tumors (Mk 862; IM 1435; C3T 917; BR-hb 243; BR 557; DC 232) • **Uncommon in cattle**, Cause: unknown; arise from cutan. mast cells; majority malignant & metastatic; 6 mo-7 yr
*
• **CS:** Multiple usually, 1/4 - 16" in diameter, firm to fluctuant, dermal or SQ± alopecia or ulcerative

Cutaneous lympho-sarcoma *

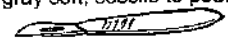


• **See pg 268** • Rare malignancy in cattle, 1-4 yrs
• **CS:** Multiple SQ nodules (Urticarial or ringworm-like); 1/2 - 3" in diameter; anywhere, esp. neck & trunk, animal healthy initially
• **Dx:** History, CS, Biopsy
• **Tx:** None, Freq. spontaneously regress

• **Px:** Poor: remission usually followed by relapse & fatal internal involvement

Hemangioma
C3T 917; BR-hb 244; BR 558 **

• **Uncommon** in cattle; Benign tumors of endothelial cells of blood vessels; Cause: unknown; Mature animals, but m/ be congenital
• **CS:** Single or multiple, anywhere on body, Black-red/gray soft, sessile to pedunculated masses on back (1/5-1"), recurrent profuse hemorrhage
• **Tx:** Surgical excision • Prognosis: good - benign



Cysts
IM 1437; C3T 918
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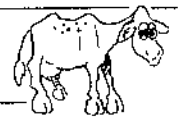
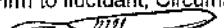


• **Uncommon in cattle**; Benign lesions, epithelial wall w/ keratinous contents, Types: epidermal, dermoid & dentigerous
• **CS:** Single or multiple, Firm to fluctuant, Circumscribed, smooth & round
• **Tx:** Surgical excision



Congenital & hereditary skin dizs * (C3T 907; BR-hb 244; BR 559; Br 150): no specific therapy for most

Hypotrichosis (C3T 907; Br 150): Less than normal amount of hair, Congenital & Acquired (illness [BVD], nutritional defc [iodine], or condition during pregnancy)

Hypertrichosis (C3T 907): More than normal amount of hair; Hereditary in European Friesian cattle; Abnormally curly hair - congenital in Ayrshire & Hereford cattle

Ichthyosis (C3T 907): Congenital generalized thickening of skin due to excessive keratin in Friesian, Brown Swiss & red poll cattle. No hair, large, thick, horny scales w/ deep fissures, stillborn or die shortly after birth. Ichthyosis congenita: milder form, Pinzgauer, Holstein & Chianiana: viable w/ hyperkeratosis & assoc. cataracts & small ears

Cutaneous asthenia, collagen dysplasia, dermatosparaxis, cutis hyperelastica, **Ehlers-Danlos syndrome** (C3T 907): Congenital collagen dizs (hyperextensive & fragile skin) resulting in gaping wounds & thin cutan. scars; Usually fatal due to septicemia

Aplasia cutis, epitheliogenesis imperfecta (C3T 909): Focal ulceration w/ absence of epithelium • Px: variable: Severe/die (septicemia); mild cases m/ heal or surgical Tx

Epidermolysis bullosa (C3T 909): Hereditary bullous eruptions & ulcerations in response to trauma to face, extremities, mouth or over joints; mortality high due to 2° septicemia

Hereditary zinc defc (C3T 909): Parakeratosis, lethal autosomal recessive
• CS in few wks of birth - progressive alopecia & scaling, diarrhea & rhinitis • Tx w/ zinc replacement

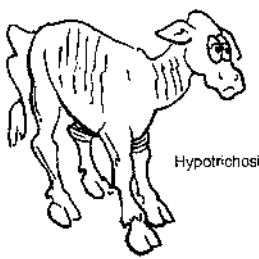
Albinism (C3T 910; BR-hb 630; BR 1631; Br 151): Partial or complete lack of pigment

Chediak-Higashi syndrome (C3T 910; BR-hb 630; BR 1631): See pg 274; Pigment disorder (Hereford & Brangus) dilution of hair color, tendency to hemorrhage, incr. infections, photophobia, fatal at 1 yr.

Porphyria (C3T 910; BR-hb 633; BR 1634): Hereditary photosensitization (Limousine, Shorthorn, Holstein-Friesian, Hereford); CS: photodermatitis, anemia, stunting, discolored teeth & urine

Keratogenesis imperfecta, Baldy calves (Br 151): Lethal, Holstein-Friesian • CS: alopecia, horns don't grow

Chediak-Higashi syndrome

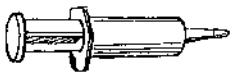
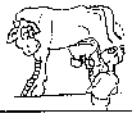
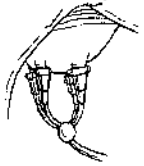
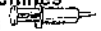
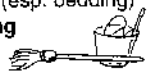


Hypotrichosis

Mastitis

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Mastitis Mk 687; C3T 762; IM 1181; BR-hb 251; BR 563; Br 289, 305; DC 279 ***	• **Most costly diz in adult dairy** (1/3 of all dizs) - ↓ Milk production - Economic losses $200/cow, 2 billion/yr USA, - 10% loss of total production - 40% of all cows - Will continue bec. of difficulty in controlling environmental pathogens • Causes - Milking hygiene (75%) - Equipment malfunction (20%) - Cow factors (5%) • Defense - 1st line is teat canal - Cell mediated: normally 0.5-20,0000 cells/ml (less more susceptible to mastitis)	• **Subclinical & clinical mastitis** - ↓ Milk production - Milk discard - Early culling (7% of affected) - Other economic losses (drugs, vet, labor) - Death (1%)	• **CS inadequate for cause** • **Individual**, examine before milking - **Abnorm. milk** - **Hot udder** (swelling, heat & edema) - **SCC/culture** • **Herd - subclinical cases** - ↑ **SCC** (somatic cell count) . 80% of cows w/ SCC > 200,000 are infected . Bulk tank SCC - **Cultures/AB susceptibility** . **Bulk tank** - ID pathogens monthly to monitor herd, cheap .. **< 250,000 cells/ml OK** . **Routine culture** all infected quar. .. Do routinely or at least whenever unusual mastitis . **Herd cultures** all cows in herd .. When contagious bact. suspected .. ID infected cow for isolation &/or Tx . **Selective survey cultures**: .. Indiv. testing on basis of elev. SCCs .. Finds infec. animal w/ less testing, but misses some positive animals • **Palpate** udder for symmetry, fibrosis, firmness, swelling, etc. - Acute: Inflammed, hot, swollen - Chronic: fibrosis, but no heat - Subclinical: only incr. no. of cells in milk - Palpate supramammary & inguinal lymph nodes	**Prevention rather than Tx most effective** • **Herd problem** • **Total dry period** therapy routinely done - Infusion of long-acting ABs in all quarters during dry period • **Control contagious mastitis** - **Hygiene during milking** . Predip . Single paper towel/udder to wash & dry . Disinfectant in wash solution . Rubber gloves . **Teat dip** - post milking **(#1 control)** . Test & maintain milking machine - **Dry cow therapy, long-acting ABs into all quarters** - Culling - Tx clinical mastitis cases - **Isolate infected & milk last** (serve as source of contamination) sterilize cluster after affected cows - Properly functioning milking equipment • **Control environmental mastitis** - Sanitation of environment - Predipping - Feed right after milking to keep cow standing as teat canal closes - Antibacterial teat sealant when drying off - Decr. trauma to teat, decr. potential for backflow of milk (esp. contaminated) - AB Tx of little use for environmental mastitis - Diet (Vit E & Selenium) improves resistance - Vaccines: coliform vaccines likely to be profitable . *S. aureus*, Strep: more research needed • **Cull cows w/ repeated mastitis** • **Individual cows Tx**: see below
• **Contagious mastitis** VC/M 475	• ***Staph. aureus* (7-40%), *Strep. agalactiae*, Mycoplasma spp.**, *Corynebacterium bovis, Strep. dysgalactia* • Transmission: Milking time (milking equipment, nursing calves or milker's hands)			
• **Environmental mastitis**	• Bact. in environment other than mammary gland, do not need infected glands to perpetuate diz, therefore can't eliminate mastitis • Major mastitis on modern, well managed dairy farms - ***Coliform*** (gram neg., *E. coli*, Klebsiella spp, Enterobacter spp, Setaria, Pseudomonas, Proteus) - **Envir. Strep spp.** (*Strep. uberis* #1); ***Staph. aureus*** • Transmission: Usually when not milking: Fecec, water, bedding, fomites - Incr. as contegious mastitis decr. - 80-90% coliforms & 40-50% of strep result in clinical mastitis as opposed to subclinical			
• **Contagious/ environmental**	• **Overlap**: Bacteria on mammary gland or in environment *Strep. uberis, Strep. dysgalactiae, Staph. aureus*			

#1 economically; Cause: Contagious & Environmental
CS: 90% subclin.; Clinical (Acute, Chronic, Gangrenous)
Dx: CS, SCC, Culture
Tx: Herd over indiv. (Hygiene, Dry cow therapy, Isolate, Cull)

• **SUBCLINICAL mastitis** 	• **90% of all mastitis** • **#1 cause of production loss** (10-26% milk loss) • Causes - Contagious: *Staph. aureus, Strep. agalactiae* - Envir.: Strep. spp (*S. uberis, S. dysgalactiae*)	• **Milk grossly normal** • No visible inflammation • In time - fibrosis of mammary tissue, firmer, larger gland • ↓ **Milk production**	• No CS since subclinical • ↑ SCC (somatic cell count) > 250,000/ml • CMT (Calif. mastitis test) • Routine culture of all quarters 	• Tx as above - Milking hygiene (teat dipping, 1 towel) - Dry cow therapy (ABs all quarters) - Semiannual test & maintain milking machines  
• **CLINICAL mastitis**	• Further divided into acute, chronic & acute gangrenous mastitis	• **Milk grossly abnormal** - **Gargets** (milk clots) - Serum w/ fibrin • **Udder inflammation** - Redness, fever, swelling & pain	• History, CS • Cell counts > 500,000 cells/ml • Isolate causal agent • Provisional diz by CS & knowledge of herd predominant pathogens - Confirm w/ culture & sensitivity tests (see above) • **Palpation for mastitis** - Inflammed, hot, swollen - Supramammary & inguinal lnn. 	• Tx herd as above - **Milking hygiene (teat dipping, 1 towel)** - **Dry cow therapy** (ABs all quarters)  - **Treat clinical mastitis cases** - **Test & maintain milking machines**  - **Cull repeated mastitis cows** - **Sanitize environment** (esp. bedding) - **Feed right after milking**  • **Individual cows Tx** - Frequent (QID minimum) stripping of quarter & injections of oxytocin QID - Subacute: intramammary Tx after each milking for 3 days - Acutely affected: systemic & intram. ABs minimum of 3 days - Peracute: systemic & intramammary ABs, oral fluids & anti-inflammatory drugs (aspirin, Banamine®) . Severe: hydrotherapy (spray quarter 15-30 min BID) - Fresh cow/ first lactation heifers: diuretics for edema - If no response in 7-10 ds won't respond . Cull 
1. Acute mastitis	• Exacerbation of chronic or a new infection 	• **Swollen, painful gland** (difficult to walk) • **Abnormal milk** (clots or flakes, watery, serous or purulent) • **Systemic CS,** mild or severe - Anorexia, Depression, Elev. temp. - Toxic mastitis (coliform/*S. aureus*) - M/ have low serum Ca & paraplegia (resembling milk fever, no response to parenteral Ca)		
2. Chronic active mastitis	• **Intervals of no CS** • **Assoc.: *S. agalactiae*, coliforms, *S. aureus*** & *Salm. dublin*	• **Intervals or no CS** • **Intermittent acute mastitis manifestations** (see above) • ↓ Milk prod. over time due to destruction of gland alveoli & ducts	• SCCs chronically elevated • Asymmetry due to fibrosis, but no heat	
3. Acute gangrenous mastitis	• Uncommon • ***S. aureus* #1, *C. pyogenes***, coliforms, Staph. spp.	• See *Staph. aureus* pg 194	**Prognosis** • Environmental: eliminated in ds - 3 wks, except Klebsiella • Contagious: tend to persist as subclinical infection	

Mastitis

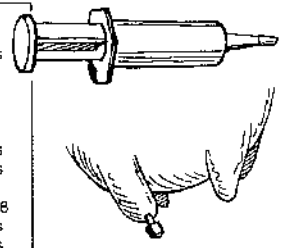
SKIN - EYE - MAMMARY

Condition	Fact/Cause	Presentation/CS	Diagnosis	Treatment

Intramammary preparations & compatible systemic ABs

C3T 767

Intramammary	Compatible systemic Rx	Dose	Drug withdrawal times	
Ampicillin (Hetaxcin®)	Procaine pen G	20,000 IU/kg SID IM	Milk: 96 hrs	Meat: 14 ds
	Ampicillin	10 mg/kg SID IM	Milk: 96 hrs	Meat: 6 ds
	Amoxicillin	10 mg/kg SID IM	Milk: 96 hrs	Meat: 6 ds
Cloxacillin or Penicillin & novobiocin, Penicillin & dihydrostreptomycin or Cephaplrin	Penicillin			
Erythromycin	Erythromycin	12.5 mg/kg SID IM	Milk: 96 hrs	Meat: 28 ds
	Tylosin	12.5 mg/kg SID IV	Milk: 96 hrs	Meat: 28 ds
	Penicillin			
Oxytetracycline	Oxytetracycline	10 mg/kg SID IV	Milk: 96 hrs	Meat: 14-28 ds
	Sulfonamides	200 mg/kg SID PO	Milk: 73 hrs	Meat: 10 ds
	Potentiated sulfonamides	24 mg/kg EOD	Milk: 72 hrs	Meat: 12 ds



• Staph. mastitis

Mk 688; C3T 763; IM 1187; VC/M 432, 484, 496, 503, 529; BR-hb 251; BR 563; Br 296, 343; DC 280

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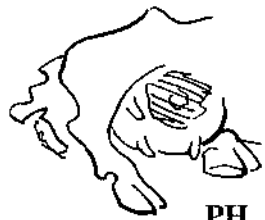
#1 cause of mastitis in most dairies bec:
- Both acute & chronic mastitis
- Responds poorly to Tx
- Easily transmitted at milking
- **Contag.**/Envir. (udder/body) contaminant
  - Adult udder infection
  - Cow to cow via milking machines, hands, fomites
  - Introduced into herd by newly infected animals
- Individual cases indicate subclinical problem in other herd members
- Exotoxin
- Chronic - walled off bact., hard to treat
- **Gangrene due** to alpha toxin causing vaso-constriction, ischemia & desquamation of tissue

#1 mastitis, subclinical, contagious, Exotoxin
- **CS: Chronic subclin., Toxemic; "Blue bag"**
- **Dx: Hx, CS, SCC, Culture**
- **Tx: Herd (hygiene, dip & isolate), Cull**

- **Usually chronic is subclinical**
- **Occasional clinical flare-ups** (usually mild, moderate)
  - Udder swollen, firm, redness, heat & pain (m/b up mammary vein)
  - Flakes & clots in milk initially
  - Purulent or watery milk
- **Severe mastitis** occasionally (esp. at parturition/first mo of lactation)
  - Systemically ill
    - Anorexic, depressed, ↓ milk prod., toxemia, ↑ temperature
- **"BLUEBAG"** - gangrene
  - Gland red, swollen & warm (early)
  - Few hrs. later gland cold, secretions watery & sanguinous
  - Delineated **blue discoloration** from teat to areas of gland
  - **Area sloughs** in 10-14 days
    - 2° infec. invade sloughed area = necrosis & continual sloughing
  - Systemic CS (anorexia, dehydration, depression, fever)
  - Moist gangrene, teat & udder oozes blood-tinged serum (thrombosis of large veins)

- History, CS
- Elev SCC (somatic cell count)
  - Strep >> Staph
- Culture all clinical cases, purchases, fresh & heifer cows routinely
- Microabscesses, necrosis



PH

Public Health
- Some Staph. produce entero-toxins in stored milk products which can multiply
  - Food poisoning

- **Herd Tx more important than individual**
  - Individual Tx of little or no value
  - Stop transmission basis of control
    - Sanitation (see preceding pg)
      - Single towel, hygiene workers & machine
      - **Teat dipping**, postmilking
      - Machine function checked routinely
    - Segregate infec. from clean cows
      - Cull infected cows, or
      - Separate pos. & neg. groups
        - Milk pos. last, cull as value goes down
  - Dry cow Tx, hi % of failures, still use bec. helps eliminate *Strep. agalactiae*; not *Staph. aureus*

- **Individual cows**
  - Lactating cow Tx limited (abscesses in gland hard for antibiotics to reach)
  - Dry off when no longer profitable & **Cull**
- **Blue bag**: amputating affected teat facilitates drainage & sloughing (weeks)
  - Recovered cows often sold for slaughter

• Strep. mastitis

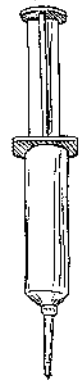
Mk 687; C3T 763; IM 1188; VC/M 491, 496, 503; BR-hb 251; BR 563; Br 296, 345; DC 279

***

- *S. agalactiae*
  - **Highly contagious**
    - **Obligate** inhabitant of mammary gland, **thus it can be eliminated from herd**
    - Cow to cow transmission
  - Doesn't invade mammary tissue, damages epithelium, causing PMN outpouring, blockage, fibrosis & decr. secretion
- **Environmental Strep.** *(S. dysgalactiae & S. uberis)*
  - Lower infec. rate bec. not contagious
  - Can't be eliminated from herd (environment)

- ***Strep. agalactiae***
  - Usually subclinical
  - Occasional flare-ups
  - Similar signs to Staph.

- History, CS
- SCC (somatic cell count)
- Culture



- ***Strep. agalactiae***
  - **Elimination possible 1-2 years**
    - **. Milk hygiene, 1 towel, gloves**
    - **. Teat dipping**
    - **. Dry or lactating cow AB therapy**
      - Intramammary penicillin G, highly effective (withholding times)

- **Environmental Strep.** spp. (*S. uberis*)
  - Can't be eliminated bec. environmental
  - M/ be more resistant to penicillin, other choices: chlortetracycline, oxytetracycline, cephalosporin, Na cloxacillin
  - Routine dry cow therapy
  - Sanitation of environment
  - Sand bedding

#1 *Strep. agalactiae* (Contagious; m/b eliminated)
CS: Subclinical w/ flare ups
Dx: Hx, CS, SCC, Culture
Tx: Sanitation, Teat dip, Dry/Lactating - Pen G

Control
Elimination of *S. agalactiae* possible:
- Susceptible to antibiotics
  - Obligate inhabitant of mammary gland, not environment
  - Doesn't invade tissue, susceptible to ABs

• Coliform mastitis; Gram-neg.

Mk 688; C3T763; IM 1189; VC/M 510, 490, 496, 503; BR-hb 251; BR 563; Br 297, 339; DC 286

***

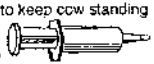
- **Environmental mastitis**
  - ***E. coli,*** *Enterobacter aerogenes, Klebsiella pneumoniae, Pseudomonas aeruginosa, Pasteurella multocida,* Setarria spp.
- Acute clin. mastitis in early lactation
- Transmission:
  - **From environment** (not like *Staph. aureus, Strep. agalactia*)
  - Milking wet udders incr. incidence
  - Low cell counts (SCC) in udder, predispose
  - Single quarter usually
  - Inflammation destroys coliforms & releases endotoxins

- **Acute clinical mastitis**
  - Uniform swelling of affected quarter
  - Watery milk
- Subclinical infection uncommon
- **Toxic shock:**
  - Acute, m/b peracute - death
  - High fever, anorexia, depression, milk ceases, rapid weight loss
  - Recumbency
  - Pulmonary hypertension
  - Abortion
  - Diarrhea
  - Death (5%)

- History, CS
- Little fibrosis or induration
- SCC
- Culture

- **Sanitize envir. over indiv. cow Tx**
  - Milking hygiene, individual paper towels, premilking teat dip? Postmilking dip does not prevent infec.
  - Sanitize environment

  - . Bedding: sand better than shavings or sawdust
  - Feed right after milking to keep cow standing while teat canals close



- **Individual cow mastitis**
  - **Spontaneous recovery** (most cases)
    - . Intramammary infusion
  - **Severe: Endotoxin/mediator shock**
    - Milk out every 2 hrs or allow calf to suckle (decr. endotoxins & inflam. mediators & bacteremia)
    - IV ABs, sulfamethazine or oxytetracycline
    - Intramammary ABs, following complete milking (cephalosporin, ampicillin, aminoglyc., polymyxin B)
    - IV fluids (initially 5-10 L/hr 2 hrs; then 5 L/hr)
    - Aspirin or Banamine® (cause abomasal ulcers)

Acute clinical mastitis in early lactation, Envir.
CS: Acute mastitis, Toxic shock
Dx: Hx, CS, SCC, Culture
Tx: Envir. sanitization, Feed after milking, Tx shock

Unique - upon recovery, gland returns to capacity

Mastitis

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Mycoplasma mastitis Mk 689; C3T 763; IM 1190; VC/M 475; BR-hb 251; BR 563; Br 298, 342; DC 283 ***	• ***Mycoplasma bovis***, *M. californicum, M. canadensis, M. bovigenitalium, M. alkalescens*) • Probable systemic phase (rapid spread to other quarters & to joints) • Extremely contagious • Chronic carriers **Extremely contag., Systemic phase (joints)** **CS: Outbreaks, Severe mastitis, Joints** **Dx: Nonresponsive to Tx** **Tx: No response to Tx, Elimination**	• **Possibility of explosive outbreaks** • **Usually severe mastitis** • Secretions watery to purulent • Spreads from quarter to other quarters • Tannish-brown milk, sandy flakes that float • Milk secretions m/ cease until next lactation • Not systemically ill, eats • Mild forms - indistinguishable from Staph., Strep. or coliform mastitis • Sequelae - Arthritis & lameness	• History, CS • **Nonresponsive mastitis** • Neg. milk cultures using standard microbial methods • Fibrosis & alveolar cell atrophy • Routinely culture bulk tank, fresh & new cows - Specific microbiological & serological tests • History of nonresponsive mastitis • Negative milk cultures	• **Eradication program** - Serial herd cultures - Slaughter or segregate for life • No Tx - Do not respond to therapeutic Tx
Salmonella mastitis C3T 764; IM 1191 **	• **Rare; *Salmonella dublin***, Public health problem, Neonatal health • Chronic, acute, or subclinical, Occasional flare-ups similar to chronic coliform mastitis • Dx: ELISA assay for *S. dublin* antibody levels • Tx: Cull carrier cows (public health & neonates)	**PH**		
Corynebacterium bovis mastitis Mk 689; C3T 764; IM 1191; Br 297 **	• Rare; Colonize teat canal, but cause little pathology; Consistent culturing indicates **ineffective teat dipping**. Questionable if protective to other infec. by raising SCC • **CS:** Asymptomatic, mild inflammation • **Dx:** Mild elev. SCC, Culture • **Tx:** Routine teat dipping prevents infection			
Leptospira mastitis, "Flabby bag" C3T 764; Br 298, 569 *	• Rare; Hematogenous dissemination; Causes vasculitis • CS: "Milk drop syndrome": abrupt termination of milk secretion, leakage of blood in milk (brownish orange), Flaccid udder ("Flabby bag")			
"Summer mastitis", "August bag" C3T 764; Br 301, 343; VC/M 512 *	• **Rare**; Common in N. Europe, reported in Florida; Dry cow & parturient heifers; mixed infec. (*Actinomyces pyogenes* + anaerobic bact. [Peptococcus indolicus]). Transmission: teat canal or biting flies (horn fly) • **CS:** Distended, swollen teat, hard gland, foul, thick yllw secretion, fever; Acute: toxemia - shock, DIC (disseminated intravascular coagulation), abortion & death • **Dx:** Hx, CS, Destroyed udder, Extensive necrosis of mammary tissue, abscesses & fistulous tracts; Abortions • **Tx:** Salvage; Prevention: Fly control, prophylactic dry-cow therapy			
Other mastitic agents * IM 1191; VC/M 571, 572; Br 763, DC 292	• **Considered atypical, rarely problems** (*Cryptococcus neoformans*, *Bacillus cereus*, Nocardia spp, Mycobacterium, Clostridium spp, Candida spp, Pseudomonas, Setaria (check hot water supply) • **Zoonotic implications:** *C. neoformans*, Leptospira spp. & Nocardia spp., so handle infected samples w/ care			

Milk collection technique

- Sterile tubes, 15 ml, tight fitting seal
- Foremilk collection samples (better than during milking because more organisms)
- Wash udder & teat, let drain, dry w/ single use paper towel
- Strip each teat 2 or 3 times (initiates milk let down & removes some streak canal contaminants)
- Individual quarter samples (identify infected quarters, 1 or all 4)
- Quarter samples together - identify infected animals
  - Scrub teat end & orifice until clean w/ 70% alcohol (ethyl or isopropyl), using separate cotton ball or gauze for each
    . Clean 2 quarters furthermost away, then closest
    . Collect teats closest, then farthermost away
  - Fill horizontally-held tube 1/2 full & seal (do not touch teat to tube)
  - Clean & thoroughly dry hands between cows (germicidal sol.) or use disposable gloves

Transport collected milk

- Process ideally in 15 to 30 min. (sure!)
- Cool to 39.2-41° F (4-5° C) if > 30 min. to processing
- Freezing reduces no. of bacteria
  - Can't determine SCCs (somatic cell counts), but ok for cultural assays
  - CMT, WMT & Gelatin-based assay can be performed on frozen samples
  - Avoid repeated freezing & thawing
  - Staph. recovery m/b enhanced by single freeze, thaw
- Storage at 39.2° F (4° C) for 1 wk or frozen will not affect isolation of most common mastitis pathogens

Routine milk culture: determines cause of clinical mastitis in a herd

- Culture all infected quarters
- Freeze or refrigerate before culture
- Culture before therapy
- Antibody susceptibility testing for future Tx
- Do routinely or at least whenever unusual mastitis
- 25-30% will be negative
  - Coliform mastitis: short duration, cow's defense controls
  - Coliform mastitis: most common cause of mastitis even in herd w/ chronic Staph. or Strep. infection
- Culture m/ reveal presence of *S. agalactiae*, *S. aureus* or Mycoplasma

Herd cultures:

- Culture all cows in herd
- Done when contagious bact. suspected (*Strep. agalactiae*, *S. aureus*, *Mycoplasma bovis*)
- ID infected cow for isolation &/or Tx (*S. agalactiae*)
- Composite samples (all 4 quarters)

Selective survey cultures:

- Testing on basis of elev. SCCs
- Incr. chance of finding infected animal w/ less testing, but misses some positive animals

Bulk-tank milk cultures

- Monthly cultures of bulk-tank to monitor herd
- Inexpensive monthly monitor of herd mastitis status
- Negative test indicates no or low presence of pathogens
- Swab samples over entire blood agar plate

Plating milk samples

- Mix milk sample (gently inverting or shaken)
  - Do not vortex samples for SCCs (m/ rupture cells)
- Sterile swab swirled at bottom of tube (if contacts anything else, hand or counter top, throw away. Calibrated loop for estimating # of bacteria)

Streaking samples: a number of techniques

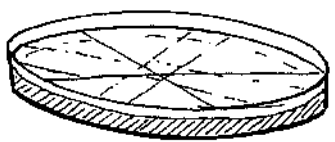
- 4 quadrants - BBA plate (5% bovine blood agar):
  - Divide bottom of plate into 4 & mark them A, rt. cran.; B, rt. caud.; C, lt. cran.; D, lt. caud.)
  - Open lid, streak a milk line from appropriate qtr. in center of quadrant, then streak side to side across quadrant, repeat for other quarters.
  - cAMP test for *S. agalactiae*: m/b done at same time
    . Sterile *S. aureus* hemolysis streaked across quadrants of blood agar plate
    . Streak milk as in 4 quadrant tech.
    . *S. agalactiae* causes synergistic ß hemolysis
- Half plates - for composite samples
- Entire plates - for bulk-tank samples

Interpreting test results

- **Single colony of *S. agalactiae*, *S. aureus*, or Mycoplasma spp. diagnostic for intramammary infection** (all assoc. w/ gland, not environ., highly contagious)
- Other isolates m/ be contamination from environment, confirm cause by:
  - Conc. of bacteria in sample
  - Purity of culture
  - Intramammary inflammation (elev. CMT)
  - Organism on repeat sampling

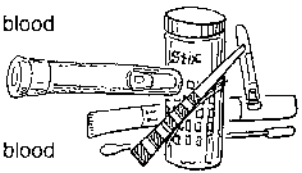
80% of cows w/ SCC > 200,000 are infected

Checking for mastitis - strip cup or strip plate - first milk used, so clean udder. Should see coagulation.



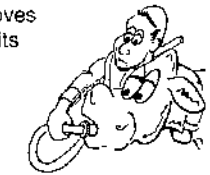
Diagnosis of poisonings (Br 601, 609)

- Sudden death
- History of circumstances & sequence of events & progression of signs
- Postmortem
  - Always performed
  - Presence or absence of lesions, both important
- **Chemical analysis - Lab:**
  - Tissues usually frozen
  - No preservatives such as formalin added
  - Live animal
    . 10 ml of whole blood
    . 50 ml of urine
    . 200 g of feces
  - Dead animal
    . 5 ml of serum
    . 10 ml of whole blood
    . 50 ml of urine
    . 100 g of liver, kidney, spleen & body fat
    . Half of the brain
    . 500 g of *rumen* or stomach contents
  - If in doubt about tissue, call lab prior to collecting
  - Environmental samples: water, feed, pasture content, etc.

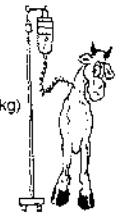


Treatment of poisonings

- Prevent continued absorption & assist elimination
  - **Lavage & laxatives** (removes unabsorbed material & limits absorption



- **Antidotes**: some have, others don't
- Detoxifying agents (assist metabolism & protect organs)
- Fluids (maintain kidney perfusion & excretion)
- Skin
  - Bathe w/ large volumes of water
- Oral route
  - Activated charcoal (1-2 g/kg mixed w/ 10-20 ml of water)
- Toxins in small intestine
  - Laxatives (sodium sulfate or magnesium sulfate)
  - Mineral oil (mild laxative & protectant)
  - Gastrointestinal binding agents (milk & raw eggs, prevent absorption)
- Fluids (Calcium, 5% dextrose & large volumes of electrolyte sol.)
  - Provide energy & conjugation material
  - Maintain cell membrane & intracellular balances
  - General nonspecific detoxification
  - IV use maintains adequate urine flow
- Colonic lavage
- Hemodialysis
- Symptomatic & supportive Tx
  - Positive respiratory assistance (give time to Tx & recover)
  - Control body temperature (blankets, heating pads or ice baths)
- Detoxification
  - Antidotes if agent known
  - *Rumenotomy* to remove toxins
  - Corticosteroids (dexamethasone 0.1-2.0 mg/kg)
  - Lactated Ringer's (> 40 ml/kg IV) Na containing polyionic fluids



- Acid base disturbances
  - Lactated Ringer's safest if acid-base status is unknown (10 ml/kg/hr)
  - Measure w/ CO_2 apparatus or blood gas machine
    . Metabolic acidosis most common in toxicity
    .. Sodium bicarbonate (1.3%) administered slowly over hours (Dose: kg BW x 0.6 x base deficit)
    . Alkalosis - sodium chloride (0.9%, 10 ml/kg/hr) usually sufficient
- Analeptic agents for resp. depression
  - Short lived, monitor patient continuously
    . Doxapram (5-10 mg/kg) pentylenetetrazol (6-10 mg/kg)
  - M/ induce convulsions
  - Resp. support preferred in CNS depression
- Convulsions
  - Diazapam (Valium®, 0.5-1.5 mg/kg IV or IM), phenobarbital, pentobarbital sodium

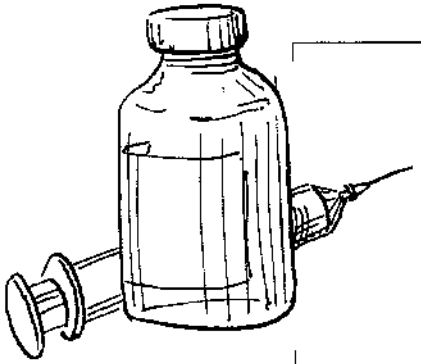
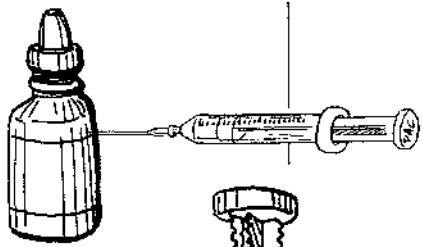
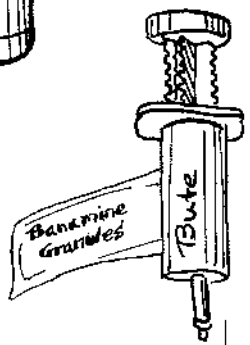
Emergency kit (keep stocked & readily available)

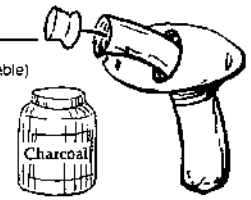
Equipment
- Endotracheal tubes (several sizes)
- Gauze & rolls of tape
- IV catheters & stylets
- Compression bag (AMBU bag) or mech. respirator
- Hypodermic needles
- Syringes
- Stethoscope
- Stomach tubes (several sizes)
- Thermometers
- Urinary catheters (various sizes)
- Venostomy kit

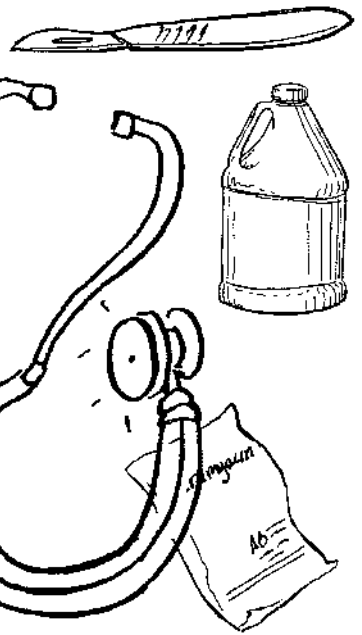
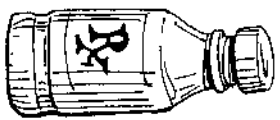
Parenteral medications
- Amphetamines
- Atropine sulfate
- Barbiturates (phenobarbital, pentobarbital)
- Calcium borogluconate
- 5% dextrose
- Diazapam
- Lactated Ringer's
- Normal saline
- 2-PAM (protapam chloride, pralidoxine)
- 5% sodium bicarbonate

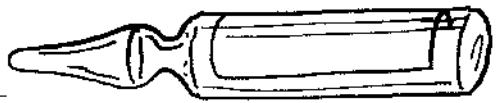
Oral medications
- Activated charcoal
- 5% Dioctyl sodium sulfosuccinate (DSS) (1/2 L/450 kg)
- 20% Magnesium sulfate solution
- Mineral oil

Miscellaneous
- Oxygen

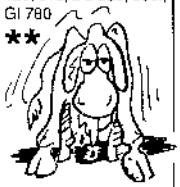
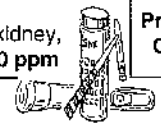
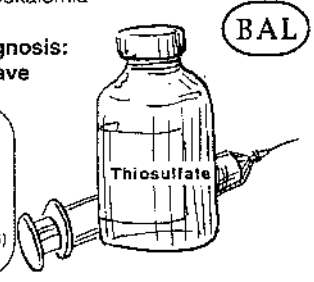






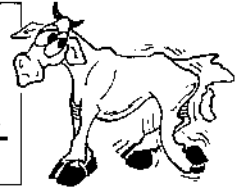



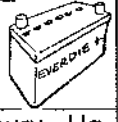
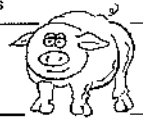


Metals & Metalloids

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Arsenicals Mk 163, IM 1902; C3T 394; BR-hb 560, 577; BR 141480, 1517; Br 125, 613; DC 250, 5061; GI 780 ** 	• **Pesticides** - main source - Herbicides, defoliants, insecticides, rodenticides, slug/snail baits • Organic arsenicals (MSMA & DSMA) • Inorganic arsenicals: Na arsenite • **Eating contaminated foliage** - Not accumulative • Mech: binds to **-SH enzymes - disturbs cellular resp.**: Skin, GI mucosa, Liver, Kidney, Lung, Blood, capillary walls, esp. splanchnic, decr. in blood pressure - shock	• **Acute - sudden death** - **Severe colic** - **Weakness, trembling, ataxia** - **Salivation** - **Diarrhea** - hemorrhagic w/ mucosal shreds  - Rapid HR - Collapse & death • Subacute - Depression, anorexia - Watery diarrhea  - PU/PD to anuria - Paraparesis - Stupor, death • Chronic toxicity rare in animals 	• **History of exposure**  • Postmortem - GI degeneration, necrosis, perforation - Kidney, liver, lung degeneration - No CNS damage • **No other heavy metal has this rapid GI signs (severe)** • Lab: - Feed, GI, liver, kidney, urine **levels > 10 ppm**  **DDx** • Thallium (p 208) • Lead (p 152) • Caustics • Irritant Plants • Pesticides • Urea (p 204) • Enteric diz • Monensin (p 203) • Blister beetle (p 214)	• Remove source • Mineral oil & saline purgatives PO • **Na thiosulfate** PO (20-30 g/300 ml of H2O) • Antidote: **BAL** (British Anti-Lewisite, Dimercaprol) IM 3 mg/kg • Succimer® (DMSA, 2,3 - Dimercaptosuccinic acid) chelating agent, expensive • Correct acidosis, hypocalcemia, hypokalemia **Prognosis: Grave** BAL 

Pesticides on foliage
CS: Rapid death - GI
Dx: Hx - Rapid death
Tx: Na thiosulfate - BAL
Px: Grave



Lead *** 	• **See pg 152**: Uncommon, 31 inorganic poisonings; Lead paints, Batteries, Leaded Gases, Crankcase oil; **Enters brain**, Binds -SH enzymes • **CS: CNS** - stagger, blind, maniacal, convulsions, death; **GI** - bloat, colic, diarrhea • **Dx: Incr. blood levels > 0.3 ppm, Basophilic stippling of RBCs** • **Tx: Ca EDTA**, Thiamine, Supportive; Rumenotomy • **Px: Poor** if neurological involvement	
Mercury, Hg Mk 1676; IM 1906; BR-hb 564; BJR 1486 Tox 121; Br 614 *	• Rare. Mercuric fungicide treated grains historically. Banned for years; Concern in contaminated water - fish • CS: CNS (staggering, blindness, weakness, vomiting, diarrhea, ulcerative stomatitis) • Dx: Exposure, Kidney levels • Tx: Sodium thiosulfate IV or w/ BAL. Meat danger to humans, report to Feds	 Hg
Iron toxicity * Mk 1673; IM 1906; Tox 197; C1T 502	• Seen mainly in newborn pigs given supplemental iron, pigs more susceptible if Vit E/Selenium deficiency 	Fe

Copper poisoning

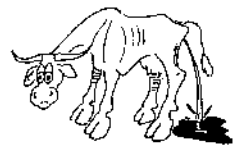
Molybdenum deficiency

C3T369; IM 1230, 1904; BR-hb 583; BR 1495; B&R 1466; Br 613, 263; DC 508; Pic 217; Pa 90

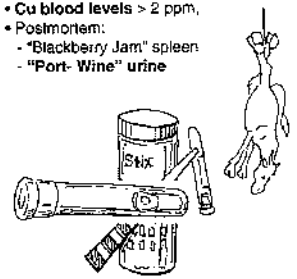
*

- Cu: Mo > 10:1; Excess Cu or Mo deficiency
- **Sheep** >> cattle > goats; calves > adults
- Sources: Anthelmintic drenches, Improperly formulated rations, Low levels of Mo (molybdenum) or sulfate in diet (Mo not supplemented in feed), Fungicides, molluskicides, footbaths
- "Sink organ" - Cu stored in liver

- **Hemolytic crisis** (massive release of stored Cu from liver)
- Anemia
- Hemoglobinemia
- Icterus



- **Cu blood levels** > 2 ppm,
- Postmortem:
  - "Blackberry Jam" spleen
  - **"Port- Wine" urine**



- Often Tx not successful
- Chelating agent (**D-penicillamine**)
- **Supplement molybdenum**
- **Na sulfate**

Prevention:

- Top-dressing pastures w/ 1 oz Mo/acre
- Mo supplementation or restrict Cu intake

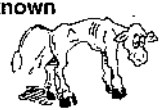
Prognosis:

- Sheep - poor

Copper Defc Molybdenum toxicity

***

- **See pg 89, Cattle > sheep, Cu:Mo < 2:1 toxic, Excess Mo or Defc Copper**, Sources: soil, mining, **Mech: Unknown**
- **CS: Foul diarrhea, Wasting Diz,** Ataxia, **Anemia, Depigmentation, Osteoporosis,** fractures, Rough hair coat
- **Dx: Response to Cu Tx;** Lab: Cu & Mo in forage, Liver < 10-30 ppm Cu, Mo > 5 ppm
- **Tx: Cu sulfate** (oral), **Cu glycinate (SQ)**
- **Px: good response to Cu supplementation**



Monensin, Lasalocid, Ionophore AB toxicity

Mk 1474, 1540; IM 1917; C3T 329; BR-hb 583; BR 1524; BR 614; DC 41, 503t; Tox 338; N-L 318

**

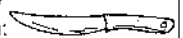
- Cattle: feeding or mixing errors
- Ionophorous antibiotic produced by *Streptomyces cinnamonensis*, Rumensin® (monensin), Lasalocid
- Not approved in sheep, dairy cattle, swine or horses
- **Highly toxic to horses** getting into cattle or poultry feed
- Mech:
  - Incr. intracellular Ca
    - . Causes cell death
    - . Results in epinephrine release

Acute toxicity (similar in all species)

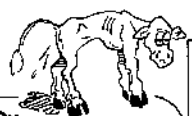
- **Multiple organ systems**
- Transient drop in feed intake
- Acute 24-36 hours
  - Anorexia, depression
  - Weakness, ataxia
  - Dyspnea
  - Diarrhea

- Subacute - related to cardiac failure
  - Several wks
  - Dyspnea, hydrothorax, ventr. edema
  - Stilted gait, ataxia, recumbency & death w/o struggle

- **CS, History**



- Postmortem:
  - **Cardiac muscle, kidney, liver lesions**
  - **Heart & skeletal muscle (tongue)**
- **Lab:**
  - Increased ASP & CPK



DDx

- White muscle diz
- Toxic plants (Taxus spp, vetch, *Cassia occidentalis*)

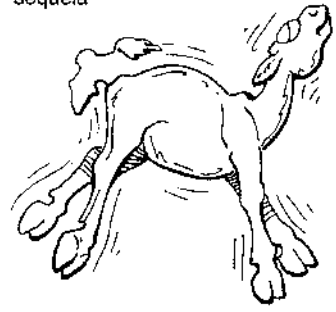
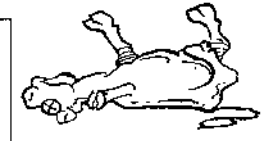
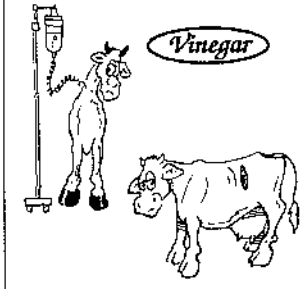
- **No antidote** that will reverse CS
- Remove source from other animals

Uses of Monensin

1. Anticoccidial for chickens & cattle
2. Feed additive in cattle to incr. feed efficiency
   - Microflora produce more proprionic VFAs
   - Decrease intake while maintaining weight gain
   - Reduces feedlot bloat & acidosis, preventative against tryptophan-induced atypical bovine pulmonary emphysema
3. Sheep & pigs as growth promoter

Horse > Cattle; Coccidial ABs
CS: Multiple systems - Heart failure
Dx: CS, Hx, PM
Tx: No antidote, Remove source

Feed Additives — TOXICOLOGY

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Urea toxicity **Ammonium toxicosis** **NPN** (Nonprotein nitrogen poisoning), Ammonium forage toxicosis, **Bovine Bonkers** *Mk* 1693 IM 1070, 1916; C3T231; C1T393, 1089; BR-hb 582, 585; BR 1522, 1524; Br 616; DC 503t; VC/N 154; Tox 341; N-L 99 *** 	• Urea not poisonous • **Ammonium (NH3) is toxic** • **Sources: NPN (Nonprotein nitrogen)** - Feed additive (1-3%) for cattle - Cheap supply of protein nitrogen - Urea most common source, also biuret, ammonium compounds (rice hulls, cottonseed, bonemeal, etc.) - "Lick-tanks": liquid supplements combine urea & molasses - Fertilizer (animals eat or drink) • Quick change to NPN source - Need to adapt over days to weeks • **Ruminants** most susceptible, all susceptible - Due to alkaline pH of rumen - Young 3-6 wks less susceptible (pH lower & microflora not developed) - High roughage/low CHO incr. toxicity - Lack of adaptation incr. toxicity - Liver converts ammonium back to urea, if overwhelmed, ammonium in blood = toxicosis & acidosis • Any factor that increases alkalinity of rumen increases toxicity • Mechanism - Inhibits TCA cycle: incr. in lactate (acidosis) 	• **Acute CS in 20-60 min** • **Rapidly progressive** • **Highly fatal** • **Muscle tremors initially** (face & ears) • **"Bovine bonkers"**: wildly aberrant behavior, agitated, violent & belligerent • Severe colic - struggle & bellow • Rumen atony —> **bloat** • Marked jugular pulse • **Dyspnea**, salivation, gasping • Terminal convulsions to death - W/in 2 hrs in cattle • Survivors recover in 24 hrs w/ no sequela 	• **CS, History, dietary exposure** • Smell ammonia m/b • Lab: - Incr. NH_3, glucose, lactate, phosphorus, K^+, AST, ALT, BUN • Analysis for NH_3-N in ante- & postmortem specimen & feed - Ruminal reticular fluid, serum, whole blood & urine - All specimens frozen immediately & thawed at analysis, or preserve rumen fluid w/ a few drops of mercury chloride - Blood or serum > 2 mg/100 ml indicates excess NPN • Postmortem: - Rumen pH 7.5-8 indicative of NPN - Bloat & rapid decomposition  	• **Often impossible bec. of speed of CS** (cattle) • Fluid therapy • Relieve bloat • Ruminal infusion - 5% acetic acid (vinegar) 2-8 L in cattle - Iced water (40 L) • Rumenotomy, remove contents & replace w/ hay slurry  **Prevention:** • Feed urea (NPN) < 3% of concentrate, ≤ 1% of total diet, < 1/3 of total nitrogen in ration • Slowly adapt to NPN feed, quickly lose adaptation to NPN if go off feed, toxic when come back on

Excess NPN to ammonium
CS: Acute, Rapid, "Bonkers", Convulsions, Death
Dx: Hx, CS, Diet, Ammonia smell, Lab, PM
Tx: Difficult (rapid), Relieve bloat, Fluids

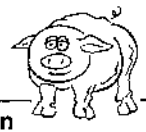
Ruminants
• Incr. in rumen pH
Ammonia
Urea —> NH3 + CO urease
• NPN (nonprotein nitrogen)

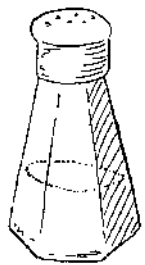
Salt poisoning, Water deprivation, Sodium toxicity

Mk 1358, 1726; IM 1229, 1062; C1T 396; BR-hb 568; BR 1499; Br 697; DC 440; VC/N 55; Tox 355; N-L 99

**

- **Water deprivation**
  - "Salt poisoning" misnomer bec. water deprivation required
- Mostly in swine & poultry
- Occasionally in ruminants (or horses) when water consumption is low
  - Caretaker rarely will admit

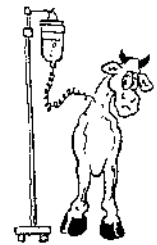




- **GI tract:** Vomiting, Diarrhea, Abd. pain, Anorexia, Mucous in feces
- **CNS**
  - Blindness
  - Convulsive seizures
  - Partial paralysis
  - Drag rear feet or knuckling of fetlock
- **Die w/in 24 hrs of CS**

- CS, Hx of limited water intake
- Na conc. in plasma & CSF >160 mEq/L
- Postmortem: m/b no lesions
  - Cerebral edema
  - Gastric inflam. or ulceration
  - Edema of skeletal mm.
  - Hydropericardium

- **Difficult, most die**
- **IV fluids**, induce diuresis & correct gradually, if too fast can cause cerebellar edema
- Lasix® (furosemide, 1.0 mg/kg) loop diuretics, incr. Na secretion



Prognosis:
- **Grave - most die**

Water deprivation
- **CS: GI, CNS**
- **Dx: Hx, CS, Na >160 mEq/L**
- **Tx: Difficult, IV fluids, Lasix®**
- **Px: Grave, Most die**

Iodine toxicity

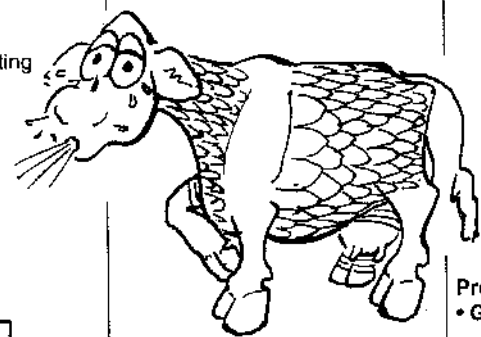
Mk 1472; IM 1905, 2121; C3T 904; C1T 398; BR-hb 570; BR 1505; Br 225; Tox 340; DC 250, 506t

**

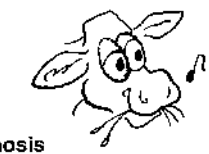
- **Essential element**, present in thyroid hormone
  - **GRAS** (generally regarded as safe) food additive
  - EDDI (ethylene diamine dihydriodide) feed additive, except for dairy cattle in production
- Used typically as antiseptic, antifungal, antibacterial; toxicity common w/ Tx
- Expectorant, stimulates vagus nerve
- Antifibrotic drug for lumpy jaw (*Actinomyces bovis*); NaI, KI

- Excess lacrimation (vagus n.)
- **Seromucoid nasal discharge** w/ nonproductive cough
- **Scaly skin**
- Anorexia
- Hyperthyroidism - sweating
- Lameness - joints
- Reproductive problems

- CS, History of high levels



- **Remove source, it is rapidly excreted**

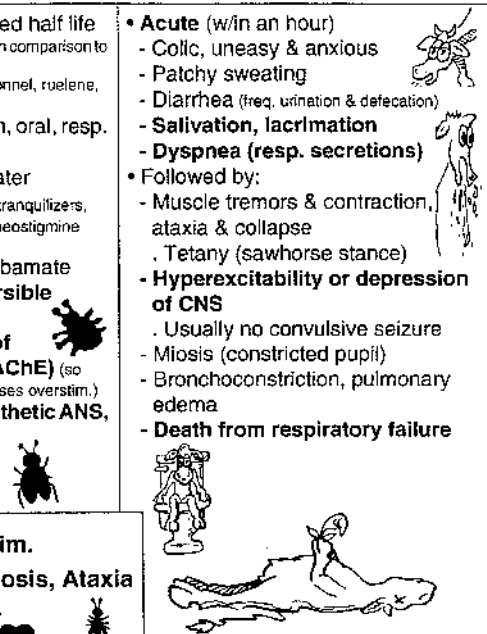


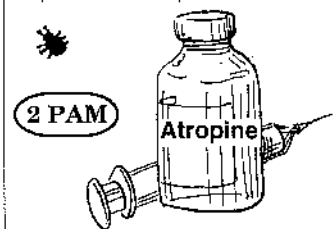
Prognosis
- **Good**

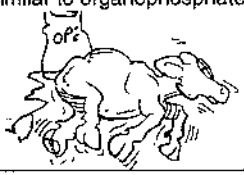
- **Essential element, GRAS**
- **CS: Lacrimation, Scaly skin, Lameness**
- **DX: Hx, CS**
- **Tx: Remove source** • **Px: Good**

Insecticides

Condition	Facts/Cause	Presentation	Diagnosis	Treatment
Organophosphates, OPs **Organophosphorus insecticides** Mk 1490, 1669; IM 1154, 1908; C3T 381, 855; BR-hb 576; BR 1514; Br 612; VC/N 149; Tox 231; Pic 216; DC 504t; N-L 120, 211 ***	• Increasing use bec. reduced half life (less environmental contamination in comparison to CHC [chlorinated hydrocarbons]) • Parathion, dichlorvos, malathion, ronnel, ruelene, Trichlorofon (ascarids & bots) • Absorbed by all routes, skin, oral, resp. - Anthelmintics or sprays - Contaminated feed or water - Interaction w/ phenothiazine tranquilizers, succinylcholine, physostigmine, neostigmine carbamates • Similar CS & mech. to carbamate poisonings, except **irreversible** • Mech: - **Irreversible inhibition of acetylcholinesterase (AChE)** (so acetylcholine accumulates & causes overstim.) - **Overstim. of parasympathetic ANS, skeletal mm. & CNS**	• **Acute** (w/in an hour) - Colic, uneasy & anxious - Patchy sweating - Diarrhea (freq. urination & defecation) - **Salivation, lacrimation** - **Dyspnea (resp. secretions)** • Followed by: - Muscle tremors & contraction, ataxia & collapse . Tetany (sawhorse stance) - **Hyperexcitability or depression of CNS** . Usually no convulsive seizure - Miosis (constricted pupil) - Bronchoconstriction, pulmonary edema - **Death from respiratory failure**	• History, CS • Response to atropine therapy • Lesions: - None or nonspecific - GI contents • Lab: - Cholinesterase (ChE) levels in blood - Stomach or rumen contents **DDx:** • **CHC** (convulsive seizures, no respond to atropine) • Carbamate • Fog fever • Urea • Nitrate • Hypomagnesemia	**Emergency** (rapid progression) • **Atropine** treats muscarinic effects (0.1 mg/kg IV), Admin. to effect (mydriasis & absence of salivation) - **Repeat** SQ every 2 hrs m/b necessary (irreversible action of OPs) - Doesn't affect nicotinic signs, muscle fasciculations & muscle paralysis • **2 PAM** (protopam chloride) 20 mg/kg IV every 4-6 hours • If dermal route bath w/ soap & water • Oral route - Activated charcoal by nasogastric tube, mineral oil - Osmotic laxatives (magnesium sulfate) • IV fluids • M/b respiratory support •Contraindicated: morphine, succinylcholine & phenothiazine tranquilizers
Irreversibly blocks AChE - CNS, pANS stim. **CS: Parasymp. ANS stim. - Salivation, Miosis, Ataxia** **Dx: Hx, CS, Atropine response** **Tx: Atropine**				
Carbamate Mk 1665; IM 1908; Tox 231, 258; BR-hb 577, BR 1518; Br 612; DC 504t	• Insecticides similar to carbaryl - Not toxic w/ normal use • Mech: like OPs, except **reversible**	CS & diagnosis similar to organophosphate toxicity	**DDx:** • See OPs (above)	**Like OPs** • 1 Tx of atropine usually enough (because reversible) • No need for 2 PAM, but it doesn't hurt if can't DDx from OPs
Same as OPs, except reversibly blocks AChe				







Chlorinated hydrocarbons (HCH) Organochlorine insecticides

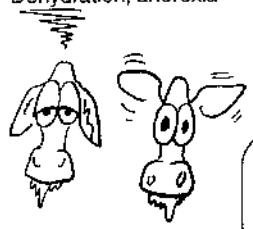
Mk 1666; IM 144, 294; C3T 51; BR 1511; BR-hb 576; VC/N 152; Tox 286; N-L 120, 212

**

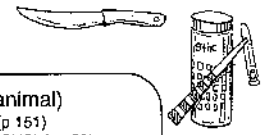
DDT

- **Use curtailed bec. of persistence in environment** (DDT [prototype])
  - **Only lindane, methoxychlor & toxaphene approved for use around livestock**
- Sources - contaminated feed or water
- **Recommended levels no problem**
- **Diffuse stimulant of CNS**
  - **Stress - Incr. epinephrine - Incr. lipolysis - Incr. release of stored CHC**

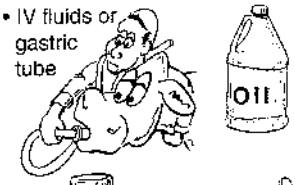
- **Stimulation or depression of CNS**
  - **Depression** alternates w/ muscle activity
  - **Fasciculation** (muscle twitching)
  - **Convulsive seizures** (unlike OPs)
  - **Death during severe seizure**
  - Fever
  - Dehydration, anorexia



- History, CS
- Lab:
  - Levels in blood, serum or urine from live animals
- Postmortem:
  - **Absence of specific lesions**
  - ppm of CHC in liver & **brain** tissue



- **No specific antidote**
- **Symptomatic Tx**
  - Dermal: wash in soap & cold water
  - Oral
    - Lavage & purgative, heavy mineral oil, activated charcoal
- Barbiturate, chloralhydrate or Valium®, if excitatory CS
- Remove stress from envir.
- IV fluids or gastric tube



DDx (lg animal)
- Meningitis (p 151)
- Lead (Pb) (CNS) (p 152)
- Rabies (p 144)
- OPs (p 206)
- Carbamate (p 206)
- Polioencephalomalacia (p 140)
- TEME (p 144)
- Bovine Ketosis (p 33)
- Urea (p 104)
- Salt poisoning (p 205)

Decreased use, DDT, Lindane - Diffuse CNS stim.
CS: CNS stim./Depression - Convulsions
Dx: CS, HX
Tx: Symptomatic, Lavage, Valium®

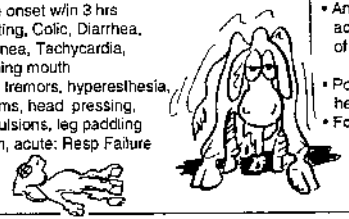
Metaldehyde

Mk 1676; IM 1912, BR-hb 580; BR 1520; Br 614; VC/N 154; Tox 250; N-L 121, 211

*

- Rare, most common in dogs, also sheep
- **Molluskicide** - slug & snail bait
- Snarol®: looks & tastes like dog food
- Palatable to dogs & other animals, reported in dog, cat, sheep & children
- Mech: Unknown
- Irritant to GI mucosa
- Liver, metabolic acidosis

- Acute onset w/in 3 hrs
- Vomiting, Colic, Diarrhea, Dyspnea, Tachycardia, Frothing mouth
- **CNS:** tremors, hyperesthesia, spasms, head pressing, convulsions, leg paddling
- Death, acute: Resp Failure



- Analyze stomach contents for acetaldehyde (break down product of metaldehyde)
- Postmortem: Lung congestion, GI hemorrhages
- **Formaldehyde odor**

- **NO specific antidote**
- **Symptomatic**
  - Sedate to minimize muscle tremors (diazepam)
  - Emetic/gastric lavage (Na bicarbonate)
  - Fluids (Na lactate) for hydration & acidosis

DDx: Lead, CHC, Mercury, Urea

PCP, Penta ★ Pentachlorophenol

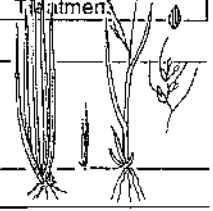
IM 1631; MK 1696; BR 1521; DC 507

- **Rare,** Wood treatment, fungicide, molluskicide & insecticide, Not street drug called PCP (angel dust), Incr. O2 demand - blocks oxidative ATP formation
- **CS:** Fever, Gasping, Dehydration, Sweating, Salivation, Incr. HR & RR, Muscle tremors, Convulsions, Death
- **Tx:** Cool animal, Remove source, Fluids, Anticonvulsants

Herbicides

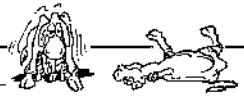
Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment

Herbicides (IM 1910) • Routinely sprayed on pastures grazed by animals, **Used properly few toxic problems**, toxicities due to accidents



Phenoxys; 2,4 D; Silvex®
Phenoxy Herbicides; Tox 261

• By themselves relatively nontoxic, but increase palatability &/or an increase in nitrate or cyanide contents of plants; do not allow access to sprayed pastures for at least a week



Arsenicals See pg 202 Herbicide

Dinitro compounds ★
Mk 1658; BR-hb 577; BR 1517

• Dinitrophenol & denitrocresol - highly toxic; readily absorbed through skin & lungs • CS: fever, dyspnea, incr. HR, convulsions followed by death & rapid rigor mortis
• Tx: No antidote, cool animal & sedate to control hyperthermia: phenothiazine tranquilizers m/ potentiate; atropine contraindicated

Dipyridyls, Paraquat ★ Mk 1656; IM 1910, 932; BR-hb 577; BR 1518; Tox 260, 262

• **Rare:** Desiccant herbicides, Toxic effect - free radicals in tissues, Mainly in dogs & cattle
• **CS:** Tissue irritation (mouth lesions, skin & cornea), **GI**, centrilobular necrosis of liver, **Resp.** (dyspnea, pneumonia)
• **Tx:** w/in 24 hours, Oral absorbents (activated charcoal), Cathartics, Fluids, Vit E/Se supplementation, Mannitol or Lasix®, O2 contraindicated
• **Px: Guarded to grave**

Na Chlorate ★
Mk 1657; Tox 251

• **Rare:** Seldom used anymore as herbicide, Accidentally added to feed as salt (mistaken for Na chloride) (NaCl) (Looks & tastes like table salt)
• Causes **conversion of Hb to methemoglobin**
• **Tx: 1% Methylene Blue** IV, sodium thiosulfate

Barium ★
Tox 290

• Barium carbonate. Rarely used currently as a rodenticide
• **CS:** colic, diarrhea, hemorrhage, depression & prostration
• **Tx:** Symptomatic (charcoal, diuresis, IV potassium)

Strychnine
IM 1912; BM&S 268; Br 125; Tox 284; N-L 121
★

• **Rarely** found today, Indole alkaloid; Used for rodents & coyote control; **No rational for its use!**
Stim. CNS by interfering w/ inhib. spinal neurons
• **CS: Uncontrolled reflex activity, Generalized extensor rigidity, Tonic seizures**
• **Tx: Control seizures** (phenobarbital), **Inactivate unabsorbed arsenic** (tannic acid or potassium permanganate)

Thallium
Mk 1723, IM 2121, 2181; BR 549; Tox 349
★

• **Rare**, banned as a rodenticide, general cellular poison affecting all species
• **CS:** GI (hemorrhagic), Resp (dyspnea), CNS (seizures) & integument (alopecia)
• **TX:** Controversial, potassium salts (incr. secretion), Hydration

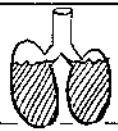
Sodium fluoroacetate (1080)
Mk 1723; VC/N 153; Tox 289
★

• **Rare, Highly toxic**, Use restricted to licensed exterminators, banned on federal lands
Used to control coyotes
Blocks Kreb's cycle ("jamming"), decr. ATP; Affects cardiac conductions
• **CS:** Cardiac collapse, CNS stimulation - death in convulsions
• **Tx:** No specific antidote, Calcium gluconate, Glycerol monoacetate
• Px: Grave once CS

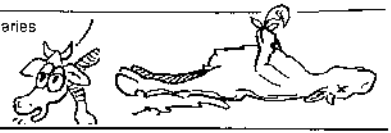
ANTU

C3T 388

*



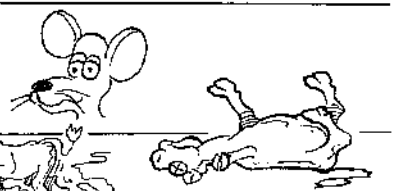
- **Rare**, *Alpha-naphthyl thiourea* (exclusive rodenticide). Bait in sausage or bread, also in water. Incr. permeability of pulmonary capillaries
- **CS:** Pulmonary edema "drowns in own fluid"
- **Tx:** No specific Tx, Emetics early before edema



Zinc phosphide, Zn_3P_2 *

Mk 1724; IM 1912; C3T 386; BR-hb 579; BR 1520; VC/N 154; Tox 354

- **Rare:** For licensed pest control, grain mix (Kilrat®, Goph-rid®, Mr. Rat®); Tox.: Release of **phosphine gas** on contact w/ water
- **CS:** GI, Resp. failure, muscle tremors, moderate excitement, mania
- **Tx: NO specific Tx**, Gastric lavage w/ 5% sodium bicarbonate (raise pH to delay formation of gas), Symptomatic



Phosphorus

Mk 1722; IM 932; C3T 386; BR-hb 563; BR 1486; Tox 288

*

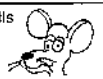
- **Rare** (rarely used), Garlic odor, Protoplasmic poison, liver damage
- **CS:** Biphasic, apparent recovery, 2nd phase, Hepatoencephalopathy (CNS) - death
- **Tx:** Symptomatic

Pyrimilin, "Vacor"

VC/N 154; Tox 291

*

- Rodenticide, Not currently available, Mech.: Vit. B antagonism, destroys pancreatic cells & depresses glucose uptake by cells
- **CS:** CNS: incoordination, weakness (altered conducting velocity in peripheral nerves)
- **Tx:** May recover spontaneously if protect from self trauma & supportive care, Nicotinamide



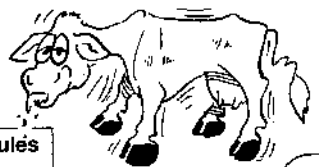
Ethylene glycol poisoning, Antifreeze poisoning

Mk 1648; IM 1076, 1913, 997; BR-hb 586; BR 1530; Tox 317

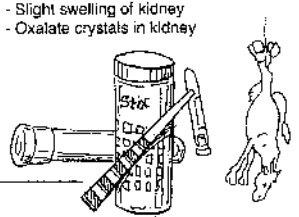
*

- See Oxalate poisoning
- 1° dogs & cats, 1° lg. animal - ruminant
- Source
  - **Antifreeze** (Sweet tasting alcohol)
- Metabolized to oxalic acid
  - Oxalic acid combines w/ calcium in kidney to form insoluble calcium oxalate crystals in renal tubules

- CNS
  - Hind limb ataxia
  - Salivation
  - Depressed sensorium
  - Loss of menace response
  - Nystagmus
  - Tonic clonic seizures



- Same as in oxalate poisoning
  - Azotemia
  - ↑ serum creatine, hypophosphatemia, hypocalcemia, acidosis, hyperosmolality, ↑ glutamyl transaminase
- Isolate ethylene glycol w/in 1st hrs in GI
- Postmortem:
  - Slight swelling of kidney
  - Oxalate crystals in kidney



- Early (w/in 12 hr of exposure)
  - **20% ethanol** at a rate of 50 ml/hr
- **Activated charcoal**
- NaHCO 1V
- Replace fluids

Metabolized to oxalate - Combines w/ Ca - pcpt in renal tubules

CS: CNS

Dx: Azotemia

Tx: 20% ethanol, Activated charcoal

DDx:
- Metaldehyde (p 207)
- Renal failure (p 100)
- Oxalate poisoning (p 224)

Toxic Gases

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment

Toxic gases (IM 660; Tox 369) **1° in closed housed** animals (outside they blown away)

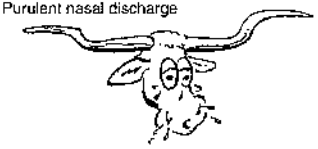
Ammonia (NH_3)

IM 660; C3T 267; Br-hb 287, BR 531; Br 796; DC 95; Tox 369

*

- #1 toxic air pollutant in housed facilities
- Closed housing
- Excrement decomposing on solid floors
- Pungent ammonia odor

- **1° Decr. growth rate & feed intake**
- Excessive tearing
- Shallow breathing
- Purulent nasal discharge

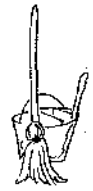


- History
- Field observation (sniff the air)

NH_3

- Adequate ventilation
- Sanitation (remove feces)

O_2



#1 air pollutant of housed cattle - Decr. growth rate

Carbon dioxide (CO_2)

Mk 1361; IM 660; C3T 680; Tox 371

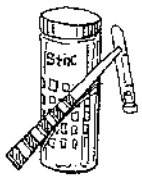
*

- **Improbable deleterious levels ever reached**
- Sources: energy metabolism, fuel burning, decomposed manure
- Present in atmosphere normally at 300 ppm

- Anxiety
- Staggering
- Coma, death if > 400,000 ppm **(unlikely)**

CO_2

- History, CS
- Blood PCO2



- Tx: fresh air

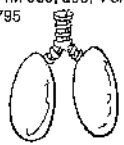
O_2

Probably never a problem

Hydrogen sulfide (H_2S); Manure gas; Slurry gas

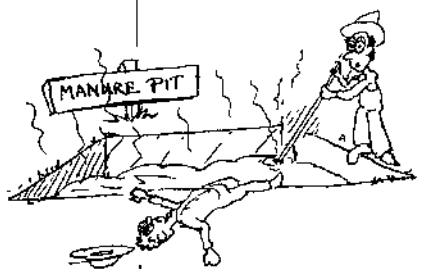
Tox 372; IM 660, 293; VC/N 155; Br 795

*



- Colorless, **heavier-than-air**
- **"Rotten egg" smell**
- **Liquid manure holding pits** underneath animal housing
  - H_2S retained in liquid
  - When liquid agitated prior to pumping it out gas is released (m/b 1000 ppm)
  - > 500 ppm eminent threat to life, respiration

- Irritant to eyes & respiratory system
- Pulmonary edema
- Hyperpnea, apnea
- **Asphyxia** (if not immediate artificial resp.)
- CNS: ataxia, depression



- Smell in air at low levels
  - Hi levels can't smell (olfactory paralyzed)

- **Public Health:**
  Human asphyxiation when cleaning out holding pits:
  - Artificial respiration

O_2

Prevention:
- Remove animals & humans before agitating manure pit
- Ventilate area

Liquid manure pits, "Rotten eggs"
CS: Asphyxia
Tx: Humans -> Artificial respiration

H_2S

Carbon monoxide, CO, Smoke inhalation

IM 593; Tox 374; DC 95

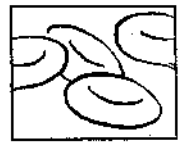
*

CO

- **Rare**
- Odorless, colorless, poisonous gas
- Unvented fuel burning heaters
- Exhaust fumes
- Competes w/ Oxygen to bind to Hb (hemoglobin) (**affinity 250x Oxygen**)
- **Forms carboxyhemoglobin** (blocks O2 pick up & release)
  - Produces **tissue hypoxia**

- **Hypoxia**
- Rapid death w/ high exposures
- Lower exposures:
  - Drowsiness
  - Disorientation
  - Incoordination
  - Dyspnea
  - Coma

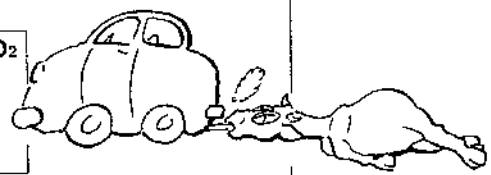
- History (fuel burning heaters), CS
- **Cherry red blood**



- **Fresh air**

O2

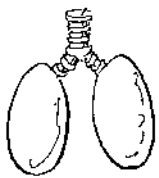
Rare, 250 x affinity of O_2
CS: Hypoxia - Death
Dx: Cherry red blood
Tx: Fresh air



"Silo gas", Nitrogen dioxide/ Tetroxide (NO_2)

IM 660, Tox 376; DC 102

*



- **"Silo gas"**
  - Brown/yellow gas, "chlorine odor"
  - **Heavier than air**, settles down chute
    - Outbreaks in housed cattle near silo chute
- "Silo filler's diz" in humans
- Pathology:
  - NO2 + water = corrosive nitric acid, **lung damage** (high water content)
  - **Edema & fibrosis**

NO_2

- Irritated mucous membranes
  - **Salivation, lacrimation**
- Dyspnea, tachypnea
- **Cough**
- **Fever**
- **SQ emphysema**
- Coma
- Paralysis
- Chronic: Pneumonia

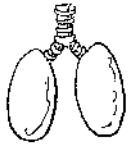
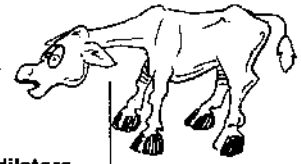
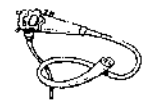
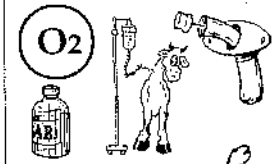
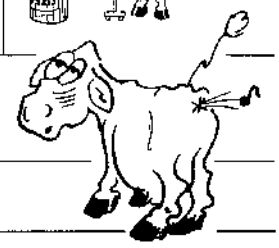
- **History**, CS
- Silo inspection
- Auscultation: decreased breath sounds & crackles
- Postmortem:
  - Lung lesions (fibrosis, edema, hemorrhage)

- **Adequate ventilation - Oxygen**
- Remove from closed housing (animals still maydie)
- Sedation: ↓ Oxygen need
- Diuretic - Lasix® (furosemide)
- ABs for 2° infection

O2

Heavier than air + water => Corrosive acid
CS: Lung damage (dyspnea)
Tx: O_2

Petroleum

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Smog, **Sulfuroxides (SO2, SO3)** BR-hb 570; BR 1504; Tox 127 *	• **Smog** (Sulfur oxides + H2SO4) • Smog major factor in air pollutants • Deaths of man & animal • Cattle & horses in urban environments **SO_2, SO_3** **Urban areas** **CS: Eye, Respiratory** **Tx: No specific Tx, Move? write your congressman**	• Eye irritation & salivation • Emphysema • Respiratory distress  	• History (urban area) • CS 	• No specific Tx
Smoke inhalants IM 661. 593, 1643; DC 94 * 	• **Barn fires** • Pathophysiology: **- Smoke toxicity** - CO toxicity (carbon monoxide poisoning) • Alveolar damage, interstitial edema, hypoxia & 2° bronchopneumonia **Barn fires** **CS: Oral burns, Respiratory, Conjunctivitis** **Dx: Bronchoscopy** **Tx: Open airway, O_2, ABs, Fluids, Bronchodilators**	• Oral burns • Conjunctivitis • Laryngospasms • **Respiratory problems** (cough, stridor, tachypnea)  	• History, CS • Bronchoscopy • Transtracheal wash 	• **Patent airway** (intubation, tracheostomy) • **O2 therapy** (up to 100%), careful because O2 m/ cause lung damage • IV fluids (monitor for pulmonary edema) • ABs for 2° pneumonia • Bronchodilators (aminophylline) relieve soot-induced bronchospasms 
Methane (CH4) IM 660 * CH_4	• **Not poisonous**, only problem if displaces Oxygen (87-90% of atmosphere, sure!) to cause **anoxia** • **Danger: explosive**, lighter than air & spark can blow a barn sky high			
Hydrogen cyanide gas (prussic acid) (VC/N 155): plant sources & burning insulation material; stop cellular respiration, Convulsive seizures terminally *				

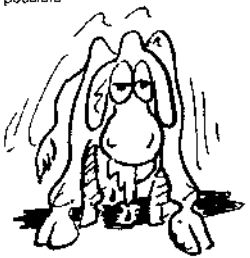
Petroleum products, Petroleum hydrocarbons

Mk 1696; C3T 407; IM 1076, 1913; BR-hb 586; BR 1528; Tox 213; DC 504t

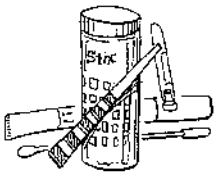
*

- All susceptible, **cattle 1°**
- Source of hydrocarbons
  - Containers, Spills, Mines
  - **Gasoline + Pb** (lead)
  - Insecticide vehicles
- Properties:
  - Sweet crudes (kerosene, gas, naphthalene)
  - Irritant
  - Oily, some penetrate skin
  - Naphthalene contaminations: which compounds cause what irritation (e.g., chlorinated naphthalene causes bovine hyperkeratosis)

- **Topical:** skin irritation & pruritus
- **Ingestion:** blistering of muzzle & mouth, salivation, colic, diarrhea
- **Dyspnea,** coughing, sneezing, incr. RR, edema of lungs, pneumonia
- **Fever**
- If Pb gasoline, Lead toxicity
  - CNS signs possible



- Hx, CS
- **Petroleum breath**
- Oil in lungs + GI
- Lab
  - Rumen fluid + water shaken; oil floats
  - "Fingerprint" oil from animal & source



DDx
- All causes of pneumonia

- Dependent on extent of damage
- **Paloxiene** (surfactant)
- Prevent absorption
  - Lavage GI, laxatives (oil)
- Clean skin
- **Emetics contraindicated** (re-expose to irritant on way out)
- ABs

Cattle 1°, Sweet crudes
CS: Topical, GI, Resp
Tx: Depends on damage

Polybrominated biphenyls, (PBB) *

IM 213t; BR-hb 585; BR 1527; Tox 223

- Catastrophe in Mich. in 1973
- PBB (a fire retardant) was supplied in red bags labelled "**Firemaster**" & a feed ingredient, magnesium oxide, was supplied in brown bags labelled "Nutrimaster". Due to a red bag shortage PBB was then supplied in brown bags, confused w/ "**Nutrimaster**" & added to feed. CS: decr. milk, lameness, wt. loss. 18,000 cattle, 3,500 swine, 1,200 sheep & 1,500,000 birds were destroyed & buried. Subsequent health problems were blamed erroneously on PBB. Interesting story, we can assume they found some red bags. See movie "Bitter Harvest"

Polychlorinated biphenyls (PCB) *

Tox 223

- Excessive residue problem in milk & animal tissue used for human consumption
- PCB (Aroclor®) used as oil in transformers, condensers & paints, flame retardant, heat transfer systems. Leaks of heat transfer systems has gotten into feed. Dx: Chemical identification of PCB residues in body fat of liver tissues. Farmer knows of problem usually when letter from a regulatory agency informs him. His & veterinarian's problem is to identify source. Saving feed samples in quart jars from each batch bought would be a big help.

Nicotine

IM 1879; C2T 86; BR-hb 573; BR 1509; Tox 248

*

- See pg 239
- Uses:
  - **Anthelmintic**
  - **Horticulture spray**
- Mech
  - Initial stimulation then blockade of nicotinic receptors

- **Initial parasympathetic** stimulation
  - Excitement, salivation, rapid resp., diarrhea, irritation of mouth
- Followed by **depression** & paralysis
  - Ataxia, tachycardia, shallow, slow resp., flaccid paralysis, coma & death from resp. paralysis

- History (exposure)
- CS (CNS)
- Nicotine odor

- **Usually unsuccessful**
- Oral tannic acid, potassium permanganate
- Artificial resp. helps, but impractical

Dewormer, Plant spray
CS: CNS stimulation followed by depression
Tx: Unsuccessful

Rodenticides — TOXICOLOGY

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment

Rodenticides

IM 1911; VC/N 153; Tox 275, 294

*

- **Toxicity rare in livestock**
- Accidental contamination of a batch of feed
  - Occasional access to bulk-packed rodenticides
  - Palatable bec. often formulated w/ grain
- Few rodenticides selective, most designed to kill mammals
- Baits & tracking powders (walks through & ingests while cleaning)
- Flavored, so tastes good (to livestock also)
- W/ safety incr. few of old chem. used (arsenic, cyanide, barium, thallium, phosphorus)
- Early detection & prevention important
- 10% of world food supply eaten by rats

Anticoagulants (Warfarin, coumarins)

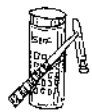
IM 1210, 1911; C3T 383; BR-hb 579; BR 1520; Tox 276; DC 61, 506t

- **Warfarin**, Diphacinone, Brodifoaxoum, Bromadiolone
- Source
  - **Rodenticides**
  - Tx of navicular diz in horses
- Mechanism
  - **Inhibition of Vit K** (necessary for production of clotting factors II, VII, IX & X)
  - Thrombin formation depressed
- Potentiated by
  - Vit K deficiency
  - Concurrent protein bound therapy

Anticoagulant - Inhibits Vit. K
CS: Bleeding
Dx: CS, Hx, Prolonged PT, Anemia
Tx: Vit. K1

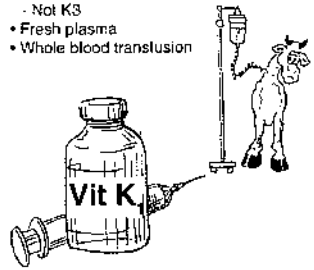
- **Hematoma formation**
- Ecchymoses (small hemorrhagic spot, > petechiae) in mucous membranes
- **Epistaxis**
- Hematuria, rarely melena

- **Exposure**
- CS or large vessel hemorrhagic diathesis
- Prolonged PT (later also ↑ APTT)
- No other abnormalities of clotting profile (norm. platelet count, plasma fibrinogen)
- Anemia
- Hypoproteinemia



DDx:
- DIC
- (thrombocytopenia) (ρ as)

- **Vit. K1** SQ every 6 hours until PT normal
  - Not K3
- Fresh plasma
- Whole blood translusion

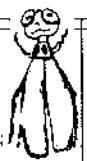


Prognosis:
- Good if early Dx & prompt adm. Vit. K1

Prevention:
- Limit access to rodenticides
- Careful monitoring of Warfarin Tx

Blister Beetle toxicity *

Mk 1643, IM 1895; C3T 413; BR-hb 620; BR 1810; Tox 437



- **Rare** in cattle; Horses >>> sheep & cattle
- **Blister beetle (*Epicaura* spp), Swarm in alfalfa** during harvest, In baled hay, 4 g of dried beetles m/b **lethal**, Storage of hay or pellets doesn't reduced toxicity, Southwest
- **Cantharidin:** potent irritant, Contact damage, vesicle (blisters) formation of mucosal surfaces of GI, kidneys, Produces nephritis, cystitis, hyperemia & ulceration of GI mucosa
- CS: Endotoxic shock, **Renal failure** (renal tubular damage), **Hematuria, Found dead peracute**, Colic, Depression, Salivation, Diarrhea (melena), Dyspnea, Skin (see vesicles), Stiff gaited
- **Dx: Hx (alfalfa), CS, Find beetle in alfalfa, Cantharidin** in urine or stomach (chromatography), Hypocalcemia, Leukocytosis, Incr. PCV & TP (hemoconcentration), BUN & creatinine
- **Tx: No specific antidote, Shock Tx (IV fluids),** Tx hypocalcemia, Mineral oil & activated charcoal, Diuretics m/b, Analgesics for abd. pain (xylazine), ABs controversial
- **Prevention:** Check hay
- Px: Guarded if obvious CS & lot of blood in feces & urine

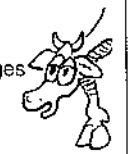
Venomous snake bites

Mk 1729; C3T 411; IM 1894; BR-hb 617; BR 1608; Derm 219; Tox 440

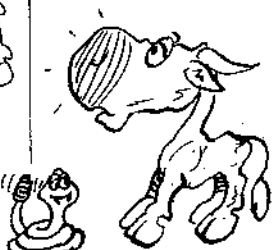
★★★

- **Rattlesnakes usually**
  - Bites from copperheads & water moccasins usually innocuous to livestock
- Only in warm season, not winter
- **Pit vipers**
  - Copperhead (Agkistrodon)
  - Cottonmouth (*Agkistrodon pescivorus*)
  - **Rattlesnake** (Crotalus)
    - Mojave green rattlesnake (*C. scutulatus*)
  - Massasauga or pygmy rattlesnake (Sistrurus)
- **Elapines**
  - Eastern or Texas coral snakes (Micrurus)
  - Arizona or Sonoran coral snake (Micruroides)
- Toxic principle
  - Coral snakes: neurotoxic - resp. paralysis
  - Pit vipers: hemotoxic, necrotizing & anticoagulant (some neurotoxin)
- Identification
  - Pit vipers - pit organ on each side of eye
    - Rattlesnakes easy - rattle; broad, flat head
  - Coral snakes: bands of yellow, red & black (Yellow bands in contact w/ red bands), short fangs
    - "Pseudo" coral snakes - black bands bordering yellow bands on both sides
- Rarely fatal in adult equid or bovid

- **Teeth marks usually not found**
- **Marked edema & erythema at site**
- Skin discoloration common w/ rattle snakes, infreq. w/ copperheads
- Necrosis
- Intense pain
- Muzzle bites
  - Swollen nasal passages
  - Dyspnea
- Local tissue necrosis
  - 2° clostridia infections
- Cardiac, neurologic & resp.
- CS rare, except w/ Mojave green rattlesnake
  - Paralysis, convulsions & death
- Coral snakes
  - Pain & swelling minimal
  - Systemic neurologic signs predominate
  - CS delay of hours for coral snakes

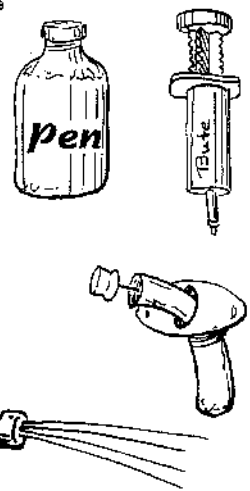


- History
- CS (bite wounds)



DDx:
- Abscesses
- Spider bites
- Clostridial cellulitis
- Allergic reaction to insect bites or stings

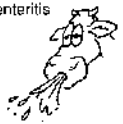
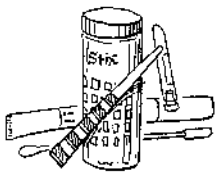
- **Penicillin**
- **Tetanus antitoxin**
- **NSAIDs for pain & edema,** not early aggravate possible thrombocytopenia
- **Immediate cool hydrotherapy** (minimize edema)
- Warm hydrotherapy (once edema formed to remove fluid)
- Thorough cleaning, disinfection & irrigation
- Antivenin (Micrurus) w/in 2 hour of bite
  - Rarely warranted except in calves & usually to late to do any good
  - Administer if see bite by large diamond back rattlesnake IV
  - Have epinephrine for anaphylactic shock ready
- Tracheostomy if dyspnea from swollen nose



Rattlesnakes (Pit viper), Coral (Elapines) CS:
CS: Red, edematous nose
Dx: Hx, CS
Tx: Penicillin, Tetnus, NSAIDs

"Red on Yellow - Kill a Fellow"

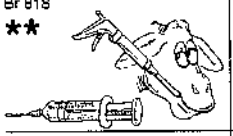
Fluorosis

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Fluoride, Fluorosis Mk 1651; C3T 398; C2T 454; IM 1309, 1905; Br 621; Tox 221; L 412 ★	• **1° dairy cattle** (most sensitive) - **Chronic fluoride => fluorosis** - Horses, sheep & swine; all susceptible • Source - Industry related (Fe & Al smelters & fertilizer plants) - Contamination of pasture water - Soil (acid), legumes, plants (esp. leaves), grains < roughage, rock phosphates - Mineral mix overdose - Rodenticides • Accumulates if increasing or constant amounts ingested - Slowly eliminated from body - Stored in bone & teeth (calcified tissue) . Effects formation & remodeling of bone . Young most suscept due to developing bone & teeth	• **Acute/rare** (large accidental ingestion) - Decreased cell resp. by enzyme inhibition - **Resp./cardiac failure** - **CNS/clonic convulsions** (excitement, weakness, depression) - **GI diarrhea/vomit** (nausea, wt. loss, salivation) severe gastroenteritis - Urinary incontinence - Decr. milk production - Death  • **Chronic/Teeth & bone** - Exostosis, sclerosis & osteoporosis . 1st on med. side of prox. metatarsal bones then mandible, metacarpals & ribs . Spurring & bridging of joints . **Intermittent lameness** . Fractures  - **Mottled teeth** - discolored (if during development) . Unevenly worn teeth, wt. loss, lapping of water (painful teeth) - **Rough hair** - **↓ milk production & weight loss** 	• **History (exposure)** • **CS (teeth, bone, lameness)** • **Lab analysis for fluoride** - Urinalysis > 2 - 6 ppm - Bone - biopsy, postmortem: cannon, rib, pelvis & mandible) > 1,200 ppm - Feed & water (> 30 - 40 ppm dairy)  **DDx:** • Any skeletal problem • Neoplastic • Degenerative arthritis • Nutritional	• **No specific Tx** • Remove animals from source **Prognosis:** • Poor for intermittent lameness • Teeth damage irreversible **Prevention:** • Oral aluminum sulfate, Ca, Fe, Mg reduce bone fluoride - Supplement w/ phosphorus to avoid osteoporosis & fractures • Balance high fluoride water w/ low fluoride feed - Grains << roughages 

Dairy, Contaminated pastures, Accumulates
CS: Acute (rare) - Resp., Cardiovascular
Chronic - Bone, Teeth
Dx: Hx, CS, Lab • Tx: No specific Tx
Px: Irreversible dental lesions, Prevention key

Levamisole

Br 818
★★



- Anthelmintic against lung worms & GI worms (not effective against arrested Ostertagia)
- Pour-on, oral drench, feed, injectable & sustained release bolus
- Nonteratogenic so safe for use in pregnant cows
- Therapeutic index is low compared to other anthelmintics, nicotinic effect
- CS of toxicity: Frisky for a few minutes, salivation, bradycardia, muscular tremors, death from resp. failure; Inflammation at injection site

Formaldehyde; Formalin ★

BR-hb 585; BR 1528; Br 614

- Used in foot baths, poisonings assoc. w/ inadequate drinking water
- CS of toxicity: Mild (salivation, inflammation of buccal mucosa), Severe (dullness, abdominal pain, weak pulse, coma, death)
- Tx: Symptomatic therapy; do not leave cattle unattended near source

Carbon tetrachloride

C2T 860; BR-hb 573; BR 1507

*

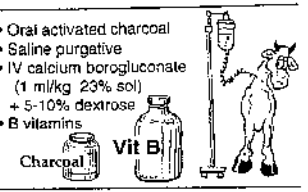
- **Fluke treatment**
- Vofatile, colorless liquid
- Mechanism of toxicity
  - Alters selective permeability of membranes, allowing escape of coenzymes

- Commonly acute
- Anorexia, depression, drowsiness
- Staggering, incoordination
- Bloody feces
- Constipation followed by diarrhea
- Cardiovascular collapse, fibrillation
- Death w/in 24 hrs

- History (defluking)
- CS (CNS & GI)

DDx
- Similar to ammonium toxicity

- Oral activated charcoal
- Saline purgative
- IV calcium borogluconate (1 ml/kg 23% sol) + 5-10% dextrose
- B vitamins



Hexachlorophene

C2T 861; BR-hb 573; BR 1509

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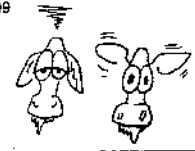


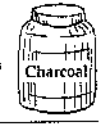
- **Phenol**
  - Antitrematodal drug (flukes), disinfectant, soil & plant fungicide
- Mech: uncouples oxidative phosphorylation, inhibits resp. enzymes, damages cell membranes

- Fever
- Depression or hyperexcitability
- Muscle tremors
- Tetanic spasms, convulsions
- Sudden resp. failure - death

DDx
- Lead (p 152)
- Ammonium (p 204)
- Hepatic encephalopathy (p 154)

- History (exposure)
- Any level of CCl4 suspicious in feces, stomach, blood or tissue

- Oral poisoning: oral activated charcoal & saline cathartics
- Dermal: Wash w/ soap & water
- Cold water sprays & enemas to control fever
- Phenobarbital to control convulsions
- Volume diuresis w/ IV fluids to speed elimination

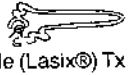


Aminoglycoside toxicity

C2T 16; C3T 812

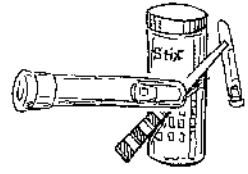
**

- Broad spectrum ABs used mainly against gram negative bacteria
- **Nephrotoxicity** is major concern
- Related to dose & duration of Tx (> 7 ds)
- Predisposing factors
  - Dehydration & hypovolemia
  - Renal insufficiency
  - Metabolic acidosis
  - Concurrent furosemide (Lasix®) Tx
  - Severe sepsis or endotoxemia
- Ototoxicity rarely seen in food animals

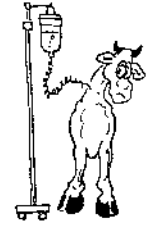


- **Nonoliguric renal failure**

- Proteinuria
- Sediment changes due to tubular injury



- Stop administration
- Treat renal failure



Nitrofurans, Furizolidone, Nitrofurazone

C2T 860; Br 224, 614; Tox 334

**

- Synthetic broad spectrum ABs
- **Illegal for use in cattle in USA**
  - Still sometimes used in calves w/ diarrhea (nitrofurazone)

- Anorexia
- Hyperexcitability
- Intermittent convulsions
- Weakness, total paralysis & death
- Tremors, circling

- History (nitrofurazone Tx)
- CS (CNS)

DDx
- Enterotoxemia (p 250)
- Enteric/toxemic colibacillosis (p 18)
- Lead or mercury toxicity (p 152)
- Water deprivation (p 205)
- OPs (p 206)
- Polioencephalomalacia (p 140)
- Nervous coccidiosis (p 150)
- Vit A defc (p 142)
- Meningitis (p 151)
- Brain abscess (p 140)

- Stop Tx
- Acepromazine

Poisonous Plants

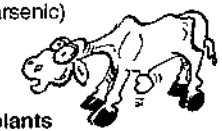
POISONOUS PLANTS

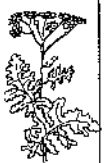
Generally not palatable, Overgrazing, Contaminated hay
CS: Confusing, Similar signs for different plants
Dx: CS, Hx of ingestion, ID plants
Tx: Prevention, Symptomatic (few antidotes)
Prevention: Don't overgraze, Supplement feeds

Facts

- **Rule of thumb: poisonous plants usually not palatable**
  - Usually eat only when nothing else (drought, early spring)
  - When mixed w/ hay or grain
- **Economics**
  - W. USA 3-5% annual deaths for cattle, horses & sheep
  - Poor weight gain & poor reproduction
- **Variables**
  - Plants vary in toxicity
  - Animals affected (some OK for cattle & horses, but kill sheep)
  - Conditions of poisonings:
    . Some nutritious, except during certain seasons when they are poisonous
    . Some nutritious unless only thing eaten (choke cherry)

- **Poisonous substances**
  - Poisonous substances themselves to livestock (alkaloids & oxalates)
  - Harmless substances transformed by decomposition or ingestion (nontoxic amygdalin in choke cherries changed to toxic prussic acid)
  - Substances absorbed from soil into plant (milkvetch accumulates selenium)
  - Substances making animal hypersensitive (St. John's wort causes photosensitization)
  - Miscellaneous substances (toxic metals: fluorine, arsenic)





- **Toxicity of plants**
  - Palatability (influences how much eaten, herbicide or fertilizersm/ make more palatable)
  - Available nonpoisonous forage: will eat instead of nonpalatable toxic plants usually
  - Stage of development: usually more toxic when immature, some when mature
  - Drought or freezing (stress) commonly incr. toxicity
  - Soil (e.g., some toxic on selenium soil, but good on other soils)
  - Moisture contents: drying m/ incr., decr. or leave toxicity the same
  - Parts of plants: some more toxic than others (seeds, leaves, stems or roots)
  - Toxic substances
    . Some lethal in small amounts, others require large amounts
    . Some accumulate in animal while others don't

- **Animal factors**
  - Species: some toxic to certain species, others toxic to all
  - Young usually more susceptible than adults
  - White animals - photosensitization
  - Variability of susceptibility of individual animals
  - Stressed animals more susceptible (temperature, exertion)
  - Fasted animals more susceptible
  - Horses are more selective grazers than cattle (indiscriminate eaters)

- **Management factors**
  - **Overgrazing** most common cause of poisonings, have to eat poisonous plants
  - Turning hungry animals into new pasture, eat first thing they see
  - Early turn out onto range, toxic plants often1st to "green up" (low larkspur, lupine, death camas)
  - Crowding animals, let spread out
  - Driving hungry animals quickly
  - Inadequate nutrients
  - **Feeding contaminated hay**
  - Grazing during dangerous seasons
  - Spraying or fertilizing pasture m/ ↑ palatability of toxic plants
  - Grazing snow covered fields, taller toxic plants m/b only available feed (tall larkspur or lupine)

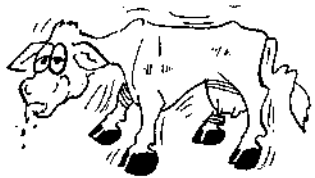
- Grazing after heavy rainstorm, some more toxic after rain, some more palatable, easier to pull up toxic roots
- Grazing during drought, some toxic plants remain green, while good forage is gone

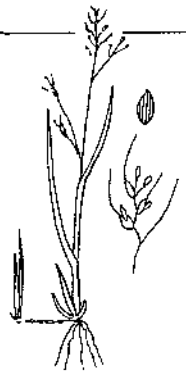
Clinical signs m/b confusing

- Similar signs for different plants
- Incomplete or nontypical CS of poisonings by usually nontoxic plants

Diagnosis of poisonous plants

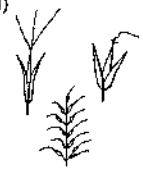
- Requires more than just identification of plant, need proof of ingestion also
- Suspected plant poisonings:
  - Sudden onset of illness w/ no apparent cause (after turned out into new pasture)
- ID plant
  - Check pasture, especially fence rows, ditches & springs for poisonous plants
  - Check GI for plant material in those that die
  - Collect plants & send to local county agent for ID
    - . Press & dry between 2 pieces of paper
    - . Send between 2 pieces of stiff cardboard
- Detailed record of events
  - If alive: observe & record CS

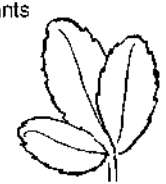




Treatment - poisonous plants

- Tx less satisfactory then for chemical poisonings
  - Therefore prevention is key to control
- Usually symptomatic bec. few antidotes
- Absorbents - activated charcoal
- Astringents (bismuth subnitrate) constrict intestinal capillaries (prevent further absorption)
- Stimulate elimination
  - Stomach pump
  - Emetics
  - Purgatives
  - Diuretics
- Treat symptoms
  - Cramps & convulsions - sedative & depressants
  - Depression & paralysis - stimulants





Prevention key to controlling

- **DON'T OVERGRAZE**
- Remove plants
  - Remove animal from pasture during poisonous season for certain plants
  - Put on range when sufficient growth of desirable forage
  - Spread out herd & slowly move so they can be selective
  - Drive animals slowly w/ full stomachs & bed down in safe areas
  - **Supplement forage** or extra hay during poisonous seasons (prefer over nonpalatable poisonous plants)
  - Mineral supplements, mineral deficiencies m/ stimulate to eat poisonous plants (e.g., high nitrates havesalty taste)
  - Check hay for too many weeds (e.g., oleander)
  - **No hungry animals into new pastures**, will eat anything
  - Don't throw lawn clippings where animals can eat (e.g.,oleander)
  - Salt & phosphorus blocks (supplement & spread livestock out)
  - Adequate water supply
  - Keep off sprayed or fertilized land for 2 weeks
  - Feed supplements when snow covers all forage except tall toxic plants
  - Supplement during drought or reduce numbers
  - Fence uncontrollable areas

Poisonous Plant Chart

Plant	Proper name	System	Value	Toxin	Season	Loc.	Habitat	Species	Fact
Arrowgrass	*Triglochin*	Blood	Hi	Glycoside	Sp	W	Wet areas	Ox/Shp/all	HCN - bright red blood
Astragalus	*Astragalus*	NS	Hi	Se	Sp/S/Fall	W/NW	Valley/mts	Ox/All	Locoweed
Bermuda grass	*Cynodon*	NS	Hi			SW			
Black locust	*Robinia*		Low	Glycoside	Any	MW/E	Cultivated	Ox/All	
Bracken fern	*Pteridium*	Blood	Hi	?	Sum/Fall	All	Mts	Ox/Eq (CNS)/All	Bone marrow depression
Broomweed	*Gutierrezia*	Repro	Hi		Sp	SW		Ox	Abortions, Weak calves, RP
Chokecherry	*Prunus*	Blood	Hi	Glycoside	Sp/Sum	W/MW/E	Valley/Fthl/Mts	Ox/Shp/All	HCN gas released
Cockleburr	*Xanthium*	GI/NS	Mod	Other?	Sp/Sum	MW/E	Waste/cultiv	All	Two leaf stage (toxic)
Death camus	*Zygadenus*	NS	Mod	Alkaloid	Sp	W	Valley to Mts	Sheep/All	Onion-like
Dock	*Rumex*	Renal	Low	Oxalate		All	Waste/cultiv	Sheep	Hypocalcemia
Dogbane	*Apocynum*	Renal	Low						
Elderberry	*Sambucus*	Blood	Low	Glycoside		MW/E	Valley/Mt	?	HCN
Ergot	*Claviceps*	NS	Hi			SW			
Fiddleneck	*Amsinkia*	Liver	Hi	Alkaloid		W/All			
Greasewood	*Sarcobatus*		Hi	Oxalate	Sp	W	Valley/Plains	Ox/Sheep	Hypocalcemia
Groundsels	*Senecio*		Low	Alkaloids	Sp/Sum	All			
Halogeton	*Halogeton*	Kidney	Hi	Oxalate	Fall/wint	W	Waste	Sheep/Ox	Hypocalcemia
Jimsonweed	*Datura*		Low	Alkaloid	?	MW/E	Waste areas		
Larkspur	*Delphinium*	Gen	Hi	Alkaloid	Sp	W	Low; Hi (Mts)	Ox/All	#1 cattle poisoning in W
Locoweeds	*Astragalus*	NS	Hi	Se	Sp/Sum/Fall	SW/W	Valley/Mts	Ox/Eq/All	CNS
	Oxytropis	NS	Hi	Se	Sp/Sum/Fall	SW/W	Foothills/Mts	Eq/All	
Lupine	*Lupinus*	NS/Rep	Hi	Alkaloid	Fall	W	Valley/P/FHill/Mt	Ox/Shp/All	"Crooked calf"
Milkvetch	*Astragalus*		Hi	Se	Fall	W	Foothill/Mts	Ox/All	"Blind staggers"

Milkweed	*Asclepias*	Card/Vas	Hi	Alkal/Glyco	Sp/Sum	SW	Valley/Plains	Sheep/All	
Nightshades	*Solanum*	NS		Alkaloids					
Oak	*Quercus*	Renal	Hi	Tannin	Sp/Fall	SW	All	Cattle/Shp/All	Acorns & buds
Oleander	*Nerium oleander*	Card/GI	Mod	Glycoside	All	W/S	Ornamental	Cattle/All	#1 Cardiotoxic plant
Pigweed	*Amaranthus*	Ren/Hep	Low	Oxalate		W/MW		Cattle/All	
Poison hemlock	*Conium*	CNS	Hi	Alkaloid	Sp	W/MW/E	Waste/Valley		No convulsions
Ponderosa pine	*Pinus*	Repro	Hi	?	Sp/Fall/Win	W	Plains/Mts	Ox	Abortions
Princes' plume	*Stanlea*	CNS/MS	Mod	Se	?		Valley/Plains	All	"Blind staggers"
Ragwort	*Senicio*	Hepatic	Hi	Alkaloid	Sp/hay			Ox/Shp/Eq	Liver fibrosis
Rattlebox	*Sesbasnia*					SW			
Rhododendron	*Rhododendrona*	GI, CNS	Low	Oxalate	Any	All	Cultivated	All	Fence off
Rhubarb	*Rheum*	Renal	Mod	Oxalate	?	MW/E	Cultivated	?	
Senecio	*Senecio*	Liver/NS	Little	Alkaloid	Sp/Sum	SW/MW/E	Valley to Mts	Ox/Eq/All	"Walkabout"
Sneezeweed	*Helenium*		Low	Glycoside	Wet areas	MW/E		Ox/All	
Sweet clover	*Meliotus*	Blood	Low	Dicoumerol	Wint. (hay)		Waste areas	Ox/All	Needs mold - pasture OK
Sorghums	*Sorghum*	Blood	Low	Glycoside			Grasses	Ox/All	Sudan, Johnson grass
		Blood	Low	Nitrate					Chocolate blood
Tall fescue	*Festuca*	Blood	Low	Alka/Nitrate			Cultiv/Wet	Ox	
Tobacco	*Nicotiana*	CNS	Low	Alkaloid	?	ME/E	Waste/cultiv	All	
Water hemlock	*Cicuta*	CNS	Mod	?	Spring	W/MW/E	Wet	Ox/All	Convulsions
Yew	*Taxus*	Card/NS/GI	Low	Alkaloid			Ornamental	Ox/All	Cardiac standstill, NS



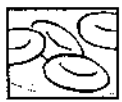




Plant Accumulators

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Cyanide (HCN), Hydrocyanic acid, Prussic acid Mk 1647; IM 1882; C3T 367, 344, 347, 386, 393; C1T 456; BR-hb 588; BR 1533; Br 613; DC 5061; Tox 400; N-L 100 ★★★	• **Cyanogenic glycosides** - **Hydrocyanic acid** (prussic acid, HCN gas) released on hydrolysis • **Very rapid-acting poisons** • Susceptibility: **cattle** > sheep/goats > equine > swine • Sources - **Plants 1°** (see box) . Many plants safe low levels usually (Johnson, Sudan grasses, Sorghum) . Damage (wilted, trampled, drought) cause glycoside to change to HCN . Leaves &/or seeds >> fruit or stem . Immature, rapidly growing . Fresh >> hay - Rodenticides - Industry (metal cleaning, electroplating) • **Not cumulative** (must eat a lot in hr/hrs) • Mechanism of action: - **Cellular hypoxia** (cytotoxic anoxia) . Binds iron (Fe) & stops cellular respiration (stops electron transport, binds w/ cytochrome oxidase) . **Hemoglobin can't release oxygen** (bright red blood) . Result: ↓ O_2 at tissue level & ↓ ATP	• **Found dead** (rapid action w/in min.) • CS in rapid succession - Excitement & muscle tremors - **Dyspnea**, salivation, lacrimation, voiding of feces & urination - Stagger & go down, gasp for breath . Clonic convulsions m/b due to anoxia - Dilated pupils - **Bright red** mucous membranes • Survival over 2 hrs usually recover	• **Hx (exposure), CS** • **Cherry red blood** - Clots slowly or not at all - Red mucous membranes then cyanotic after respiration stops • **Bitter almond** odor - GI • GI, lung hemorrhage • "Picrate paper" test - Filter paper wetted w/ $NaHCO_3$ & picric acid in 100 ml of H_2O - Crunch leaves or rumen content in picric, cork tube & heat - Brick red color in minutes indicates HCN • Lab - Preserve specimen for lab: . Quick freezing, or . 1-3% mercuric chloride ($HgCl$) . Refrigerate blood - Plant > 20 mg/100 ml (200 ppm)	• **Na nitrate + Na thiosulfate IV** - 10 ml 20% Na nitrite + 30 ml 20% Na thiosulfate IV to 1000# animal - Na nitrate breaks HCN bonds forming cyanmethemoglobin - Na thiosulfate IV (HCN to thiocyanate & excretion) • Rare toxicity because it can be treated specifically & effectively • Methylene blue IV **Prognosis:** • **So rapid usually too late to Tx** • Survival over 2 hours usually recover Prevention: • Keep hungry ruminants away from sorghum plants less than 2' tall or damaged • Keep away from chokecherry clippings

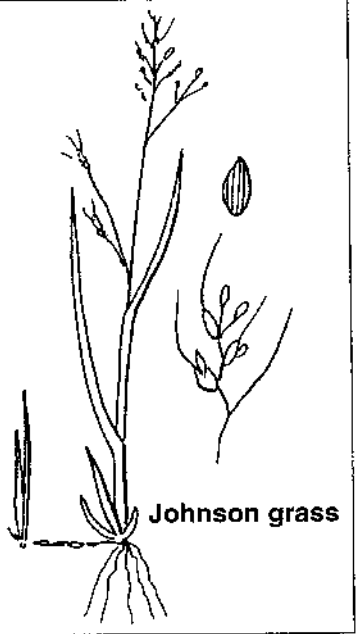
DDx:
- Nitrate poisoning NO_3 /NO_2 chocolate blood
- Pulmonary adenomatosis or emphysema
- Urea poisoning (ammonia smell & CNS CS)
- OPs/Carbamate



Cyanide plants

• Apple	*Pyrus malus*
• **Arrow grass**	*Triglochin maritima*
• Birdsfoot trefoil	*Lotus corniculatus*
• **Cherries, choke cherries,** apricot, peach	***Prunus* spp.**
• Corn, maize	*Zea mays*
• Elderberry	*Sambucus canadensis*
• Flax	*Linum* spp.
• Hydrangea	*Hydrangea* spp.
Lima bean	*Phaseolus lunatus*
Poison suckleya	*Suckleya suckleyana*
• **Sudan grass, Johnson grass Sorghum grass hybrids**	***Sorghum* spp.**
• Velvet grass	*Hoecus lunatus*
• Vetch seed	*Vicia sativa*
• White clover	*Trifolium repens*

Bound hemoglobin - Hypoxia
CS: Resp. distress - Rapid death
Dx: Bright red blood, Almond odor, > 200 ppm
Tx: Na Nitrate, Na thiosulfate



Arrowgrass, Triglochin

Mk 1647; Tox 455; PP/Mt 11; PP/USA/C 26, 501

- *Triglochin maritima* & *T. palustris*
- Toxic principle: hydrocyanic acid

- Description
  - **Grasslike** plant, 1-3" tall
  - Leaves: basal, 6-18" long, slightly fleshy
  - Flowers: small, bunched along upper stem

- Sheep & cattle, all susceptible
- Poisoning: in hay or in Spring drought w/ little other forage

Chokecherry

Mk 1647; Tox 455; PP/Mt 44

- *Prunus virginiana*
- Cattle & sheep, all susceptible
- Toxic principle: hydrocyanic or prussic acid
- Poisoning: good forage usu., poisons in early spring when other vegetation scarce, must consume a lot quickly (not cumulative), end of summer not poisonous, fruit OK, but pits poisonous

- **Description:**
  - Large shrub or tree
  - Leaves: dark green, 2-4" long oval w/ pointed tip, saw-toothed margins
  - Flowers: small, yellow-white, dense clusters
  - Fruit: dark red to black (3/8")

Thiocyanates (SCN), Goiter

Mk 283; C3T 297; IM 11451, 1303; B&R 1174, Tox 58, 378

- Thiocyanates (1-5-vinyl-2-thiooxazolidone glycoside), plant goitrogens
- **Goitrogenic plants** or excess iodine (kelp) eaten by pregnant animal
- **Hyperplastic goiter**
  - Neonates, most common thyroid disorder in horses & **small ruminants**
  - Inhibit thyroid hormone production (constant TSH stimulation of pituitary)

- **Goiter** - enlarged thyroid (m/not be present)
- Hypothyroidism
  - Incoordination
  - Poor suckle response
  - Poor righting reflex
  - Hypothermia (lower metabolic rate)
  - Tendon contracture &/or rupture
  - Retarded bone development
- Young born normal then skeletal lesions, esp. tarsus, in weeks

- Thyroid stimulating hormone response test
  - 1 d-old 5 IU of TSH IV
  - Peak of T3 w/in 1-3 hrs if normal

- **Thyroid hormone supplementation (iodine)**
  - If hormone level low
  - No way to reverse developmental lesions

Plants w/ goitrogenic compounds Mustard family (*Cruciferae*)

• *Brassica* spp	Rape seed, Mustard, Kale, Broccoli, Cabbage & Turnip
• *Glycine max*	Soybean
• *Linum usitatissimum*	Flax

Oxalate

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Oxalate Mk 1709, IM 1885; Tox 387; C3T 364; C1T 436; BR-hb 590; BR 1539; Br 615; DC 506t; PP-US/C 33, 235, 241; PP/Mt 24) **	• Oxalic acid (HOOCCOOH) • Unpalatable • 1° **Cattle**, sheep occasionally eat - **West USA** (greasewood & halogeton) • Source - Plants, palatable to livestock . Leaves > seeds > stem . Alkaline deserts (Idaho, Nev. & Utah) . Greasewood (N. Dak. to Tex. to Cal.) - Fungi (Aspergillus & Penicillium) produce oxalates on plants - Household & industrial products (rust removers, bleaches & tanning cmpds) - **Ethylene glycol** • Pathophysiology - Toxic principle: combines w/ ionic Ca => insoluble precipitates - **Hypocalcemia** - tetany - Crystallize in vessels => vascular necrosis & hemorrhage & edema - **Renal tubule blockage** => anuria, uremia & elec. imbalances • Some rumen microbes can detoxify plants - Tolerance increased if small amounts grazed - Large amounts overwhelm microbes (hungry animals)	• 2-6 hrs after ingestion • Colic, restless, up & down • Depression, ill-thrift due to chronic renal damage • **Muscle weak** (paresis) - Irregular gait - Head drops downward • **Labored, rapid breathing** • M/b convulsions • **Frequent urinations** • Blood froth around mouth • Death often w/in 10 hr	• CS, History & Postmortem • Lab - **Hypocalcemia** (↓blood Ca) - ↑GOT, GPT, LDH - ↑BUN, creatine - Electrolyte imbalances - Urinalysis: crystals • Postmortem - Ascites & hydrothorax - Diffuse hemorrhages - Swollen, edematous kidneys - Histopath . Oxalate crystals in renal tubules	• **No treatment** **Control:** • ↑Ca in diet (dicalcium phosphate) Prevention: • Don't overgraze • Allow time to adapt to oxalate plants

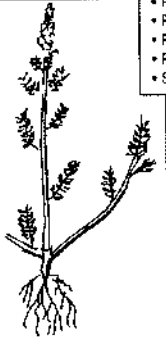
DDx:
- Grain overload (p 25)
- Rumenitis (p 24)
- Hypocalcemia
- Milk fever (p 148)
- Starvation

Oxalate plants

• **Dock**	*Rumex*
• Fireweed	*Kochia scoparia*
• **Greasewood**	*Sarcobatus vermiculatus*
• **Halogeton**, barilla	*Halogeton glomeratus*
• Lamb's quarters	*Chenopodium album*
• Pigweed	*Amaranthus* spp.
• Purselane	*Portulaca oleracea*
• Rhubarb	*Pheum rhaponticum*
• Russian thistle	*Salsola kali*
• Sorrel, soursob	*Oxalis* spp.

Halogeton

- *Halogeton glomeratus*
- Distribution: heavily grazed, salty soils
- Sheep > cattle
- Fall & early winter
- Description
  - Stem: thick, juicy, branching from base
  - Leaves: thick, succulent, 1/4 -1/2" long, tipped w/ weak spines
  - Flowers: greenish, inconspicuous
  - Fruit: winged, mistaken for flowers
  - Looks like Russian thistle or tumbleweed



Greasewood

- *Sarcobatus vermiculatus*
- Spring, succulent, good forage if w/ moderate amount of other forage to prevent poisoning
- Description
  - 3-5' tall
  - Erect, woody, highly branched
  - Stems: smooth, **white bark, spines**
  - Leaves: single or pairs, fleshy, round in x-section, long & narrow, 1/4 -1 1/4" long
  - Flowers: small, dense cone clusters
  - Fruit: small, encircled by wing

Binds Calcium
CS: Hemorrhage, Edema, Renal damage
Dx: Hypocalcemia - ↑BUN ↑GOT
Tx: Too late

L-tryptophane/ lush forages, Fog fever

Atypical interstitial pneumonia, ARDS

***

- **See Resp pg 67, ARDS**; Adults from sparse forage to lush green pasture, L-tryptophane converted to 3-methylindole (Pneumotoxic compound)
- **CS:** Acute severe resp. CS (dyspnea, grunt, mouth breathing), No coughing, 30% die in 2 days, pcpt by exercise, SQ emphysema
- **Dx:** Adult herd/new pasture, Resp. distress, No coughing, Auscultation (soft sounds), PM (hyaline membranes, multinucleated giant cells)
- **DDx:** Acute resp. distress syndrome (ARDS), Moldy sweet potato poisoning & perilla mint toxicity, Parasitic bronchitis, Anaphylaxis
- **Tx:** None may be best because handling may kill, Removing doesn't prevent new cases
- **Px:** Guarded: 30% die, recovery - some poor doers
- **Prevention:** Slowly introduce to lush pasture, Prophylactic medicine (Monensin) before putting on pasture

Perilla mint toxicosis

IM 659, 1888; C3T 368; Tox 396; DC 101

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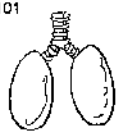


- SE USA
- Causes interstitial pneumonia, ARDS
- ***Perilla frutescens*** (perilla, purple mint, wild coleus, beefsteak plant)
  - Weed in waste areas
  - Some cows like taste
- Toxic principles 3 furans
- Fall, flowering stage

- **Fatal pneumonia/ARDS**
  - Severe dyspnea (head extended)
  - Expiratory grunt
  - Froth from mouth
  - Incr. RR & HR
  - Constipation
  - Rapid to death 1-3 ds

- **History, CS**
- **Auscultation**: crackles & consolidation
- Postmortem: Swollen lungs, separated lobules
  - **Square stems in rumen**

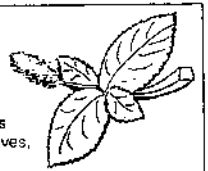
- **None** m/b best (Tx stresses & kills)
- Don't stress
- Remove source
  - 1-2 wks for CS to abate

Prognosis: Poor, survivors m/ have permanent fibrosis of the lungs

Prevention:
- More important than treating cases

Weed, Square stem, Mint aroma
CS: ARDS (Dyspnea, Rapid death)
Dx: Hx, CS, Auscultation, PM
Tx: None (stress kills) • Px: Poor

Perilla mint
Perilla frutescens



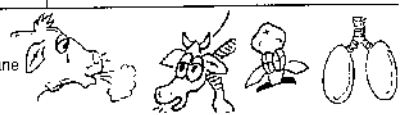
Description:
- 1-6" tall. Square stems
- Opposite aromatic leaves, turn purple over time

DDx:
- Fog fever (p 67)
- Moldy sweet potatoes (p 67)
- BRSV (p 64)
- Pasteurella pneumonia (p 255)

Moldy sweet potato toxicity

IM 658; DC 101

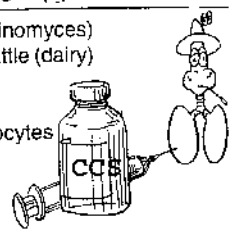
- **ARDS**, Sweet potato + fungus = pneumotoxin; Intoxication, not allergy to fungus; Damages cells; Cows not nursing calves
- **CS:** in 1 d of exposure - death in 2-5 ds, Acute resp. distress (dyspnea, grunts, extension of head & neck, deep coughing)
- **Dx:** Hx, CS, Adventitious lung sounds, crackles; Postmortem: Lungs - wet, firm & large, uncollapsed, emphysema, hyaline membrane
- **Tx:** Tx not investigated
- **Px:** Grave



Moldy hay toxicity, "Farmers lung"

**

- **See Resp pg. 68**; Inhaling organic dust, Moldy hay - spores of *Thermophilic actinomycetes* (Micropolyspora & Thermoactinomyces) Wet summers (moldy hay) & cold winters (housed cattle), Spores - hypersensitivity - destroys alveoli; Confined adult cattle (dairy)
- **CS:** Animals in diff. stages: Acute resp signs: Coughing, dyspnea, tachypnea, transient fever
  Chronic: - Fibrosis, Wt. loss & coughing over several winters
- **Dx:** History & CS, Auscultation: cranioventr. crackles; Postmortem: grossly normal lungs, small gray spots of lymphocytes
- **Tx:** Remove moldy hay ($), Corticosteroids (Dexamethasone .04 mg/kg IV)



Selenium Toxicosis

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Selenium toxicity, Nutritional myopathy Mk 1727; IM 212t; Tox 132; C3T 366; C1T436; BR-hb562; BR 1484; Br 266, 616; DC 250, 508t; Tox 132; L 407; N-L 288, 319; PP/MI 32, 36; PP/US/C 50 **	• Cattle, sheep & horses (all susceptible) • Trace amounts of selenium required • 5-40 ppm in plants for toxicosis - **Arid & semiarid areas** (requires < 20" annual rainfall) - **"Accumulator"** (obligate) plants require Se & m/ contain > 1000 ppm . Fortunately only eaten if starving - **"Converter"** (facultative) plants don't require Se, but absorb it . Commonly grazed & cause poisoning - Western 1/3 of USA (Colorado, Neb., S. Dakota & Wyoming) • Astragalus, Oonopsis & Stanleya • Se supplements m/ result in toxicosis	• Acute (rare, bec. avoid plants, unpalatable) - Sudden death (resp. failure), Pyrexia, Incr. RR, Dyspnea, Frothy nasal discharge, Dilated pupils Abnormal postures &/or gait, Recumbency, Diarrhea (dark & watery), Polyuria, Death • **Chronic "alkali diz"** - **Weight loss, depression** - **Lameness** - Abnormal hoof conformation - Coronary band inflam. & breakage, grows down & sloughs - **"Bobtailed" diz**, hair loss - mane & tail - **Repro. compromise** (soft testicles) • **Chronic "blind staggers"** (controversy if caused by Se) - Aimless wandering or circling - Incoordination - Forelimb weakness - Dyspnea - Blindness - Death	• Exposure & CS • Lab - Se blood levels 1-2 ppm in "alkali" diz; 1.5-4 ppm in "blind staggers" - Elev. ALT (SGPT), AST (SGOT), ALP - Conc. of Se in hair & urine • Postmortem: - Kidney degeneration - Hepatic necrosis - Erosions of articular cartilage • Se levels in tissue - Kidney > Liver > Pancreas	• **Acute: no treatment** • Remove from plants Prevention: • Diet < 5 ppm • **Arsenic** (arsenitic acid) application to feed reduces absorption???

DDx:
- Acute
  - Pneumonia (p 62)
  - Anthrax (p 247)
  - Infreq. necrotic hepatitis
  - Enterotoxemia (p 250)
  - Pasteurellosis (p 255)
  - Other poisonings
- Chronic
  - Frostbite (p 163)
  - Fluoride poisoning (p 216)
  - Laminitis (p 163)
  - Thallium toxicosis (hair loss also) (p 208)

Plants accumulate from Se soils - CNS
CS: "Alkali diz" (lame) - "Blind staggers"
Dx: Blood/Hair/Feed levels
Tx: Remove from plants

Se Plants
Obligate Se-indicator plants (often >1000 ppm)

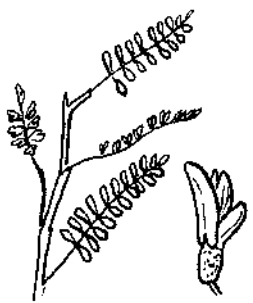
• Goldenweed	*Oonopsis*
• **Milk vetch**	***Astragalus bisulcatus***
• **Poison vetch**	***Astragalus pectinatus***
• **Prince's plume**	***Stanleya pinnata***
• Woody aster	*Xylorrhiza*

Facultative Se-indicator plants

• Broomsnakeweed	*Gutierrezia sarothrae*
• Groundsel varieties	*Senecio* spp.
• Gumweed	*Grindelia*
• Aster	

Astragalus spp., Milkvetch, Poisonvetch

- Astragalus spp. (over 300 species), largest genus of legume family
- Toxic principles: as a group have 3 distinct toxic principles: Se, an unknown for loco plants, & Nitrogen compounds
- Cattle, sheep, horse, all species
- **Description**
  - Low growing
  - Woody tap root
  - Leaves pinnately compound
  - Flowers: white to purple, rounded keel petal (lower most petal)
- Difficult to ID species of astragalus
- Oxytropis, point locoweed, point vetch (so closely resemble astragulus that some botanist treat as the same)
- Unpalatable, garlic odor



Astragulus spp. m/ also contain loco toxin

Prince's plume

- *Stanleya pinnata*, Toxic principle: Selenium
- Unpalatable, questionable if livestock will even eat
- **Description**
  - Bush 1.5-5' tall
  - Leaves thickened & fleshy, 2-8"
  - Flowers: numerous on upper 0.5-1.5' of stem

Slobbers
Slaframine, Moldy red clover; Black patch diz

C3T 338; IM 1893, 822; Tox 428; BR-hb 615t; BR 1601; DC 505t; PP/US/C 360; PP/O 18 **

- Red clover (*Trifoleum pratense*) or other legumes parasitized w/ Fungus
  - *Rhizoctonia leguminicola* **(Fungus - dark brown)**
  - Wet weather or high humidity
- Toxin:
  - Slaframine (alkaloid)
    - Parasympathomimetic
  - Swainsonine alkaloid also m/b
- Cattle, sheep, goats & horses
  - Addictive
- Eastern & central USA

Legume + Fungus - Parasympathomimetic
CS: Prolonged, Excessive salivation
Dx: Hx, CS (slobbers)
Tx: Remove source & wait 3 ds

- **Salivation (copious)** in 30 min - 1 hr
  - Lasts for over 3 days
- Anorexia
- Freq. urination
- Watery diarrhea
- Longer exposure: decr. milk, bloat, stiff joints, abortions & sometimes death

- **History, CS (slobbers) usually enough**
- ID *R. leguminicola* in red clover or other legumes (dissecting scope) dark brown (coarse or hairlike) mycelium
- Chemical ID of slaframine

- **Remove from toxic forage**
- Atropine if severe, but not completely effective

Prognosis:
- **Good**: complete recovery w/in 96 hrs usual after forage removed
- Fatalities rare

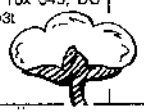
Prevention:
- Chem seed treatment for areas free of diz
- Precautionary feeding of red clover to a few animals first

Gossypol toxicosis, Cottonseed toxicity

C3T 331; BR-hb 607t; BR 1576; Tox 345; DC 41, 503t

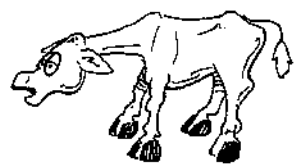
**

- **Cottonseed** - cheap high protein, high fiber, high digestibility feed
  - Contains gossypol
- **Gossypol** - cardiotoxin - gradual destruction of heart muscle in calves
  - Most common in bottle raised calves on starter rations of cottonseed meal



Cheap feed - Calves < 4 mo, Cardiotoxic
CS: Sudden death, Resp. dyspnea
Dx: Hx, CS, Feed analysis
Tx: No response to Tx Px: Poor

- **Calves**
  - **Sudden death**
  - **Respiratory dyspnea**
  - Depression, anorexia, hemoglobinuria
  - Mortality
- Adults
  - Repro problems
    - Sterility in bulls (reversible)
    - ↓ testicular size
    - ↓ conception in cows

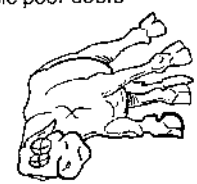


- History, Clinical signs (CS)
- Feed analysis < 400 ppm deadly to calves, > 10,000 ppm m/ not affect adults
- Tissue analysis

DDx
- Monensin (p 203)
- Lasalocid (p 203)
- Vit. E/Se defc (p 78)
- Cassia poisoning

- **No response to any treatment**

Prognosis:
- **Poor**, survivors m/b chronic poor doers



Blood — POISONOUS PLANTS

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Bracken fern toxicosis Mk 1641; IM 1883, 949; C3T 350, 856, 823; C1T 334, 451; BR-hb 596; BR 1559; Br 619, 127; Tox 396, 741; DC 506, 55, 363; BM&S 839; PP/US/C 321 **	• *Pteridium aquilinum* (bracken fern, western bracken), *Pteris aquilina* • Throughout USA in forests (NW/MW) • Toxic principle: unknown in ruminants - **Bone marrow depletion** (aplastic anemia) in **ruminants** . Platelets & WBCs . Accumulates over 1-3 mo - Not thiaminase leading to thiamine defc (B1) as seen in horses bec. B1 synthesized in rumen • Palatable • **Enzootic hematuria** (see Circ.) - Suspected to be due to bracken fern	• **Hemorrhagic syndrome** (platelet loss) - Melena, epistaxis, mucosal petecchiae, hematuria - Bleeding from body orifices & insect bites • CS ≥ 2 wk after grazing • Temp. elevation • Laryngeal edema, dyspnea • **Chronic infections** of multiple systems due to lack of WBCs • Usually fatal (death 1-3 ds after CS) • Enzootic hematuria - Neoplastic syndrome of urinary tract	• **Lab** - Platelet < 40,000 per ml (200,000 normal) - Profound leukopenia - Anemia less severe than thrombocytopenia due to longer half life of RBC - Die before anemia usually • No confirmatory test 	• **Usually fatal once CS** • Batyl alcohol (has reversed some cases) • No drug stim. bone marrow production Batyl OH  **Prognosis:** • Grave: > 90% fatal, don't survive once bone marrow depressed **Prevention:** • Remove bracken fern, keep out of hay

DDx
- Acute septicemia (p 258)
- Anthrax (p 247)
- Mycotoxicosis (p 185)
- Sweet clover (p 229)
- Trichloroethylene extracted soybean meal
- Leptospirosis (p 257)
- Babesiosis (p 91)

Bone marrow depletion
CS: Bleeding syndrome & Infections
Dx: ↓platelets & WBCs
Tx: Fatal - Batyl alcohol

Bracken Fern
(Pteridium)
Description
- Fernlike
- Broad, triangular fronds
- Fruiting bodies: small circular dots on underside of leaves

Moldy sweet clover toxicosis

Mk 1682, 1733; IM 1211, 1884; C3T 358; C1T 449; BR-hb 593; BR 1546; Tox 398; DC 61; PP/Mt 40

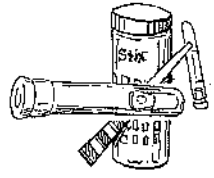
★

- **Rare** (not commonly used for hay)
- *Melilotus* spp. (sweet clover)
  - Moldy hay (esp. small bales) or silage
- Toxin: **Dicoumarin** synthesized from coumarin in clover hay by mold, Palatable
  - Grazing fields OK (no mold)
- **Cattle** in northern plain states, All spp. susceptible
  - Winter on moldy hay
  - Consumption over long time
  - Rapidly absorbed from GI
  - Crosses placenta - calves m/ die
- Mechanism: coagulopathy
  - **Inhibition of Vit. K** (like Warfarin poisoning)
  - Vit. K necessary for prod. of clotting factors (II, VII, IX & X)
  - Thrombin formation depressed

Vit. K

- **Swellings** (shoulders, thighs, neck, back & chest) due to SQ hemorrhage
- **Hemorrhage** where body traumatized (brisket, tuber coxae, carpi)
  - Hematoma formation, Ecchymoses
  - Epistaxis
  - Periarticular swelling
  - Hematuria
- No fever
- Death rate high bec. progresses before CS noted

- **History (exposure), CS**
- **Prolonged PT time** (later also APTT)
- No other abnormalities of clotting profile (normal platelet count, fibrinogen)
- **Anemia**
- Hypoproteinemia
- No fever
- Chem. analysis for dicoumarin - feed, blood & liver (absence doesn't R/O dz)

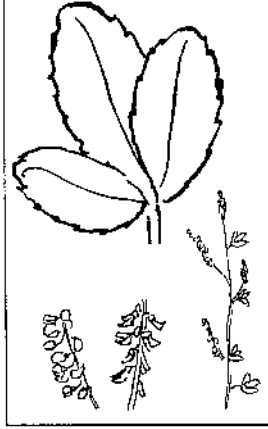


- **Remove source**
- **Vit. K1** (1.1-3 mg/kg IM) every 6 hrs until PT normal, Not K3
- Fresh plasma
- Whole blood transfusion

Prognosis:
- **Poor: often Dx too late**
- Good if early Dx & prompt Vit. K1

Prevention:
- Easily by careful forage preparation &/or inspection of hay & silage
  - Discard moldy portions

DDx:
- DIC (thrombocytopenia) (p 85)
- Bracken fern poisoning (p 228)
- Mycotoxicosis (p 185)
- Clostridial diz (Blackleg) (fever) (p 244)
- Septicemia (fever) (p 258)
- Liver failure (p 34)
- Dicoumerol (Warfarin) (p 214)



Sweet Clover
(Meliotus)

Description:
- 2-6" tall
- Highly-branched
- Leaves: 3 finely toothed, ovoid leaflets
- Flowers: white or yellow, 1/4" long, pealike, racemes (along stem)
- Widespread distribution by roadsides, fields, waste places

Rare • Mold on clover hay • Coumarin to dicoumarin; Vit. K Inhib.

CS: Coagulopathy - Hemorrhages/Swellings

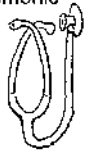
Dx: Prolonged PT time, Normal platelets

Tx: Vit. K1

Cardiotoxins - Nitrate

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Cardio-glycosides, Cardiotoxic plants C3T 371; C1T 440; IM 1881; BR-hb 592; BR 1544; Br 125, 621; Tox 364; Dc 41 **	• Toxic principle - Cardiac glycosides (CG) (principle agents) - Yew - alkaloids - All species susceptible - Cardiac & GI CS	• **Rapid**: CS - 4-12 hrs of ingestion, Death in 12-24 hrs (sublethal dose CS persist for 2-3 ds) • Depressed & weak to comatose • Fasciculation & trembling • Cardiac **"Thumps"**: incr. pounding HR - Fibrillation - terminal event - Cold extremities - Open mouth breathing - ↑ rate & depth of respiration - Hemorrhagic nasal discharge • GI CS (except in Yew) - Catarrhal/hemorrhagic diarrhea - Colic	• CS & History of exposure • **Prolonged auscultation**: bradycardia, tachycardia, dropped beats, heart block, auricular fibrillation, ventricular tachycardia & ventricular fibrillations • ECG not necessary • PM not pathognomonic - Rumen content	• **Rid GI of plant only effective Tx** - Rumenotomy: empty & wash - Ruminal transplantation • No antidote? • As in digitalis poisoning - Atropine + propranolol (extremely carefully) • TLC (tender loving care) • Remove from source **Prevention:** • Keep out of hay

Cardiotoxic plants
- Oleander (*Nerium oleander*) (CG)
- False helbore (*Veratrum sp.*)
- Foxglove (*Digitalis purpurae*) (CG)
- Indian hemp (*Apocynum sp.*) (CG)
- Lily of the Valley (Convallaria) (CG)
- Milkweed (*Asclepias sp.*) (CG)
- Yew (*Taxus sp.*) (alkaloid)



DDx
- Infec. gastroenteritis
- Castor bean (p 235)
- Arsenic poisoning (p 202)

Oleander toxicosis (IM 1881; DC 5081)

- *Nerium oleander*
- Ornamental hedge west coast & S. USA
- #1 cardiotoxic plant
- Toxic principle
  - Cardiac glycoside similar to digoxin
  - All parts, seeds most
  - Lethal dose cow or horses 30-40 dried leaves
  - Bitter taste: Ingested when given in hedge clippings mixed w/ grass clippings (palatable)
- Heart effects
  - ↑ force of contraction
  - ↓ rate of contraction
  - ↑ excitability
  - ↑ automaticity

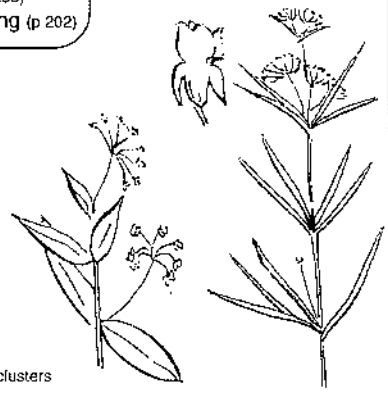
Cardiac glycoside
CS: "Thumps", Dyspnea
Dx: Hx, CS, Bradycardia
Tx: Empty rumen

- Description
  - Ornamental shrub or bush up to 20' tall
  - Flower: terminal clusters, showy pink, red, yllw or white blossoms
  - Leaves: leathery, oblong, sharp point (4-12" long)
    - Opposite or whorling

Milkweed, Asclepias

IM 1881; Tox 364; PP/Mt 36; 267

- 1° sheep, all species affected
- Toxic principle: Cardioactive glycosides & an alkaloid
  - Unpalatable: bitter taste - consumed when only thing or when mixed in hay
- Broad-leaved milkweed generally cardiogenic & GI
- Narrow-leaved gen. neurologic
- Description
  - 4' tall
  - **Milky sap**
  - Leaves: few to many, narrow to broad
  - Flowers: whitish to purple, waxy, umbrella clusters



Nitrate/ nitrite poisoning, Oat hay poisoning

IM 1164, 1887; Mk 1691 ; C3T 344; C1T 433; BR-hb 589; BR 1536; Br 622; Tox 398

★★★

- **1° NO_2 (ite), accum. plants**
- Nitrite 10 x more toxic than nitrate (NO_3)
- 1° Ruminants bec.:

$$NO_3 \xrightarrow[\text{Microbes}]{\text{Rumen}} NO_2 \text{ (nitrite)}$$

- Source:
  - Plants m/ accumulate toxic levels
    - . Roots & stems > leaves, not in flowers or seeds
    - . Highest level just before flowering
  - Contaminated soil & water
  - Nitrate fertilization
  - Drought
  - 2,4-D herbicides
- Water soluble (rain leaches into water supply)
- Additive in causing toxicity

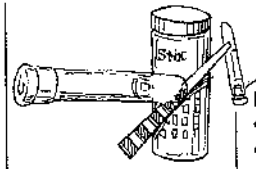
- Young more susceptible
- Properties
  - **Methemoglobin** (Mt-Hb) formed (Fe^{+2} to Fe^{+3})
    - . **Chocolate colored blood**
    - . **Tissue hypoxia**, can't transport O_2
  - Crosses placenta

- Acute - rapid onset
- **Tissue anoxia**: anxiety, polypnea, **dyspnea**, rapid, weak pulse
  - Cyanotic mucous membranes
  - Muscle tremors, weakness, ataxia, exercise intolerance
  - Terminal anoxic convulsions
- Die w/in hrs to a day w/o Tx
- Chronic - slow onset
  - Abortion + resorption ("lowland abortion")
  - ↓ body weight
  - ↓ milk prod.

Plant accumulators of nitrate

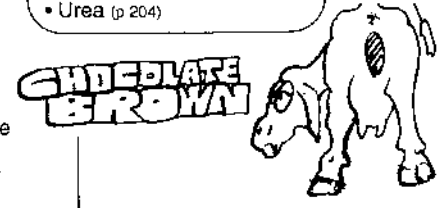
- ***Sorghum* - Johnson grass, Sudan grass**
- Small grain pastures (oats [worst cereal grain], barley, wheat, rye)
- **Fireweed**
- ***Brassica*** (rape, turnips)
- *Rumex* spp. (dock)
- *Datura* spp. (jimsonweed)
- *Solanum* spp. (nightshade)
- *Meliotus* (sweet clover)
- ***Amaranthus* spp. (pigweed, redrot)**
- Canada thistle, Cheeseweed, Lamb's quarters, Russian thistle, Smartweed, Wild sunflower

- **Blood chocolate brown** (Met-Hb)
- Cyanotic mucous membr.
- Exposure (fertilizer easy Dx)
- Lab
  - Measure methemoglobin
  - Add 1 part blood to 20 parts PO4 buffer (pH 6.6) to preserve Met-Hb
  - Forage, plant, H2O, soil, ruminal fluid, serum, blood, urine, fetus (freeze samples)
- NO_3 Field test (see box)



DDx:

- Chlorates (herbicide, Mt-Hb also)
- Cyanide (bright red blood) (p 222)
- Urea (p 204)



- **Slow IV Methylene Blue**, reduces Met-Hb back to Hb (1% in distilled water), 4-15 mg/kg
- Tx shock, hypotension
- Rumen lavage
- Chronic

Methylene Blue

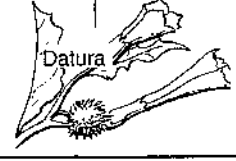
  - Progesterone
  - Vitamin supplement

Prevention:

- Check level in feed
- Dilute w/ other feed
- Ensile feed
- Cut forage late in a sunny day
- Test a few animals on forage 1st

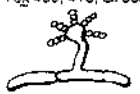
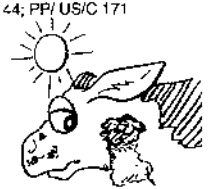
NO_3 field test

- Stock solution in brown bottle
  - 0.5 g diphenylamine in 20 ml water + 80 ml sulfuric acid
- Working solution
  - Equal parts stock sol. w/ 80% sulfuric acid
- Drop of working sol. to split stem at a node or joint
  - Deep blue color in 10 sec indicates 2% or higher nitrate
  - Poisoning possible w/ 1%

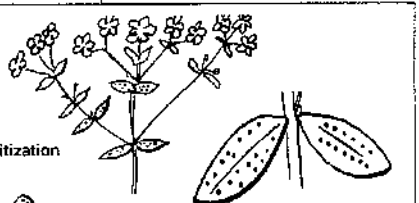


Met-Hb - Hypoxia - Rapid
CS: Dyspnea, Weakness, GI, Convulsions, Abortion
Dx: Chocolate blood, Cyanosis - NO_3 field test
Tx: Slow IV Methylene Blue

Hepatotoxic Plants

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Aflatoxin, Aflatoxicosis, Mycotoxicosis Mk 1679; C3T 355; B&R 1316; Br 613; Tox 409, 416; GI 832; Pa 103 ****** 	• Poultry > dogs > swine > horse > calves > cattle > sheep • Metabolites of *Aspergillus flavus* - Moldy corn, foodstuff • Mechanism - Suppresses messenger-RNA synthesis . Impaired protein synthesis . Ability to mobilize fats . Hepatic necrosis & fatty changes • **Immunosuppressive**	• Acute - Death w/no CS - Anorexic, depressed, ataxic - Dyspnic & anemic - Convulsions occasionally • Subacute - Icterus, hypoprothrombinemia, hematoma, hemorrhagic enteritis • Chronic - Reduced wt. gain, rough hair coat, anemia, enlarged abd., mild icterus, depression & anorexia 	• **History, CS** • Postmortem: Pale liver, cirrhosis, hemorrhagic enteritis • Lab - Decr. BSP secretion, icterus - Incr. serum transferase, ALP - Anemia  • Aflatoxin in feed - Presence of mold doesn't mean aflatoxin present • UV light - characteristic fluorescence - Greenish yellow "firefly"-like glow (BGYF, Bright Greenish Yellow Fluorescence)	• **Remove suspected feed** • Methionine or methionine + cysteine & Na thiosulfate • Incr. protein in diet • Vit. supplementation (A, D, E, K, B complex) • Aggressively Tx infections (since immune system is compromised) 
Moldy corn - Hepatotoxic **CS: Death, CNS, ↓weight, Rough coat** **Dx: Feed analysis** **Tx: Remove moldy feed, Supportive** 				
Photosensitizing plants, Photodermatitis, **"Trefoil dermatitis",** **"Rape scald"** ****** Mk 820; C3T 355, 904; IM 1442, 1882; BR-hb 238; BR 546; Br 615, 686; DC 239; L377; Pa 84; GI 824; PP/Mt 44; PP/ US/C 171 	• Not common, sunburn • Toxic principle - Exposure to sunlight, plus: - Chem. substances deposited in dermal tissue . **1° photosensitizing plants** contain photodynamic substances .. Absorbed from GI & deposited in dermis . **2° Photosensitizing plants cause hepatic damage** preventing clearance of normal chlorophyll breakdown products which are photodynamic & deposited in dermis - Chemical (phenothiazines, sulfonamides, tetracyclines)	• **Sunburn of light colored skin** (ears, nose, lips, vulva, udder, coronary band) • **Erythema, edema, blister & serum exudate** **DDx** • Common sunburn **1° Photosensitizing** • *Hypericum perforatum* St. Johnswort, Klamathweed • Brassica (rape) • Erodium (trefoil)	• Exposure, CS • Biological assays for 1° photodynamic principle	• **No specific Tx** • **Avoid sunlight & plants**

St. Johnswort,
Goatweed, Klamathweed
IM 1887, Tox 403
- *Hypericum perforatum*
- Cattle > sheep > horse
- Unpalatable unless starving, Spring
- Poisonous principle - **1° photosensitization (fluorescent pigment in "dots")**
- Ditches, low moist ground
- Widespread in USA



Description
- Stiff, erect, 1-3' tall
- Leaves in pairs covered w/ sm. clear to black **dots**
- Flowers: numerous, bright yellow

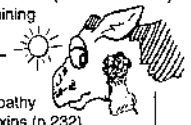
Pyrrolizidine alkaloid toxicity, "Ragwort poisoning"

Mk 1698; IM 928, 213t, 1878; C3T, 354,343; C1T 443; BR-hb 118, 597; BR 321; Br 618; Tox 385; DC 507; GI 831; Pa 84

★★★

- **Extensive livestock loss worldwide**
- **Poisonous plants:**
  - **Not very palatable** (forage sparse [drought])
  - 1st cut hay, alfalfa or hay cubes
- **Cumulative & progressive**
  - Chronic disorder
  - Problem 1-5 mo later (material often no longer on farm to ID)
  - In utero infections
- **West US** (also in pastures throughout US)
- **Pathology**
  - Alkaloids damage hepatocytes. Cause megalocytes & cellular death => **Fibrosis**

- **Weight loss**
- **Liver failure**
- **Hepatoencephalopathy** (abnormal behavior, ataxia, wandering, blindness, death)
- **±Icterus**
- **Photosensitization** (white areas)
- Diarrhea, colic & straining
- Abortions

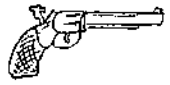


DDx

- Hepatoencephalopathy
  - Fungal hepatotoxins (p 232)
  - Rabies (p 144)
  - Brain abscess/tumor (p 140)
  - Lead poisoning (p 152)
  - Encephalomyelitis (p 134)
- Wt. loss & jaundice
  - Parasitism (p 54)
  - Chronic fascioliasis (p 37)
  - Hepatitis & biliary obstruction (p 37)

- **Geographic area**
- Feed analysis, time consuming & $$
- Lab: nonspecific
  - Clotting abnormalities
  - GGT, AST (liver enzymes normal or elevated)
  - BSP is prolonged
- **Liver biopsy** (similar to aflatoxins)
  - Triad: hepatocytomegaly, **fibrosis (cirrhosis)**, bile duct proliferation
- None of above specific for this toxicity so Dx difficult if no longer consuming

- **Euthanasia once CS**
- Remove unaffected cattle from plant source
- Tx for liver failure
  - Sedate (xylazine) for CNS CS
  - 10% glucose IV + methionine
  - Mineral oil + neomycin or lactulose (acid GI ammonia to ammonium)
- Correct any acidosis slowly
- Slow 5-10% dextrose drip
- Sm. meals 4-6 x/d., molasses
  - Vit. B1, folic acid & Vit. K1
  - Grazing, protect from sun



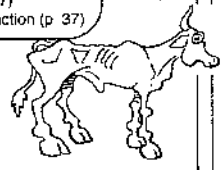
Prognosis:

- **Poor to grave:** due to fibrosis

Fibrosis of liver
CS: CS in 2-8 mos, Liver failure, CNS
Dx: Liver biopsy
Tx: Euthanasia

Tansy ragwort, *Scenecio jacobea*

(Mk 1698; IM 850)



Hepatotoxic plants

Pyrrolizidine alkaloids - 2° photosensitization:

- **Senecio** (tansy ragwort [S. jacobea], groundsel [S. vulgaris], ragwort)
- Crotalaria (rattlebox, rattleweed, wild pea)
- *Amsinckias intermedia* (fiddleneck, fireweed)
- Heliotropium (common heliotrope)
- Eichium (Viper's bugloss)

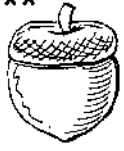
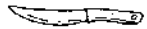
Other hepatotoxic plants

- *Lantana camara* (Lantana)
- Tetradymia spp. (Horsebrush, rabbit brush)
- Gossypium sp. (Cottonseed, contains Gossypol)
- Xanthium sp. (Cocklebur)
- *Microcystis aeruginosa* (Blue green algae)
- ***Aspergillus flavus* (fungus)**
- *Amanita phalloides* (Death cap mushroom)

1° Photosensitizing plants

- *Hypericum perforatum* - St. Johnswort, Klamathweed
- Brassica (rape)
- Erodium (trefoil)

Oak Poisoning

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Oak poisoning, **Quercus poisoning, Oak bud or acorn poisoning** Mk1720; IM890, 1850; C3T372; C1T463; BR-hb 676; BR 1718; Br 623; BM&S 468, 435; Tox 389; DC 506t; Pic 210 *** 	• **Quercus spp.** • Buds until "green out" in Spring, acorns in Fall - **SW USA**: browsing new leaves in Spring - **Midwest & NE** eating acorns in Fall . Windstorms drop acorns . Hi rainfall softens acorns (more palatable) • **#1 Cattle** (less selective eating), also sheep, goats, rarely in horses • Toxicity - Oak tannin (gallic acid [gallotannin]) . Hepatotoxic & nephrotoxic • Description - Oak scrubs to trees, found all over - Irregular, rounded leaves & acorns - White oaks & black oaks - 60 spp. in USA & Canada 	• Gradual onset • **Emaciation** (anorexia), GI atony • Depression • Constipation then diarrhea (mucus or blood) • Rough hair coat & dry nose • Dehydration, Icterus • Oral lesions • Occasional abortions • **Anuria then polyuria** (dilute) PU/PD • **Uremic smell** • Hematuria • Ammonium breath (renal) • Edema • Hemorrhage • Progressive weakness & collapse • **Death in 3-7 days**	• History, CS  • Lab  - **Elevated GOT, GPT** - **BUN & creatinine elev.** - Elev PCV (dehydration) - ↑ hemoglobin - **Low urine spec. gravity,** granular casts & hematuria - Occult blood positive • Postmortem:  - Uremic smell to carcass - Gastroenteritis (mucoid to hemorrhagic terminal intestine, ulceration from pharynx to colon - **Edema**: SQ, pelvic limbs & ventr. body, ascites & hydrothorax - **Perirenal edema** - Hemorrhages GI, abdomen, kidney - Renal lesions: nephrosis, enlarged, pale, hemorrhagic kidneys, hyaline casts	• **Remove from oaks** • **Stimulate rumen,** pills to move through GI • Fluids (dehydration & acidosis) • Supplemental feed so don't continue to eat oak  • Rumenotomy if severe • Diuresis, acid base balance & serum calcium levels $$$$ **Prognosis:** • **Poor: Rarely recover once renal dysfunction**  **Prevention:** • Prevent exposure • 10-15% calcium hydroxide/protein supplements in grain ration to protect if exposure can't be prevented

DDx
- Pigweed poisoning (*Amaranthus retroflexus*), similar lesions (p 234)
- Aminoglycoside poisoning (p 217)

Buds in Spring (SW) - Acorns in Fall (MW, NE)
Tannins - Nephrotoxic & Hepatotoxic
CS: Gradual; PU/PD, Wt. loss, Death
Dx: Elev. BUN, GOT, Low Specific Gravity
Tx: Remove

Amaranthus/Pigweed poisoning (IM 1888; C3T 352; BR 1536; Tox 389; DC 506; PP/O 16)

- 1° **swine**, Occasionally in cattle
- Ingestion of *Amaranthus retroflexus* (redroot, pigweed)
- CS, course of diz, gross & microscopic lesions strikingly similar to oak (acorn) toxicity
- Examine pasture for either species to DDx, no chemical analysis for either diz

Dogbane, Indian hemp

C3T 352; IM 11881; Tox 391; PP/US/C 32, 263

*

- *Apocynum cannabinium* (Indian hemp, dogbane), *A. androsaemifolium* (Spreading dogbane)
- Cattle, horses & sheep
- CS: Urinary system, cardiac arrhythmias
- Dx: Urinalysis —> Crystals in urine
- Tx: Dilute toxins —> Diuretic

Dogbane
Description
- Erect herb
- Woody stem - milky sap
- Leaves: opposite pairs
- Pods hanging in pairs

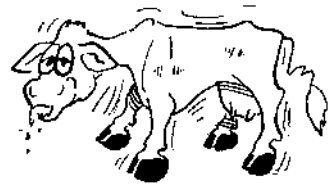
Larkspur toxicosis, Delphinium

IM 1879, C3T 346, 350, 393; C1T 466; Tox 371; DC 508t; PP/Mt 14, 15; PP/US/C 25

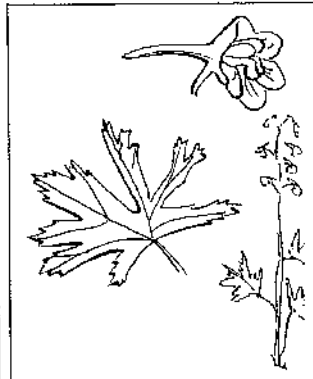
**

- **#1 poisonous plant in W. USA**, relatively nontoxic to horses & sheep
- **Tall or high larkspur** (*Delphinium barbayi, D. occidentale*)
  - Higher elevations
- **Short or low larkspur** (*D. nelsonii, D. andersonii, D. geyeri*)
  - Plains or low mountain slopes
- Toxic principle: alkaloid (Delphine) (similar to substance isolated from Aconitum)
  - **Palatable** to livestock, will eat even if other forage is also available
    - Low: Spring, cattle like it
    - Tall: midsummer at about its flowering stage

- **General, nonspecific CS**
  - Salivation/Eructation
  - Bloat
  - Muscle fasciculation
  - Irregular HR
  - Staggering & falling
  - Resp. paralysis
  - Collapse
  - Death



- CS & History of eating



- **No antidote**
- **Relieve bloat**
- Do not disturb animals

Prevention:
- Palatable so keep away until flowers
- Spray pastures for 2 successive years

Larkspur
Description
- Low: 1/2-2'
- Tall: 3-7'
- Flowers: have "spur", blue, purple, white
- Stems: low - fine, hairy; tall - no hair, hollow
- Leaves: low - cluster at base; tall - deeply lobed
- Look alike: geranium (shallow lobed, solid stem, sticky hairs covering leaves & stem)

#1 in West cattle - Tasty; Tall & Short
CS: Nonspecific general, GI, CNS, Resp.
Dx: Hx, CS
Tx: None • Control: Management

Castor bean (ricin) toxicity

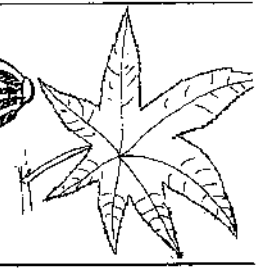
Mk 1718; IM 11889; C3T 351; Tox 382

**

- **Minor importance; *Ricinus communis*** (Oil producing plant from which seeds are harvested)
- **Toxin: Ricin**: seed-borne protein phytotoxin, potent proteolytic enzyme, antigenic properties
  - Lethal dose 0.1 ug/kg, plant not usually ingested, but seeds in feed as an oil by-product, readily absorbed form GI
- **CS:** Gastric irritation - profuse, watery diarrhea; anaphylactic shock m/b, Hi fever, depression, incoordination; muscle twitching; pounding heart beat; convulsion before death
- **Dx:** Hx of ingestion; Seed in feed material; RBC agglutination or precipitation test for ricin
- **Tx:** Sedation & Tx shock initially; Keep warm; Antihistamines; IV fluid; prevent further absorption: oral laxatives, intest. protectants & activated charcoal

Minor importance, GI irritation

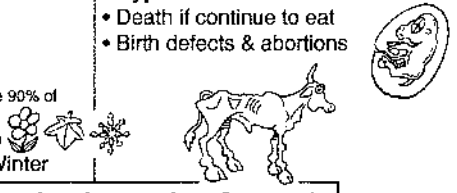
Castor Bean



- Description
  - Shrub - 12' tall
  - Stem: reddish - purplish
  - Leaves: large, alternate, deeply palmated, 6-11 lobes
  - Fruit: spiny capsule
  - Seed: large, brown, female tick-like

CNS - Toxic Plants

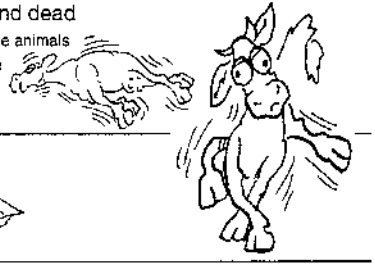
Condition	Facts/Cause	Presentation	Diagnosis	Treatment
Locoweed *** **"Locoweed diz", Texas loco,** IM 1877; C3T 348, 357; C1T 456; BR 1554; Tox 366; DC 507t; N-L 100	• **West; Horses** > cattle > sheep • Plants: - **Astragalus** spp., not all are toxic, Specklepod loco, Pursh loco (*A purshii*) - **Oxytropis** spp. - Swainsona in Australia • Toxic principle: Unknown (m/b barium, selenium, alkaloid or larhyrogen) - Also Selenium accumulators • Unpalatable, starvation - **Addiction** if start eating it - Chronic grazing: cattle consume 90% of their weight over 4-6 wks => CS • Spring when little forage, also remains green in late Fall & Winter	• **CNS** (motor & sensory) - **Stagger** (irregular gait/hypermetric) - **Depressed** (staring gaze) - Rough hair coat - Dull eyes - Emaciation • **Hyperexcitable** when stressed • Death if continue to eat • Birth defects & abortions	• CS, History of prolonged eating	• **Remove from plants** • **Will selectively seek out plant** (addicted) **Prognosis:** • M/ recover, m/ have permanent damage throughout life, m/ show loco signs when stressed **Prevention:** • Keep animals away from loco weed areas • If must graze such area watch & remove addicted animals



Unpalatable, Addictive; Toxin ? Chronic grazing Astragulus, Oxytropis
CS: CNS - Irregular gait, Rough coat, Emaciation, Depression
Dx: Hx, CS
Tx: Remove from plant

Astragulus spp. also Se accumulators

Grass tetany, **Wheat pasture, Crested wheatgrass poisoning,** Green oat poisoning, Barley poisoning ****	• **See Neuro pg 146**; Hypomagnesemia **facilitates NMJ, Tetanic spasms, Lactating beef cow < 7 yrs**, low Mg (grow too fast, wheat, barley, oats) • **CS: Alert, Hyperexcitable, Tetanic muscle spasms**, Bellowing & frenzy, **Staggering, Recumbent, Violent clonic convulsion & Opisthotonus**, Salivation & frothing at mouth, Snapping eyelids, Rapid forceful respirations, **Death - Resp. failure,** Found dead • **Dx: CS, Hx only bec. of need for rapid therapy,** Confirm herd problem - serum or urine Mg sample from multiple animals • **Tx: Emergency, IV Milk fever, Ca/Mg combo**, Mg oxide orally or SQ, or legume hay m/ prevent relapse • **Px: Good if treated early, Guarded if convulsions & tetany** • **Prevention**: Mineral blocks & salt licks, Mg fertilization on pasture (most efficacious way)
Milkvetch, * **Vetch toxicosis, Timber milkvetch** IM 1883; C3T 348; C1T 469; Br 147	• *Astragalus miser*, 1° Cattle, all species; W USA; Toxin: 2-nitro-1-propanol or proprionic acid • CS: Acute - Nervousness, Irregular gait, Coma, Sudden death (resp. failure); Chronic - Dullness, Incoordination of hindlimbs, "Goose stepping" & Paresis, Respiratory difficulties, Posterior paralysis • Dx: CS & Hx of ingestion, DDx: Loco weed (no respiratory involvement) • Tx: Symptomatic & supportive • Px: May recover if removed from plant, Continued ingestion => Death



Ergotism, Rye staggers

Paspalum staggers, Bermuda staggers, Tremogenic toxins
Mk 1684; IM 1115, 1892-4; C3T 334, 860; 370; C1T 460, 1129; B&R 1310; Br 613, 616; Tox 425, 429; DC 505t; L 417; N-L 213t

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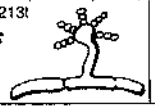


- ***Claviceps purpura***, parasitic fungi on grains & grasses
  - **#1 Rye**, oats, wheat & Kentucky blue grass
  - *Claviceps paspali* (Paspalum, Dallis, Bermuda grasses)
- Cattle, sheep, horses
- Warm, moist conditions
- Toxicity
  - Alkaloids: ergotamine, ergotoxine & ergometrine, tremogenic alkaloids
  - Incr. muscle motor activity of uterus
  - Arterial & venous constriction (peripheral vasoconstriction) - gangrene
  - Vascular stasis, thrombosis, gangrene

Dallis grass

Fungus (Claviceps) on grasses & grain
CS: Dry gangrene; CNS - staggers (rare)
Dx: ID ergot (black banana)
Tx: Remove from source, Support

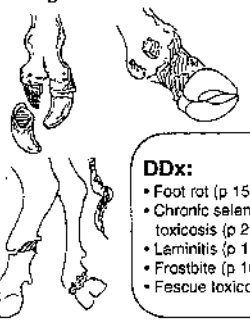
- **Dry gangrene** (limbs, nose, ears, tail)
  - Lameness - hindlimbs 1st
  - Swelling & tenderness of fetlock, then darkening & discoloration below fetlock
  - **Sloughing of hoof**

- **GI**: vomiting, colic, constipation or diarrhea
- **CNS - Convulsive** - higher daily doses 2-7 d
  - Hyperexcitability, belligerency
  - Muscle tremors to marked ataxia
  - Overstepping & falling
  - Exaggerated hypermetric gait, ataxia (proprioceptive deficit), exacerbated w/ exercise or excitement
  - Recumbency
  - Convulsion & opisthotonus (dors. recumbency & arched back)
- Abortion in cattle & swine (no solid evidence)

TREMOGENS

- **Ergot ID on grain** (rye, wheat or barley)
  - **Dark purple to black banana-shaped body** larger than grain

- Chromatographic analysis for ergot alkaloids in feed



DDx:
- Foot rot (p 159)
- Chronic selenium toxicosis (p 226)
- Laminitis (p 163)
- Frostbite (p 163)
- Fescue toxicosis (p 161)

- **Remove contaminated grain**
- Brush to remove heads of grass
- Supportive Tx
  - Supplemental feeding
  - Antibiotics
  - Pain control

Phalaris staggers (IM 1881, 1892, 1119; N-L 213t): caused by ingestion of perennial Canary grass *Phalaris tuberosa*; Cobalt supplementation can prevent by inactivating neurotoxin; but will not cure syndrome

Toxic blue-green algae, ***

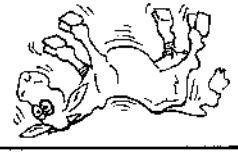
Algae or algal poisoning,
IM 1078, 1890; C3T 292; Tox 384

- Blue-green algae common in bodies of fresh water
  - Microcystis, Anabaena, Aphanizomenon
- Summer when algae "bloom" forms a thick green scum on water
  - Algae dies, toxin in water - foul, fishy smell
  - Wind blows to shore, drink & die
- Ruminants more sensitive than monogastrics

Summer bloom - Drink - Die
CS: Acute death - CNS - Liver
Dx: Difficult - Hx, CS
Tx: Support • Px: Grave

- **Acute death w/in minutes**
  - Rapid onset (15-45 min) & progresses to prostration & death
  - Nausea, vomiting, colic, bloody diarrhea, prostration, muscle tremors, dyspnea, cyanosis, paralysis & death
- **CNS**: seizures, prostration m/b
- Chronic
  - Depression, anorexia, hemorrhagic gastroenteritis
  - Photosensitization
  - Hepatic diz

- **Dx: very difficult**
- Exposure
- No practical way to isolate & identify toxins
- Postmortem
  - Gastroenteritis
  - Degeneration of kidney & liver (centrilobular necrosis)



- **No specific antidote**
- **Often animal dead or dying before Tx**
- Supportive care
- Activated charcoal & oil

Prognosis:
- **Grave**, die in 24 hrs

Prevention
- Organic herbicides or copper sulfate (bluestone) Tx of water to kill
  - Follow label direction to avoid toxicity
- Fence off water when algae bloom is present

CNS

POISONOUS PLANTS

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Water hemlock, **Western hemlock Poison parsnip, Wild parsley, Snakeroot** IM 1886; C3T 358, 346; C1T 467; Br 614; BR-hb 602 ; Tox 364; PP/Mt 17; PP/USA/C 373 *	• **Cattle**, all susceptible • ***Cicuta cituta, C. douglasii*** • Toxin: Alkaloid (Cicutoxin) extremely toxic - Throughout plant, Hi in root structures - Leaves esp. toxic in spring before blooming - 10 oz will kill cattle or horse - Most violent toxic plant • Early spring if low forage • Aquatic (ditches & streams) • Public Health: mistaken for wild parsnip, children blowing through hallow chambers like a reed - Confused w/ Poison hemlock (*Cituta douglasii*)	• 6 hrs after ingestion • **Death** m/b in 1-2 hrs after CS (resp. paralysis) • Muscle twitches, tremors • **Violent grand mal seizures** • Rapid pulse, Incr. RR (tachypnea) • Salivation, frothing at mouth • Dilated pupil, Coma • Birth defects like lupine (spinal curvature & crooked limbs)	• History, CS	• No specific Tx - Sedate to control convulsions, phenobarbital PHENOBARBITAL Prevention: • Seldom eaten if appropriate feed available
Cicuta, Branched root, Chambers **CS: Grand mal seizures - CNS** **Dx: Hx, CS** **Tx: None, Phenobarbital**	PH			Description • 2-7' tall • **Root: branched, tuberous, chambered** • Stem: highly branched • Leaves: divided 2 or 3 times, serrated edges • Flowers: small, white & umbrella clusters • Wet soil (aquatic, along streams & marshes) • Confused w/ Poison hemlock
Poison hemlock IM 1879, PP/Mt 17; PP/USA/C 379; C3T 346; C1T 459, 467; BR-hb 608; Br 614; Tox 371 *	• Cattle & pig - sheep & horse less susceptible • ***Conium maculatum*** • Toxic principle: Alkaloid *(Coniine)*, extremely toxic, but less than Water hemlock - CNS - Throughout plant, Hi in root structures - Leaves esp. toxic in spring before bloom - 4-8 oz. poison sheep & cattle respectively • Moist soil - semiaquatic, stream beds & ditches • Condition of poisoning - Spring w/ no other forage (overgrazing) - **nauseating taste** • PH: humans - mistake roots for wild parsnip & leaves for parsley	• Similar to water hemlock, **except seizures** **- Trembling, ataxia** • Mydriasis • Weak, slow heart rate • Cold extremities • Coma & death • Birth defects like lupine (spinal curvature & crooked limbs)	• History (exposure), CS	• Stimulants • Charcoal Charcoal Prevention: • Seldom eaten if appropriate feed available
Conium, Tap root, Purple spots **CS: No seizures, CNS** **Dx: Hx, CS** **Tx: None, Charcoal**	PH			Description: • 2-10' tall • Stem: highly branched stems, hollow; **purple spots** on lower stem **- Unbranched tap root** • Leaves: divided (similar to parsley) • Flowers: small, white & umbrella clusters

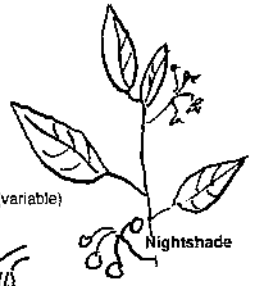
Solanum toxicosis, Nightshade,

Atropine-containing plants

IM 1880; C3T 351; C1T 461, Br 613, 616; BR-hb 611t; BR 1582; Tox 360; PP/O 13

*

Description:
- Herb or vine
- Leaves: petioled (stalk), irregularly lobed (variable)
- Flowers: yellow, blue or purple
- Fruit: berry



- *Solanum spp.* (Nightshade), green potatoes; **Toxin:** alkaloids (solanine, belladonna-like), local irritation & anticholinergic properties
- **CS: CNS**: dilated pupil, depression, weakness, progressive paralysis & prostration, m/b death
  GI: Bloat, salivation, diarrhea; **Resp:** dyspnea
- **Dx:** Decr. in Purkinje cells in cerebellum; gastroenteritis
- **Tx:** No specific antidote, atropine suggested, carefully in large animals, parasympathomimetic (physostigmine or pilocarpine), phenothiazine tranquilizers carefully because m/ accentuate anticholinergic affect

Jimsonweed, Datura

stramonium, **Thornapple**
IM 1880; C3T 351; Tox 369

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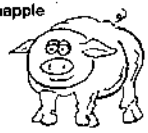
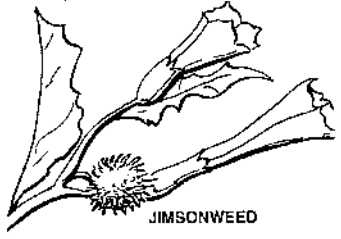


Description:
- 4-5" tall
- **Leaves:** long petioled (stalk attaching leaves), alternate
- **Flowers:** solitary, showy, large, tubular, born at fork of stem & branches
- Fruit: spiny capsule



- Toxic principle, **Atropine-like** alkaloid (scopolamine); Distasteful; swine > cattle, sheep & goats
- **CS:** CNS - Depression & parasympatholytic,
  - Restlessness, irritability, weakness, tachycardia
  - Mydriasis, photophobia, constipation, thirst, incoordination & paresis, respiratory failure, delirium, convulsions
- **Dx:** Drop of urine in lab animal's eye => mydriasis
- **Tx:** Symptomatic - parasympathomimetic (physostigmine); Activated charcoal; Laxatives
  - Convulsions - diazapam (not phenothiazine), anticholinergics

Death Camus, Zigadenus

IM 1880; C3T 346; C1T 466; Tox 393; PP/Mt 28; PP/O 14

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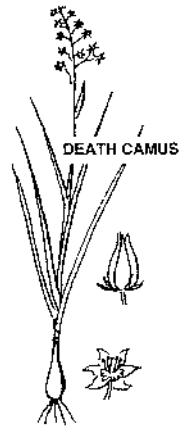


Description:
- Slender perennial herbs (8-24")
- **Onion-like bulb**
- Single stem, basal leaves w/ V-shaped cross section
- Flower whitish to yellow - racemes (along stem)

- **Sheep,** all classes are susceptible; Open range - **Western USA**
  Very early spring when lack of other forage
- Toxic principle: Alkaloids (zygocine & zygademine); all parts of plant (esp. bulb) all times, Humans mistake for wild onion, Distasteful
- **CS:** Salivation, nausea, weakness & staggering, convulsions, coma, death; Resp. distress, incr. RR; Temp incr. then falls below normal; Cardiac
- **DDx:** Onion (has onion odor)
- **Tx:** No specific Tx; Symptomatic & supportive
- **Px:** Severely affected die. Less affected m/ recover

Nicotine/Tobacco poisoning

IM 1879; C3T 360; C1T 473; Tox 248

*

WILD TOBACCO
Description:
- Annual, 1-3', sticky
- **Leaves** alternate, large on bottom

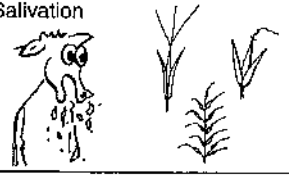
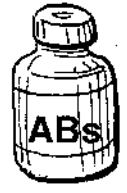
- *Nicotiana, wild tobacco*: Toxin: Nicotine alkaloids
- **CS:** Nicotine poisoning, Stim of ANS, Paralysis, Death
- **Dx:** Exposure, CS
- **Tx:** None; Activated charcoal
- **Px:** Most will recover, unless massive ingestion

Hairy vetch, Fava bean

IM 1890, 2131; Tox 174; PP/US/C 362

- *Vicia billosa*, Horse & cattle, Toxic principle: unknown
- **CS:** Neurological (bellowing, discomfort, sexual excitement, convulsions); Nasal discharge, Coughing, Salivation; SQ edema, Alopecia
- **Tx:** No Tx, Freq. refractory to Tx

Trauma Plants

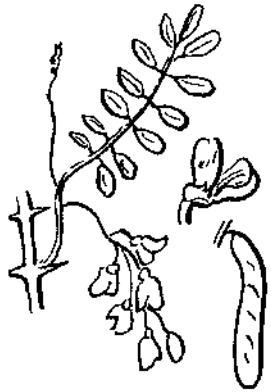
Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Mechanical trauma-producing plants IM 1884; BR-hb 599; BR 1584; Tox 376, 384; GI 706 ★★★	• Bristle grass, Foxtail, Cheatgrass, Needle grass, Povert grass, Crimson clover, Cockleburr (*Xanthium strumarium*) • Common in hay **Common in hay** **CS: Damage & Irritation** **Tx: Remove source, ABs**	• Mouth ulcers • Trauma to skin around mouth & eyes • Lodge alongside mouth • Salivation 	• History, CS • Visualize 	• Remove source from environment • Remove from animal • Antibiotics 

Black locust

C3T 351; IM 1889; Tox 382; PP/A 43

Description:

- Shrub or tree - 40' tall
- Rough deeply furrowed bark
- Paired spines at base of each leaf
- Leaves odd pinnate - 12" long
- Flowers: white, drooping racemes

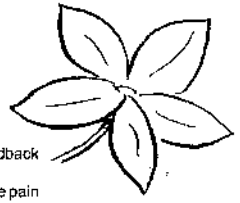


- *Robinia pseudocacia*
- Horses, cattle & sheep; Toxin: Lectins in tree bark, Not palatable Only small amount for CS
- **CS:** Colic, Diarrhea, Weakness, Posterior paralysis, Mental depression, Fatal cases rare
- **Dx:** Hx, CS, Irregular HR
- **Tx:** Symptomatic & supportive; Digitalis in severely affected; Avoid exercise (heart)

Wild jasmine (IM 1454, 1884; B&R 1353; PPUS/C 278; C3T 350)

★

- Description: Ornamental shrub, Leaves: alternate lancelet, Flowers: showy, axillary clusters, trumpet shaped - 1" long, Fruit: small berry

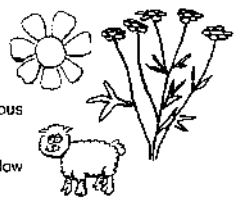


- *Cestrum diurnum*; Toxin: Natural Vit. D3 glycoside, Not recognized by negative feedback Causes excess Ca absorption
- **CS:** Weight loss over mos., decr. appetite, Lameness, "humped-up" stance, Soft tissue pain on extension
- **Dx:** Serum Ca elevated, P often normal, Renal failure signs, Elev. BUN, creatinine & phosphorus, decr. Na & Cl • PM: Mineralization of soft tissues (renal cortex, vessels, heart valves, tendons)
- **Tx:** No specific Tx

Bitterweed, Bitterweed, Hymenoxys (C3T 349; IM 1889; Tox 380; PP/O 4)

★★

- *Hymenoxys odorata*, Sheep in SW USA, also cattle & horses, Distasteful (bitter), m/ develop taste for it, Cumulative
- **CS:** Depression, anorexia, rumen stasis & tympany, back arched & grinding teeth, Serous nasal discharge, dyspnea, head pressing, tetanic convulsions, Death 24-48 hr
- **Tx ?**
- Description: Weed 2' tall, Much branched, Leaves: narrow, like stem, Flower: bright yellow

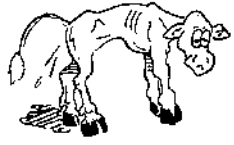


Broom-snakeweed

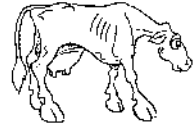
C3T 347; IM 1884

***

- *Gutierrezia* spp.
- Abortion problem in cattle



- Anorexia, Listlessness
- Rough hair coat
- Weight loss
- Diarrhea or constipation
- Vaginal discharge
- Bloody urine
- **Abortions** in last trimester (60%)
  - **Retained placenta (RP)**
  - **Weak calves**



- History, CS

- **Tx:** Remove plants

Broomsnakeweed

Description
- Herbaceous plant branching near ground
- Yellow composite flowers
- Small, alternate, filiform leaves

Lupine toxicity, Lupinosis **

IM 1879, 1720; Tox 372; PP/Mt 33; C3T 346; C1T 458, 466; Pic 214; L 415

- Toxic principle
  - Alkaloid: quinolizidine alkaloid (lupine)
- **Sheep - devastating range problem**
- **Calves - Crooked calves diz** (arthrogryposis [rigidity of joints], misaligned, malpositioned limbs, cleft palate, twisted neck or combo)
  - Ingested in early gestation 40-70 d (similar to hemlock)

- Description
  - 1/2-3" tall
  - Leaves: palmately compound 5-7 fingers
  - Flower: blue, white, pink, yellow or blue-white, in loose clusters
  - Fruit: pealike pod

Poison hemlock, astragulus, or oxytropis can also cause crooked calf diz

Abortions ***

Locoweed, Wild tobaccos, Nitrate, Pyrrolozidine alkaloids, Broomsnakeweed, Oak, Ponderosa pine

Ponderosa pine needle, Pinus toxicity

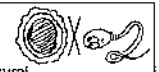
IM 1886; Tox 401;PP/US/C 119 ***

- *Pinus ponderosa*; Toxin - Poorly described
- CS: Abortion & retained placenta, Last trimester, Weak calves if born
- Tx: No Tx
- Prevention: Alternate source of feed

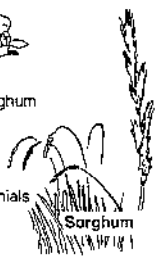
Description
- Tree
- Needles - 7-11" long
- Ovoid cone 2.5-6" long

Zearalenone **

IM 1893; Tox 410, 412, 413, 420, 422; DC 505



- **Rare**; Estrogenic chemical produced primarily by *Fusarium roseum* (mold) Natural contamination of corn (most commonly ear corn stored in cribs); also barley, oat, sorghum, wheat & hay
- Cattle more resistant than swine (induced anestrus), Swine 1-5 ppm, cows 50 ppm
- **CS:** Reduces conception rate

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Fescue toxicosis C3T371; BR1592; IM1312, 1893; Tox 394, 402, 425; DC 505t; L 418; Derm 242 *** 	• **See Gen. pg 264** • Tall fescue (*Festuca arundinacea Schreb*) - **Major forage grass** (35 mil. acres in USA) - Popular bec. adaptable to many soil & climatic conditions & can be grazed throughout most of winter - High quality, but also toxic - Major grass in **southeast** • Single or combination of syndromes if prolonged grazing • Toxic agent: unknown - Assoc. w/ fungus (*Acremonium coenophialum*) formerly *Epichloe typhina* . Grows inside plant's intercellular spaces (requires special lab procedures to detect) - Believed to decr. prolactin levels	• **Fescue foot** - **Wt. loss** (don't move to get food, pain) - Lameness of hindlimbs - Gangrene of feet & tail . Sloughing of rear hooves • **Summer slump/poor prod.** - ↓ Weight gain (reduced feed intake) - ↓ Milk production - Repro problems, Diarrhea - Failure to shed winter coat - ↑ Temperature - Search for shade instead of food • **Fat necrosis** (See GI pg. 50) - Few clinical signs unless interferes w/ intestines or uterus - **Weight loss**, scanty feces - Chronic poor doers - Dystocia	• Hx (fescue ingestion for wks or mos) • CS • ↓ Serum prolactin levels (normal 67 mg/ml) *m/b* helpful • Rectal for fat necrosis  	• **Usually valuable feed** • **If problems** - Slaughter - fescue foot or large masses of necrotic fat - Remove fescue - Good alternate feed - Summer slump often return to normal  **Prevention:** • Graze other forage • Where major forage (as in SE U.S. - Test for presence and quantity of endophyte fungus - Dilute w/ legumes (unsuccessful) - Fungicides (unsuccessful) - Fungus free seeds planted
Sorghum poisoning, Sudan grass poisoning, Cystitis/ataxia syndrome, Lathyrism Mk 594, 1730; CST 368; Tox 374; PP- USA/C 488; N-L 291 * **CNS - Urinary** **Recovery rare**	• **Usually valuable forage** • **Grazing *Sorghum*** spp. or hybrid sudan pastures - Contain cyanide (mech. unknown) - Worse when rapidly growing or stunted by drought • Other problems - Nitrate - Spinal demyelination - Teratogenic • **Horses** almost exclusively, reported in sheep & cattle • Myelomalacia or lower spinal cord • Toxic to CNS - Degeneration of nerve roots (lumbar, sacral & caudal) • Wet season - young growing grass	• **Posterior incoordination** - Swaying rear limb gait - Knuckle over - Hopping gait • **"Dribbling"** (urinary incontinence) - Relaxed perineal mm. - Flaccid distended bladder - Vulva opens & closes repeatedly - Penis relaxed & protruded • **Cystitis 2°** to urine retention - Scalding of skin & dermatitis - Pyelonephritis sequela • Abortions • Foals from sudan grazed mares - Articular ankylosis or arthrogryposis	• History of sorgum & CS • No specific tests • Urinalysis for cystitis & pyelonephritis • Postmortem - Wallerian degeneration & swelling of axons	• Withdraw Sorghum from diet - Improve over wk-mo (m/ not be complete) • No specific Tx - ABs for urinary tract infection Prognosis: • Recovery rare  Control: • Diversity diet (Sorghum not complete diet) Description • 4.5' coarse perennials • Leaves 3/4" wide  Sorghum

GENERAL - IX

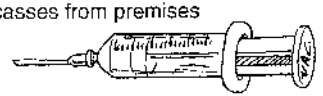
Clostridial Infection

GENERALIZED CONDITIONS

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Blackleg, Emphysematous gangrene, Clostridial myositis Mk 324, C3T 569, 897, IM 1706; BR-hb 287; BR 684; Br 557; DC 469; Derm 155 ***	• **Peracute, febrile disease** • **Emphysematous & edematous swelling of heavy muscles** • Cattle & sheep • ***Clostridium chauvoei*** *(feseri)* - Normal inhabitant of GI tract - Latent spores in soil - Ingested (?), passes from gut to bloodstream to muscles • Endogenous infec. (originate from w/in animal, DDx malignant edema) - Develops w/out wounds, but bruising m/ precipitate • Outbreaks - few new cases each day up to 10 days • **Beef breeds mainly** - **Best animals of a group** (healthy, gaining weight) • **6 mo-2 yrs** (range 6 wk - 12 yr) • Summer & Fall, rarely winter	• **Sudden onset - few found dead** • **Acute lameness** • Marked depression • Fever initially, then normal or subnormal • **Edematous & crepitant swellings** of hip, shoulder, chest, back, neck, etc. - At 1st swelling small, hot & painful - Swelling enlarges, crepitance, skin cold & insensitive • Prostration & tremors • **Death in 12-48 hours** • Lesions m/b only in myocardium & diaphragm	• **Hx (sudden death), CS** • ↑ Skeletal muscle enzymes (CK, AST, LDH) • Rapid clotting of blood • Postmortem: - **Muscles - dark red to black**, dry & spongy . Sweetish odor (rancid butter) . Serosanguinous fluid & gas pockets • **FA for *C. chauvoei*** rapid & reliable - Take samples as soon after death as possible	• **Outbreak** - **Bacterin** to all susceptible cattle (protects in 10 days) - **Prophylactic penicillin** :o all to prevent new cases for 10 ds, then bacterin protects • Individuals - Parenteral & multiple injections of penicillin (frequently unsuccessful) - **Debridement &/or fenestration** (to reduce swelling, aerate tissue & remove necrotic tissue) **Prognosis:** • **Guarded to poor**

DDx:
- Malignant edema (p 245)
- Anthrax (p 247)
- Lightning strike (p 299)
- Bacillary hemoglobinuria (p 90)

Control for blackleg & malignant edema
- **Blackleg/malignant edema bacterin** (*C. septicum* combo w/ *C. chauvoei*)
  - Calves vac. 2 x 2 weeks apart between 2-6 months (high risk areas)
  - Revaccinate at 1 & 5 years old (m/b)
- Vac. for malignant edema before castration, dehorning in endemic areas
- Deeply bury, burn, or remove carcasses from premises



***Cl. chauvoei*, Not from wounds, Outbreaks**
CS: Lameness, Gaseous edema, Death
Dx: PM: Dark muscles; FA
Tx: Herd (Bacterin & ABs to all); Individual (ABs, Debride)
Px: Guarded to Poor

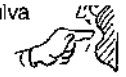
Malignant edema

Mk 327; C3T 570, 897; IM 1671; BR-hb 288; BR 686; Br 559; Derm 154

★★★

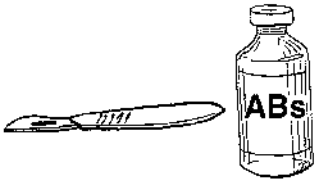
- **Acute, generally fatal toxemia**
- Cattle, horses, sheep, goats & pigs (man)
- ***Clostridium septicum***
  - Often w/ other clostridial spp, *(C. chauvoei, C. perfringens, C. novyi & C. sordelli)*
  - Soil & intestinal inhabitant
- **Contaminated wounds** containing devitalized tissue
  - Trauma, castration, docking, unsanitary vaccinations & parturition
- Sporadic, individual usually, outbreaks rare

- Anorexia, intoxication, high fever
- Soft local lesions around wound
  - **Edema** - pit on pressure
  - Spread rapidly
  - Gas accumulation uncommon
- Parturition trauma of vulva
  - Marked edema of vulva
- Severe toxemia (ill)
- Death in 24-48 hours



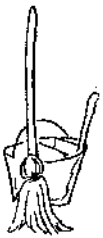
- DDx Similar to black leg
- History (wound), CS
- Postmortem
  - **Similar to Black leg**
- Lab:
  - **FA** staining
    - If specimen taken ≥ 24 hrs of death insignificant bec. invades from intest.

- **Emergency**
- **Hi doses of** broad spectrum ABs early in dlz (20,000 IU/kg IM BID penicillin)
  - Inject into periphery of lesion to check spread, affected tissue will still slough
- **Surgical incision** to provide drainage
  - Debridement &/or fenestration to reduce swelling, aerate tissue & remove necrotic tissue
  - Local irrigation w/ 3% hydrogen peroxide



DDx:
- **Blackleg** (p 244)

Prognosis:
- **Poor**



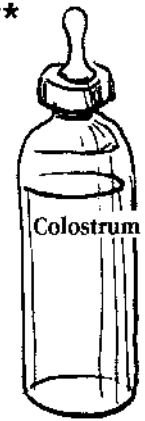
Control (see above)
- Vaccinate
- Hygiene
- Debride all wounds
- Dispose of carcasses
- If injection/infection problems: Inject penicillin along w/vaccine

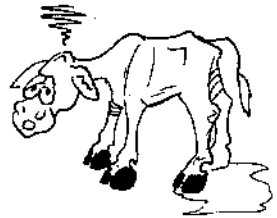
***C. septicum*, Contaminated wounds**
CS: Fatal toxemia, Edema around wound
Dx: DDx from blackleg, FA
Tx: Emergency - Hi dose pen, Sx incision • Px: Poor
Control: Vaccinate, Wound hygiene; Carcass disposal

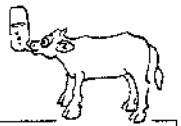
FPT - Anthrax

GENERALIZED CONDITIONS

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Failure of passive transfer, FPT Mk 1109; IM 1847; BR-hb 45; R-M 224 ***	• **Born w/out circulating immunoglobulins** • **Colostrum** (first milk) contains high % of immunoglobulin (passive transfer), protection against pathogens • **#1 cause of death in 1st wk** • Absorption 1st **12-18 hrs** of life - **Specialized intest. epith. cells**, absorb large proteins intact (immunoglobulins) - Cells replaced in 36 hrs, 18 hrs better cut off for limit of colostrum intake - **Stress** (steroids) m/ cause premature closure of specialized cells	• Bacteremia - **Dyspnea** - **Diarrhea** - Anorexia, depression - Weakness - Injected sclera Sequelae: • Survivors of bacteremia m/ get: - Septic arthritis - Meningitis - Panophthalmitis	• **Can't be determined by PE** • **Lab - Immunoglobulins** 1) Zn sulfate turbidity field test, 1 hr 2) Single radioimmune diffusion test - takes 24 hrs, so not a field test (the standard test) 3) Na sulfite turbidity test - field test (1hr) **4) Refractometer** (total serum protein) < 5 g/dl inadequate, 5-6 questionable, > 6 passive transfer 5) GGT elevated - **Field tests at 12 hours old** (takes 6 hours to get immunoglobulins into blood) • **If failure give colostrum**	• Tx clinical diz • **If less than 24 hours feed colostrum** (Zinc sulfate test) • **Over 24 hrs - plasma or serum transfusion** (20-40 ml/kg IV) • If concurrent disease, not as successful **Prevention:** • Feed colostrum automatically w/o test • Make sure suckle in first 6 hrs of life - Leaving calf w/ dam gets better absorption - More difficult to monitor if nurse mother • If not, force feed w/ bottle (preferable over stomach tube) (better absorption) • 2 L colostrum in 1st 4 hours after birth







#1 cause of death in 1st wk of life; Colostrum < 18 hrs
CS: GI & Resp - Diarrhea & Dyspnea
Dx: Immunoglobulin tests
Tx: Tx clinical diz, Colostrum < 24 hrs, Plasma > 24 hrs
Prevention: Colostrum, Colostrum, Colostrum

1st time heifers have lower colostrum, also individual differences from cow to cow

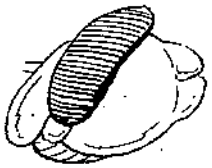
Colostrum bank (freeze colostrum from 1st milkings)
- Thaw or microwave & feed

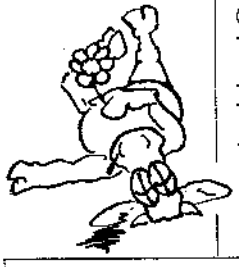
Colostrometer: measures specific gravity (immunoglobulin levels) < 1.050 assoc w/ low immunoglobulin

Anthrax,
Splenic Fever, Charbon, Milzbrand, Woolsorter's diz

Mk 359, C3T 565; IM 1246; BR-hb 282; BR 671; BR 551; DC 480

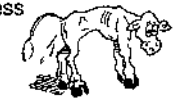
**





- **Isolated areas in U.S.** (S. Dakota, Ark., Missouri, Louisiana, Texas & Calif.; last reported epidemic in 1950's)
  - Mostly in Africa, less commonly in Asia
- Sheep & cattle > horse, goats
- Bulls > cows
- Older animals > young - overgraze
- ***Bacillus anthracis***
  - Normal flora of **alkaline soils**, Lg gram pos., capsulated, nonmotile, spore forming
  - **Spores extremely resistant**
  - Virulence factors (Capsule + EF, LF, PA)
- **Pathophysiology**
  - Spore ingestion (#1), inhalation or cutaneous penetration
  - **Lesions of reticuloendothelial system & vasculature destruction** (tissue damage thru/out body, diffuse edema, resp failure causes death usu., acute renal failure, damage vessels of CNS)
- **Enzootic after climatic changes** (heavy rainfall, flooding proceeded by drought)
  - Ingest. of contaminated animal origin feed (tankage, bonemeal)
  - Worldwide outbreaks, animal products
  - Predators of dead animals, problem where endemic
  - Main reservoir is **alkaline soil**, animal origin feeds, in fertilizers of anim. wastes & wool products

- Acute > subacute >> chronic
- **Sudden death #1 CS**
- Marked temperature elevation
- Excitement, then depression & muscle tremors
- Resp. & cardiac distress
- **Stagger, convulsion, death** (respiratory failure - 1-3 days)
- **M/b blood from orifices**
- Hematuria, Off feed
- Bloody diarrhea
- ↓ Milk production (blood tinged milk)
- SQ edematous swellings m/b
- Die in 1-3 days, convulsions, resp. distress



- Chronic infection rare in cattle
  - Edematous swellings

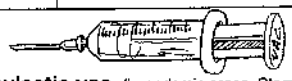
- **Difficult to Dx**, esp. in new area
- History (area), CS
- **Incomplete rigor mortis**
- **Black, tarry, bloody discharge from all orifices**
- Do only partial necropsy (look for above w/o opening carcass)

- Lab:
  - Blood from jugular in leak proof container (ear is not a good specimen)
  - Dried blood swab
  - Staining & culture (capsule)
  - ELISA, Animal inoculation
  - **String of pearls** (Giemsa stain, short or single chains)
  - Gram stain: gram pos. when young & gram neg. when older

- **Notify Feds**
- **Fatal**, so early vigorous Tx necessary to **stop epidemic**
- Soil borne outbreak
  - Isolate sick
  - **ABs for sick** (IV pen. or oxytetracycline BID, then IM for 5 days)
  - Immunize rest of herd & surrounding area
- **Bury carcass, bedding, etc.**

Prognosis:
Grave > 90% die

Control:

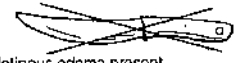


- **Annual prophylactic vac.** (in endemic areas, Stern vac)
  - Vaccinate 2-4 wks before expected outbreaks
  - Live vaccine (so no antibiotics w/in 7 ds of vaccine)
- **Notify federal agents**
- **Rigidly enforced quarantine** (2 wks after last Dx case)
- **Cremate or bury** deep (2 m) all dead animals, bedding & manure (quicklime [Ca oxide] over carcass)
- Isolate sick
- **Disinfect area** (5% aqueous lye, 10% formaldehyde for 15 min.)

PH

Public Health - man
- Cutaneous lesions (malignant pustules or malignant carbuncles), infec. through broken skin
- Fatal hemorrhagic mediastinitis (Woolsorter's diz) - inhalation of spores
- Acute meningitis from bacteremia
- Intestinal anthrax (uncooked meat)

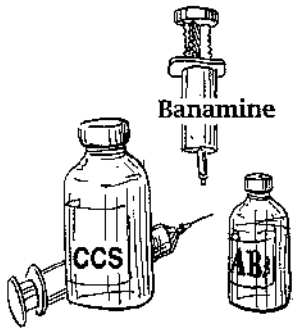
Postmortem: Don't open suspected Anthrax - Bury
- Only 1 carcass if necessary, safely, in easily disinfected environment, gloves & face masks
- Carcass nonautolyzed
- **Black, tarry, bloody discharge from all orifices**
- If opened (DON'T) - **splenomegaly** (excessively - 2 to 4 times normal)
- **Incomplete rigor mortis**
- Blood fails to clot
- Mucosal hemorrhages
- Edema noted throughout body, gelatinous edema present



Outbreaks, Bacillus (spores), Animal origin feeds, Alkaline soil
CS: Sudden death, Resp., Staggering
Dx: Bleeding, incomplete rigor, NO necropsy
Tx: Fatal, ABs, Stop outbreak (Vaccinate herd)
Px: Fatal • **Control - Feds, Quarantine, Bury deep**

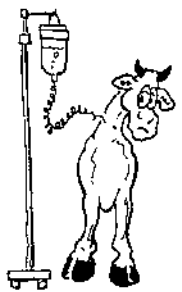
Circulatory Shock — GENERALIZED CONDITIONS

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Circulatory shock IM 45, 427, 1189; C3T 682; C2T 695; BR-hb 140; BR 377; N-L 145; S-J 160 ★★★	• **Severe insufficiency in capillary perfusion** - ↑ Resistance to blood flow - Widespread pooling of blood - Marked hypotension - Inadequate CO (cardiac output) - Inadequate blood volume • Most common clinical shock assoc. w/ GI tract, infection, vascular strangulation w/ bowel necrosis - Conditions . Severe neonatal diarrhea . Salmonellosis . GI obstruction w/ or w/o strangulation . Septic mastitis . Peritonitis . Deep wounds & abscesses - Complex systemic diz usually . **Gram negative bacteria plus** . **Loss of intravascular fluids** • Uncommon causes - Hemorrhagic - Traumatic - Cardiogenic	• **Rapid, weak pulse** • **↓ Heart sounds** • **Pale, cold & dry mucous membranes** • **Muscle weakness**, depressed sensation • **Cold skin**, esp. extremities • Oliguria or anuria	• History, Clinical signs • **Prolonged CRT (≥ 3 sec)** (capillary refill time) • CVP (central venous pressure) - water manometer in jugular vein • Metabolic acidosis • Postmortem: - Widespread hemorrhage	• **Emergency** • **Replace fluid volume - Large volumes** - Blood transfusion - Plasma or plasma expanders - **Lactated Ringer's** (electrolyte solution) . Empirical: 20-40 ml/kg conservative, 100-300 ml/kg m/b, monitor patient's response • **Drugs:** - Dopamine (Intropin®) or dobutamine (Dobutrex®) safe, cardiostimulatory - Steroids after fluid volume corrected . Dexamethasone or prednisolone (tissue profusion by arterial vasodilation) - Broad spectrum ABs in all shock, except hemorrhagic & cardiogenic . Penicillin G + aminoglycosides - Mannitol IV to encourage urine flow & minimize cerebral edema - Sodium bicarbonate to minimize acidosis (determine total CO2 or blood gases) (in older cows beware, acidosis lasts only short time, then alkalosis) . Empirically: 1 mEq/kg by slow IV - Banamine® (fight endotoxins)



Low tissue perfusion - #1 Endotoxins
CS: Rapid pulse, Pale, Weak, Cold, Anuria
Dx: CRT ≥ 3 sec, Acidosis
Tx: Emerg. - Fluids, Steroids, ABs, Bicarb

Pathophysiology:
• **Molecular diz** - metabolic derangement
- Anaerobic glucose metabolism => metabolic acidosis
. Lactic acid, amino acids, fatty acids & phosphoric acids
. Disrupts lysosomal membranes
.. Lytic enzymes cause cellular death
. ↓ ATP (energy) production
.. Disrupted protein synthesis & cell membrane pump, decreasing ability to combat shock



Classification of shock

- **Vasculogenic**: sequestration of blood in widely dilated vessels

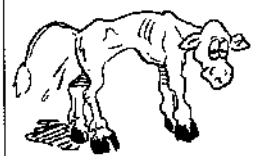
  - **Endotoxins**
    - . Septic mastitis
    - . Peritonitis
    - . Deep wounds & abscesses
    - . *E. coli*
    - . Strangulating GI obstruction
    - . Septicemia
    - . Liver diz
    - . Diarrhea

  - Vasoactive agents of anaphylaxis
  - Severe, prolonged vasoconstriction from catecholamines
  - CNS trauma or paralysis causing vasomotor paralysis
- **Hypovolemic**: marked depletion of extracellular volume
  - **Water & electrolyte loss**
    - . Diarrhea (neonatal, salmonellosis)
    - . Acute intestinal obstruction
    - . Sweating
    - . Diuresis
    - . Emesis
  - External or internal hemorrhage (rare)
  - Plasma exudation to outside or into body cavities
- Cardiogenic: loss of effective cardiac pumping action
  - Ineffective cardiac filling
    - . Cardiac tamponade
    - . Constrictive pericarditis
    - . Hydropericardium
    - . Positive pressure ventilation (PPV)
  - Restricted ventricular emptying
    - . Cor pulmonale
    - . Increase vascular resistance
    - . Ruptured chordae tendineae
    - . Cardiac dysrhythmias
    - . Toxic myocardial depression

Treatment:

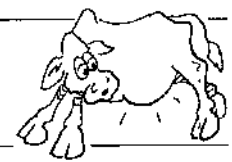
- **Replace fluid volume - Large volumes**
  - Blood transfusion: 20-40 mg/kg whole blood + 2-6 x this amount of balanced electrolytes
  - Plasma or plasma expanders (Dextran 70®) + electrolyte solutions (expensive)
  - **Electrolyte solutions: Lactated Ringer's** preferred over normal saline when large quantities given, except if hyperkalemia exists
    - . Ideal: monitor fluids by CVP, give until CVP reaches 5-10 cm H_2O
    - . Empirical: 20-40 ml/kg conservative, 100-300 ml/kg sometimes required, monitor by patient's response
  - Hypertonic solution (tonicity 8x plasma - 2400 mOsm/L)
    - . Indications: trauma (esp. head trauma to prevent edema), hemorrhage, sepsis or GI fluid loss
    - . Contraindication: dehydration, uncontrolled hemorrhage
    - . Dextran 70® initially followed by balanced electrolytes in 30 min
- **Drugs**
  - Dopamine (Intropin®) or dobutamine (Dobutrex®) safe
  - Catecholamines generally contraindicated, except in anaphylactic shock
  - Steroids (CCS) after fluid volume corrected
    - . Dexamethasone or prednisolone (tissue perfusion by arterial vasodilation)
  - **Broad spec. ABs** in all shock, except hemorrhagic & cardiogenic
    - . Penicillin G
  - Heparin: to treat or prevent DIC
  - Mannitol IV to encourage urine flow & minimize cerebral edema
  - Sodium bicarbonate to minimize acidosis (determine total CO_2 or blood gases)
    - . Empirical: 1 mEq/kg by slow IV
  - NSAIDs (Banamine®) fight endotoxins

Enterotoxemia

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Clostridial enterotoxemia Type C, Hemorrhagic enteritis Mk 325; C3T 106, 573; C2T 573; IM 885, 398; BR-hb 291; BR 39, 694; BM&S 245; DC 173, 215; GI 773; Pa 57 *** 	• ***Clostridium perfringens*** types C & D - Severe enteritis, dysentery, toxemia & hi mortality - Young calves, lambs, pigs & foals - Well fed calves < 2 wks-old • Beta toxin - Endotoxin derived from gram negative bacterial cell walls - Released into circulatory system - Effect caused by release of PGI_2 & TXA_2 . Effects on cardiovascular function, respiratory system & GI changes	• **Commonly in 1st days of life** • **Acute diarrhea, dysentery** • Abdominal pain • Convulsions • Opisthotonus • **Sudden death** m/b in few hrs • Rarely some recover after few ds - Stunted & unthrifty  	• Hx (sudden death), CS • Postmortem: - Hemorrhagic enteritis & ulcerations of mucosa, deep blue-purple • Gram stain for gram + rods • Toxin detection of filtrates 	• **Tx usually ineffective if CS** • Hyperimmune serum • ABs PO • Outbreak in newborns from unvaccinated dams - Administer antiserum immediately after birth • NSAIDs: flunixin meglumine (Banamine®) suppresses release of deleterious elements, especially if prior to onset of endotoxemia   **Prevention:** • Vaccination of pregnant dam in last 3rd of pregnancy - Initially 2 doses one month apart then annually 

***Cl. perfringens*, Hemorrhagic enteritis, Endotoxins**
CS: Dysentery, Sudden death
Dx: Hx, CS, PM - Gram positive
Tx: Ineffective if CS • Prevention (Vaccine)

Type A enterotoxemia : Causes "yellow lamb" diz; in calves suspected of causing 2 forms: 1. Intravascular hemolysis & capillary damage (uncommon) 2. **Acute abdomen syndrome** (sporadic)
IM 887; C3T 573; BR 693
• **CS:** Acute abdomen: bloat, colic, anorexia, depression w/ or w/o diarrhea or sudden death; sometimes diarrhea 1st week of life
- Recovery, then acute abdomen in 1-2 wks
• **Dx:** Hx, CS, PM: Abomasitis, abomasal erosions & ulcerations, grayish-black fluids in stomach



Type B enterotoxemia (IM 887; C3T 573; BR 694): Not reported in North America

Type D enterotoxemia (Mk 326; IM 888; C3T 574; BR 697) • *Clostridium perfringens* Type D, Sheep & goat diz. Rarely in cattle. Suspected in well-nourished beef calves nursing high producing cows grazing lush pasture & in sudden death syndrome in feedlot cattle (but lack supporting evidence)

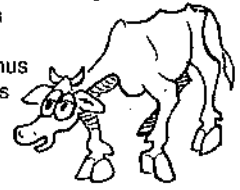
Anaphylaxis

C3T 684, 413; IM 677; DC 103

***

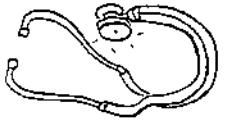
- Immediate (type I) hypersensitivity to antigens to which the body was previously sensitized
- Degranulation of mast cells & basophils (histamine, bradykinin, serotonin, prostaglandins, etc.)
  - ↑ Vascular permeability (edema)
  - Smooth muscle constriction
  - Exocrine gland secretion
- Lungs major target
- Precipitating agents
  - Vaccines
  - Drugs, Blood
  - Hypoderma spp., Bee stings, insect bites

- CS develop in 20 min,
- **Urticaria**
- **Pruritus** (itching)
- **Bronchospasm & hypotension**
  - Severe acute dyspnea
  - Flaring of nostrils
  - Extension of head & neck
  - Open-mouthed breathing
  - Hyperpnea
  - Abduction of elbows
  - Stertor
- Shivering
- Salivation, Frothing at mouth
- Diarrhea
- Edema
- Nystagmus
- Cyanosis

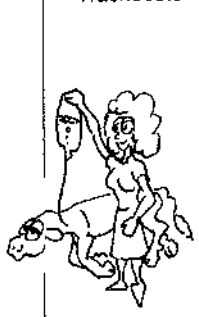


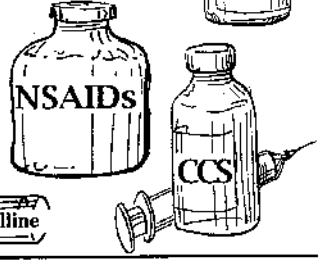
- Sequelae:
  - **Hypotensive shock**
  - **Resp. distress**

- History; CS
- **Auscultation**
  - Harsh breath sounds
  - Crackles
  - Large airway sounds



- **Emergency**
- **Epinephrine** IM/SQ
- Steroids IV/IM (dexamethasone)
- Benadryl® (diphenhydramine) IM/IV
- Other Tx
  - NSAIDs
  - Diethylcarbamazine
  - Shock doses of fluids (40 ml/kg/hr) w/ Na bicarbonate
  - Aminophylline (bronchodilator)
  - Diuretics
  - O_2 Tx
  - Tracheostomy



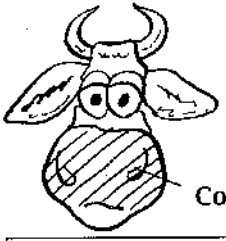


Type I hypersensitivity - Antigen
CS: Urticaria, Pruritus, Resp. distress, Shock
Dx: Hx, CS, Auscultation
Tx: Emerg. - Epinephrine, Steroids, Benadryl®

IBR - BVD

GENERALIZED CONDITIONS

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
IBR **Infectious bovine rhinotracheitis** **"Rednose"** Mk 730; C3T 417, 837; IM 1009, 639; BR-hb 409; BR 1061; Br 256; DC 80, 197; GI 765, 777, Derm 106, R-M 250, Pa 125; N-L 361 ***	• **Herpesvirus 1 (BHV 1)** - **Older carriers** . 1° reservoir for younger animals (latent infection in neural tissue) • **Contagious** - aerosol of viral particles - Found in semen, nasal & resp. secretions • Short IP - 3-7 days • > 6 months old (passive immunity worn off) • **Stress** due to weaning, crowding, vaccination, etc., intensively managed animals, dairy or beef • **Corticosteroids** (endogenous & exogenous can cause recrudescence & shedding • **2° bacterial pneumonia** - Virus destroys mucous membrane of trachea, allowing bacteria to enter • **Morbidity < 5%,** usually due to bronchopneumonia	**Large outbreak** in less than 3 weeks **1) Upper resp. tract** • **Rhinitis & tracheitis** • **Conjunctivitis** • **"Red nose"** - hyperemia of muzzle • **Ulcers & plaques** - mucous membranes • Initially temp, 106-107° F • **Salivation** & anorexia • **Recover in 10-14 days,** majority w/o Tx • Rarely corneal edema **2) 2° bronchopneumonia** • **Pasteurella** - 10% more severe CS • Nasal discharge, mucopurulent • Conjunctivitis w/ serous ocular discharge • Wt loss & recovery prolonged • Erosion & **necrotic diphtheritic membrane** in nasal cavity & trachea • Drop in milk production ($) **3) Enteric/systemic form** (calves < 3 weeks) • **Intractable diarrhea** **4) IPV** (infec. pustular vulvovaginitis) • Pustules (2 mm) coalesce to plaques **5) Abortion storms ($)** (see Repro) **6) Encephalitic** - calves (see Neuro) • **CNS signs - 100% mortality**	• **CS - resp., abortions, enteric diz, "Red nose"** • Antibody titer only good indication of exposure • Viral isolation (nasal fluids early in diz) • **Serum Neutraliz. Test - TOC** • Auscultation of lung, normal w/ just IBR **DDx:** • Pleuritis (p 72) • Pleural effusion (e.g., hardware diz) (p 72) • Fog fever (p 67) • Pulmonary edema (p 67) • Laryngitis (p 61) • Tracheitis (p 61) • Lungworms (p 69) • Pink eye (178)	• **Nonspecific** (palliative) **- Most recover in 2 weeks** • Reduce stress, high quality feed, fresh water • **ABs in feed & water** - 2° diz in feed lots (oxytetracycline, sulfas, etc.) • Ideally isolate, difficult in feedlot & intensive dairy situation • 1° isolate young calves • **Herd outbreak** - Separate large group, to decr. exposure • Corticosteroids contraindicated (increases development of diz) • Stop breeding until IPV signs return to normal **Px: Good,** most recover in 2 wks • Recovery = long term immunity



Color "red"

Contagious, Carriers, Stress, 2° bacteria
CS: Upper resp., Pneumonia, GI, IPV, Abortion, CNS
Dx: CS, Hx, Serum neutralization
Tx: ABs, Isolation • Px: Good

Vaccines:
• **IM - MLV** - (intramuscular) feedlot cattle
- Can cause abortions
- Ok for young & open females
• **IN - MLV** (intranasal) - breeding herds
- Will NOT cause abortions - faster immunity?
- Will not interfere w/ passive immunity

Vaccination program:
• Herds:
- 1 dose of MLV/IM 6 months = lifelong immunity
• Large calf pop. (feedlot & dairy):
- MLV- IN - 1-4 week
- Revaccinate 3 months
- Revaccinate 6 months
• Calves entering feedlot:
- MLV - IM w/in 24 hours
- Revaccinate 3 months
- Revaccinate 6 months

Bovine viral diarrhea (BVD) / Mucosal disease

Mk 166; C3T 432; C2T 485; IM 636, 1806, 1103; BR-hb 389; BR 993; Br 660, 627, 811, 472; DC 85, 197; BM&S 122; GI 765, 774, 789; Pa 54; Pic 50, 485; R-M 254

★★★

- **Togavirus** (pestivirus)
  - Cytopathic & noncytopathic biotypes
  - **Immunosuppressive** - predisposes to other dizs
- Transmission:
  - Direct contact w/ sick or carriers
  - Indirect from contaminated material (feces, saliva, semen, uterine discharge, aborted fetuses, placentas)
  - Transplacentally
- IP 5-10 days
- **Young most common, 8-24 months; all ages susceptible**
- Mucosal diz occurs in persistently BVD infected cattle + infection w/ cytopathic biotype later
  - **100% fatality**, but low morbidity

Togavirus: Non- & Cytotoxic biotypes

CS: Multisystem viral disease

- **Classical BVD: GI (diarrhea/oral) - Recover**
- **Respiratory: fever, tachypnea - Recover**
- **Abortions: "Weak calf"**
- **BVD/MD: Noncytopathic + Cytopathic -> Death**

Dx: PE, Hx, CS, PM, Isolation

Tx:

- **BVD & Resp/Repro: Fluids, ABs**
- **BVD/MD & Chronic infec.: Slaughter**

Px:

- **BVD, Resp, Repro: Guarded to Fair**
- **BVD/MD, Persistent infec.: Grave**

Vaccination: 2 injections w/ annual booster

1. **Majority** - usually unobserved systemic infect. Neutralizing antibodies protect for several yrs.
2. **Classical BVD**
   - **Gastroenteritis**
   - **Diarrhea** - explosive, watery, m/b blood & mucous
   - Dull, depressed, anorexic w/ fever
   - ↑HR, RR
   - Rumen stasis, m/b mild bloat
   - Rt. flank splashing sounds (intest. dilatation & fluid)
   - Rapid dehydration - elect. & acid/base abn.
   - **Oral lesions** - 75%; m/not develop for 10 days
   - Necrotic tongue - hyperemic w/ blunting of oral papillae
   - **Most recover in 10 days**
   - **If profuse diarrhea m/ die w/in 48 hrs.**
3. **Respiratory signs**
   - **Continuous to intermittent fever**
   - Tachypnea w/ no abnormal lung sounds (so not pneumonia)
   - Recovery in 10 days if no 2° bact. infec.
4. **Transplacental infection**
   - **Abortion**, cerebellar ataxia, ocular defects
   - **"Weak calf" syndrome**
   - **Persistently infected** & shedding
5. **Mucosal diz (chronic BVD, BVD/MD)**
   - **100% fatality**, but low morbidity
   - **Oral erosion**, also nares, teats & vulva
   - **Total anorexia - cachexia**
   - Diarrhea - if persistent & severe, die acutely
   - Mucopurulent nasal & ocular discharge
   - Occasional corneal lesions, 1° corneal edema
   - **Lameness**, erosive coronary band & interdigital space
6. CNS: cerebellar hypoplasia

(See Neuro pg 139)

- **Presumptive - PE & PM**
- **Defin. Dx requires 2-3 weeks**
  - Serum neutralization test or
  - Viral isolation from saliva or feces &/or serology
  - Persistently infected sero-negative, so viral isolation

- Leukopenia
- **Dx important** to DDx from similar sign in Rinderpest & FMD
- **Postmortem:**
  - Degenerative epith. cells (GI)
  - **Erosion from mouth to intestine**
  - Necrosis of lymphoid tissue
  - Peyer's patches (dark red necrotic foci in ileum

DDx:

Infect. diz w/ oral lesions, diarrhea, fever

- Salmonellosis (p 259)
- Blue tongue (p 10)
- Malig. catarrhal fever (p 10)
- Rinderpest (p 9)
- Winter dysentery (p 23)
- Papular stomatitis (p 8)
- Vesicular stomatitis (p 11)
- IBR in neonates (p 252)
- Parasitic diseases
  - Trichostrongyles (p 56)
  - Sarcocystis (p 123)
  - Coccidia (p 260)
- Toxicity
  - Chlorinated naphthalene (p 213)
  - Heavy metals (p 152)
  - Nitrates (p 231)
- Caustic substances

Pneumonia (p 62)

- **Fluids** (for dehydration)
- **Prophylactic ABs** (immunosuppression of BVD)
- Good husbandry (fresh water, feed & salt available)

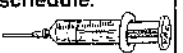
- **BVD/MD - cull**
- **Persistently infected cows** - sold to slaughter

Prognosis:

- **BVD: Guarded**
- Cow that aborts, breeding back: Good to excellent
- **Mucosal diz: Grave**
  - Euthanasia
  - **100% fatal**
- Persistent infec.: Sold for slaughter

Vaccination - good for dairy herds & beef cow/calf operations, questionable for feedlots

- Modified Live Vaccine (MLV):
  - Immunosuppres., adds to shipping fever
  - Not in pregnant cows - fetopathic
- Killed vaccine (KV):
  - Recommend killed vaccine at 6 mos
  - Use only killed in pregnant
- **Vaccination schedule:**
  - 1° immunization
  - 2 wks - booster
  - Annual revaccination



Breeding farm

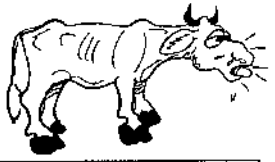
- Vac. all breeding age cattle
- Vac. heifers betw. 6 - 14 mos twice (KV) or prior to breeding (MLV)
- Goal is to reduce losses, not eliminate infective agent

Vaccinate feedlot cattle in preconditioning period (MLV)

Haemophilus - Pasteurella

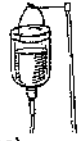
GENERALIZED CONDITIONS

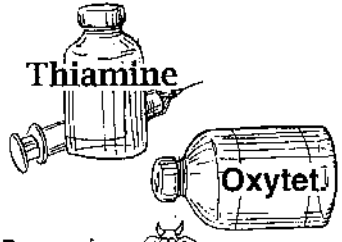
Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Haemophilus complex Mk 602, CST 546; IM 639, 648, 1092; BR-hb 323; BR 817; Br 571, 203, 215, 811; DC 336; VC/N 61 ★★★	• ***Haemophilus somnus***, Gram neg. pleomorphic rod or coccobacillus • **Calves, Feedlot**, 4-12 months - 4 weeks after entering feedlot • **Septicemic diz** -TEME (thromboembolic meningoencephalitis), Tropism for brain (cerebellum & brain stem) - Lungs (pneumonia more common) - Joint infections in those that have averted fatal septicemia - Infertility, metritis, vulvitis, orchitis, conjunctivitis, otitis, mastitis • Morbidity low, 2-10% • Pathogenesis not clear	•**Bronchopneumonia**, resp. CS: alone or leading to CNS CS - Hacking cough - Dyspnea - Pleuritis - Fever • **CNS - cerebellum & brain stem** - **Depression** - **Ataxia**, paralysis - Knuckling at fetlock, fall while walking, interference (proprioceptive deficits) - Blindness - **Recumbency** - Opisthotonus, nystagmus, strabismus, head tilt - Coma & death - 36 hrs m/b • **Septic arthritis,** hock & stifle - Swollen joints & tendon sheaths - Poor condition - Stiffness • Myocardial abscesses - Found dead, or - Fever - Respir. distress & depression from left heart failure • Retinal hemorrhages (vasculitis) seen w/ all forms • Endometrial syndrome (Australia & Europe) - Vaginal discharge, rare abortions	• **History** (feedlots) • **CS** (CNS, resp. & joint diz) • **Lab:** - **CSF analysis** . Suppurative exudate (↑ PMNs) . Elev. protein . Xanthochromia - *H. somnus* org. hard to culture • **Postmortem:** - Vasculitis to septic infarcts & abscesses	• **Effective if early** (check other feedlot cattle every 2 hours) • **IV ABs** at hi levels (double dosages) - **Oxytetracycline** (economic) - Penicillin/streptomycin • **Also thiamine** - PEM • Chlortetracycline in feed for 10 days (for herd Tx) • Tx endotoxic shock - IV fluids - Steroids (dexamethasone) • Course of disease 2-3 weeks



Polioencephalomalacia (PEM)
difficult to distinguish clinically from TEME so give thiamine along w/ ABs

DDx:
- **CNS**
  - **Polioencephalomalacia** (p 140)
  - Hypovitaminosis A (p 142)
  - Listeriosis (p 143)
  - Malignant catarrhal fever (p 10)
  - Lead poisoning (p 152)
  - Rabies (p 144)
- Respiratory
  - *P. haemolytica* (p 255)
  - *P. multocida* (p 255)
  - Mycoplasma
- Myocardia
  - Sudden death syndrome
  - Anaphylaxis (p 251)
- Repro. infections
  - *Actinomyces pyogenes* (p 129)





Prognosis:
- Good if early
- Mortality 90% if not treated early
  - Once recumbent: Grave

Bacterin - available, but only 80% seroconvert so of questionable value
- Given at time of weaning, prior to shipping to feedlot (should be preconditioned to go to feedlot, but not cost effective. At most castrations & weaning done on farms, then rest [vac., etc.] at feedlot).

Feedlot calves, 4 wks after entering feedlot
CS: Resp. + CNS + Joint
Dx: Hx, CS, CSF
Tx: Hi ABs + Thiamine, Fluids, Steroids

Pasteurellosis

C3T 555, 837, 443; IM 639, 647; BR-hb 307; BR 749; Br 202, 253, 563; B-A 563, 253

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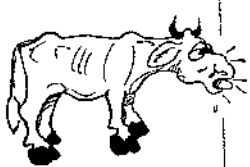
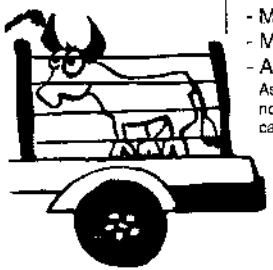
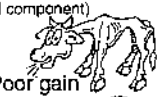


- ***Pasteurella multocida* & *P. haemolytica***
  - Commensals of nasopharynx
- Forms
  - **Shipping fever**: pneumonia in feedlot cattle most common form
    - . #1 cause of death due to undifferentiated resp. diz
    - . > $800,000,000 losses/year
    - . Viruses, mycoplasma & stress contribute
    - . 1-2 weeks after shipping
  - **Enzootic pneumonia**
    - . Young dairy & veal calves, 2-5 mo
    - . Crowded/poorly vented housing
  - Sporadic pneumonia in adult dairy cattle
  - Localized infections
  - Abortions
  - Mastitis
  - Meningitis
  - Acute fatal septicemia (rare): in Asia, Africa, in USA in Bison, but considered nonexistent in cattle (only 1 confirmed case in cattle in the US)

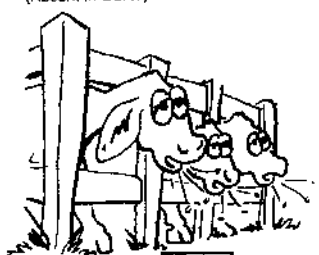


Stress + Virus + Pasteurella
CS: Shipping fever, Enzootic pneumonia
Dx: Hx, CS, Friction rub, Fibrin
Tx: ABs, Decr. stress
Px: Good/Guarded

- **Shipping fever & Enzootic pneumonia**
  - Fibrinous bronchopneumonia
  - Depression (head hanging)
  - Anorexia
  - **Fever**
  - **Dyspnea** (↑ & shallow RR)
  - Mucoid or purulent nasal discharge (viral component)
  - Conjunctivitis
  - **Coughing**
  - Weight loss/Poor gain
  - Expiratory grunt
  - **Rapidly fatal**



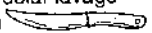
- Sequelae:
  - Localized infections (e.g., middle or inner ear)
  - Abortions
  - Mastitis
  - Meningitis
  - Septicemia (hemorrhagic) (Absent in USA?)



- **Hx (shipping/crowding)**
- CS
- **Auscultation:**
  - **Friction sounds**, expiratory grunt, esp. cranioventrally

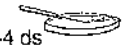
- C&S (culture & sensitivity)
  - Nasal swabs, bronchoalveolar lavage

- Postmortem



  - Cranioventr. consolidation, hemorrhage & necrosis
  - Airways filled w/ bloody, fibrinous exudate
  - **Fibrinous adhesions** betw. lungs & thoracic structures
  - Histology
    - . Atelectasis, bronchiolitis, fibrinous exudate, PMNs
    - . Oat-shaped "streaming" macrophages

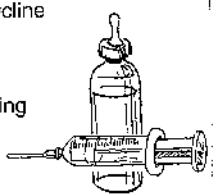
- **Antibiotics (C&S)**



  - First line drugs for 3-4 ds
  - Relapse: 2nd line ABs for 3-6 days
  - Naxel®, Micotil®
  - Long-acting - blood levels for 3 ds
    - . Oxytetracycline
    - . Tilimicosin
- Reduce stress

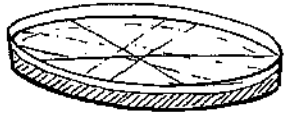
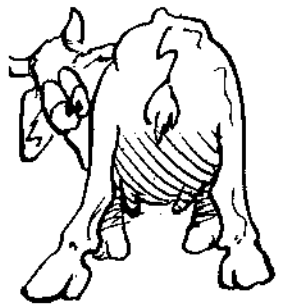
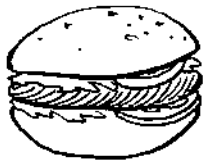
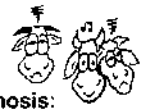
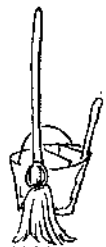
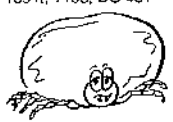
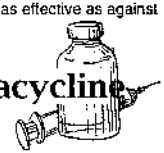
Prognosis:
Variable (age, time of year, management)
- Shipping fever - Good/Guarded
  - Good if temperature drops in 3 days (80% response)
    - . 3-4% case fatality acceptable
- Enzootic calf pneumonia - Good/Guarded
  - Low mortality w/ Tx
  - Some poor doers on recovery

Prevention:
- Shipping fever
  - Chlortetracycline in feed (1-4 g/head/d for first 2 weeks postarrival) or
  - Combo: sulfamethazine + chlortetracycline (350 + 350 mg/head/d 3-4 weeks)
  - Adequate dry matter consumption
  - **Adequate detection of diz**
  - Vaccinate for IBR & PI-3 before shipping
  - Reduce stress
- Enzootic pneumonia
  - Adequate **colostrum**
  - Management (housing & ventilation): individual hutches
  - Vaccines - bacterins & leukotoxoids



Leptospirosis

GENERALIZED CONDITIONS

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Nocardioses C3T 521; IM 211t, 216t, 1191 ** 	• **Pyogranulomatous infection** • *Nocardia asteroides*, *N. farcinica*, etc. - Exogenous nocardioform bact. - Isolated or epizootic - Soil inhabitant • Cause: - Environmental contamination (mastitis) - Iatrogenic foreign body - Inhalation - Wound contamination	• Bovine farcy (mycetoma) exotic in Africa - Draining sinus, granule formation contamination of wounds, SQ lymphatic spread to local lymph nodes  • Pneumonia (rare) - Calves < 6 months old • Abortion - rare • Mastitis - uncommon (most frequent form of Nocardiosis) - Occasional regional outbreaks in USA - Acute (fever & malaise), nonresponsive chronic, subclinical - Multiple caseating granulomas • Septicemia - rare	• Mastitis - Culture  	• **Mastitis** - **Slaughter**, as rarely able to completely eliminate infection  **Control:** • Hygiene, relentless culling of cultured & clinically positive cows   **Prognosis:** • For all forms guarded to poor
Multisystemic diz, Mastitis #1, Uncommon **CS: Mastitis** **Tx: Slaughter**				
Q-fever Mk 363; C3T 622; IM 1551t, 1153; DC 481 	• Rickettsia - *Coxiella burnetti* - Transmission: licks - Contact of man w/ infected animals, fetal fluids, raw milk (unpasteurized) • Usually inapparent diz **PH** Public health - Influenza type diz in man	• Inapparent in cattle usually • Infertility & sporadic abortion in cattle 	• Stained smears • Culture (placenta, uterine discharge, mammary secretions, or fetal liver) • Serological tests, complement fixation, immunofluorescence  	• Tx not practical in cattle • Tx for humans: - Tetracycline (TOC) not as effective as against other rickettsia **Tetracycline** 

Leptospirosis

Mk 353, 356, 1085; VC/T 352; C3T 541; IM 1222, 999; BR-hb 350; BR 890; Br 471, 568, 1298; DC 472; VC/T 352; T 267

***

$

- **180 Leptospira serovars**
  - Slender spirochete difficult to isolate
  - ***L. hardjo*** #1, 25% ("reservoir"/cattle)
  - *L. pomona* 17% *(kennewicki)*
  ("Reservoir hosts: pig & wild animals), L. canicola 10%, L. icterohemorrhagiae, etc.
  - Each adapted to maintenance ("reservoir") host
    - Persistent infection in kidney & sometimes genital tract (carrier)
- **Complex, economically important** (stillbirth & abortion)
  - Poorly understood bec. of difficulty w/ Dx
  - Hidden diz causing frustration in Dx & control
  - Ubiquitous, persistent infections
  - **Public health** - infective to man, caution
- Transmission
  - Direct, esp. in maintenance host (*L. hardjo* in cattle)
    - Urine splashing, placental or urine discharge after abortion, venereal, through milk, across placenta
  - Indirect (incidental host)
    - Envir. contamination by urine of carrier animal
    - Survives in water wks-mos (warm, moist temperatures), temperate climates in fall & early winter
- Pathogenesis (see box)

- **SUBCLINICAL** - most - esp. in nonpregnant & nonlactating cows

ACUTE INFECTION

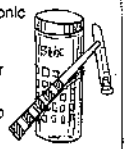
- **Calves,** *L. pomona*
  - High fever
  - Hemolytic anemia
  - Hemoglobinuria
  - Icterus
  - Pulmonary congestion
  - Meningitis occasionally

- **"Milk drop syndrome" or "flabby udder mastitis"**
  - Older dairy cattle, *L. hardjo* usually
  - Drop in milk prod for 10 days
  - Transient fever (pyrexia)

CHRONIC INFECTION

- **Fetal infection**
  - **Infertility**
  - **Abortion** (< 10%, 4 mos to term, esp. 3rd trimester)
  - **Stillbirths**
  - **Premature, weak, infected calves**
  - Healthy infected calves
  - M/b related to previous infec. 6-12 wks before
- Sequela (*L. hardjo*): retained placenta

- **Difficult**
- **IF** (immunofluorescence) of urine, fetal lung & kidney or placenta (special labs)
- **MAT** (microscopic agglutination test), better for acute than chronic
  - Titers ≥ 100 significant
  - 4 fold ↑ 2 weeks apart diagnostic, no value for chronic infection
  - Herd serology m/b more valuable
    - Divide herd into age groups
    - ≥ 300 indicates active infection



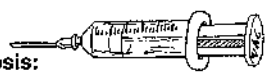
- Bacterial isolation impractical (difficult, expensive & time consuming)

- **ACUTE**
  - Streptomycin BID 3 days or
  - Tetracycline BID 3-5 days
    - Single dose of streptomycin cures carriers of *L. pomona*, but not *L. hardjo*

- **CHRONIC INFECTION** outbreak
  - Vaccinate herd
  - Streptomycin

Control:

- **Vaccination**
  - Annually in low risk herd
  - Twice yearly in high risk herd
  - Introduced cattle
    - 1 to several Txs w/ dihydrostreptomycin IM sid
    - Vaccinate before entering herd
  - Calves: Vaccinate ≥ 6 months, 2 doses 1 months apart
  - Problem doesn't prevent *L. hardjo* kidney carriers



Prognosis:

- Calves: high mortality
- "Milk let down" - Good - recovery in 10 days w/o Tx
- Abortion: usually only once

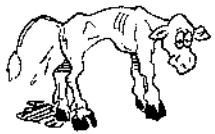
Carriers, Shed in urine - Penetrates skin, $
CS: Subclin., Acute (Calves - Flabby bag), Chronic (Abortion)
Dx: Difficult, Immunofluorescence, Microscopic Aggl. Test
Tx: Acute (Strepto. or Tetracycl.); Chronic (Vac., Streptomycin)
Control: Vaccine annually or biannually

- **Pathogenesis:**
  - Penetrates mucous membranes & skin; 4-10 ds incubation
  - Spreads to liver, kidney, lungs, reproductive (udder, placenta), CSF
  - Antibody production stops bacteremia
  - Organism persists in kidney (prox. convoluted tubules), CSF, eye, reproductive tract (uterus, male genital tract)

E. coli - Leptospirosis

GENERALIZED CONDITIONS

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
E. coli **Colibacillosis, Coliform mastitis, Enteric *E. coli*, Enterotoxigenic colibacillosis, Neonatal septicemia** Mk 181, C3T 517, 105; C1T 118; C2T 105; IM 396; BR-hb 298; Br 167; DC 155; GI 755; Pa 56; Pic 22 ***	• ***Escherichia coli*** - Normal GI flora, in GI soon after birth - Adhere & colonize gut wall (pili - K99, F5) - Mostly colon • **Calves < 4 ds old** (occasionally older) • **FPT** (failure of passive transfer) • **Forms** - **Diarrhea** - **Enterotoxins/septicemia** - hypersecretions of electrolytes, fluids, bicarbonate, water (dehydration, electrolyte disturbances & hypoglycemia) - **Enterotoxigenic K99** - **Septicemia** - bacteria & their toxins in blood stream, fever not consistent feature of septicemia in neonates . May enter through umbilicus or orally - **Mastitis** . **Environmental pathogen** - **Pneumonia, arthritis, iritis, meningitis, abortion, shock**	• **Diarrhea/septicemia** - **Found dead w/ no diarrhea** - **Profuse watery diarrhea**, white to yellow - **Dehydration** - **Acidosis** - **Weakness** - **Death in 6-12 hours (1-4 days)** - Milder forms can't be differentiated from other causes of diarrhea • **Sequelae** - Iritis, hypopyon - Pneumonia - Joints/arthritis - Meningitis - neck rigidity • **Mastitis** - **Acute clinical mastitis** - Subclinical infection common - Sequelae . **Toxic shock, possibly death**	• **Hx, CS** • **Culture:** - Feces, looking for K99 pili by indirect immunofluorescence of smears - In huge outbreak, sacrifice calf to Dx - Milk • **Lab:** - Metabolic acidosis - SCC (somatic cell count) in milk	• **Diarrhea/septicemia** - Aggressive Tx . Isolate . Fluid & electrolytes to restore hydration & vigor . Broad spec. ABs • **Mastitis** - Hygiene more important than individual cow Tx . Feed right after milking - Individual . Milk out, QID min . Intramammary ABs . IV fluids **Prognosis:** • Once in blood stream - Poor **Prevention:** • **Diarrhea/septicemia** - Hygiene - Colostrum - Bacterin (K99 + *E. coli*) 6 & 3 wks before calving to be effective • **Mastitis** - Sanitation - Feed right after milking



Devastating losses
CS: Diarrhea/Septicemia; Mastitis
Dx: Hx, CS, Culture
Tx: Aggressive: Fluids, ABs

Diarrhea/Septicemia: GI pg 18
Mastitis: Skin pg 195

Salmonellosis

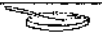
Mk 181; C3T 108, 563; C2T 576; IM818; Br183, 471; BM&S 223; Pic 23

★★★

- **#2 economic GI bact** (> $50 mil/yr)
- **Enteric & systemic infec.**, m/ merge into each other
- ***S. dublin***, host specific to cattle, therefore long carriers, Western USA
- ***S. typhimurium***, *S. montividio*, S. newport & *S. anatum* Eastern USA; > 2000 serotypes
- Invasive organism
  - Attaches to mucous membranes
  - Destroys cells & passes through wall
  - Moves to regional lnn (**Peyer's patches & mesenteric lnn**)
  - Lives in cells, protected from ABs & disseminates throughout body
  - **Endotoxins** through damaged mucous membranes
- **Susceptible: Calves 1-2 months,** debilitated animals & very old usually, but all susceptible
- **Subclinical carrier animals**
- Transmission via fecal/oral route
  - Contaminated animal by-product, feeds, milk
  - Birds, rodents & cats
  - Stress m/ cause recrudescence & shedding in feces & milk from carrier animal (IP: 1-4 days)
- Predisposition:
  - Crowded conditions/Stress
  - Hygiene
  - High protein diet
  - FPT (failure of passive transfer)

- **Calves**
  - **Enteric**
    - . **Initial fever**
    - . **Intractable diarrhea** - brownish, watery to mucoid w/ fibrin & blood
    - . Extreme weakness
    - . Dehydration
    - . Terminal septicemia
  - **Enterotoxemia/septicemia**
    - . Fever, anorexia, depression
    - . Meningitis
    - . Endotoxic shock
    - . Polyarthritis
    - . Pneumonia (dyspnea)
  - Sudden death (12 - 24 hours due to circulatory collapse) w/ or w/o diarrhea
- **Adults & older calves**
  - **Acute**
    - . **Fever**
    - . **Severe diarrhea** (distinctive smell)
    - .. Mucoid/watery w/ fibrin & blood
  - **Chronic**
    - . Persistent diarrhea
    - . Unthriftiness
  - **Abortion**
- **Feedlot (anytime)** most common soon after calves arrive

- **Difficult**
- **Postmortem culture** of org. from feces, blood or tissue: **Definitive diagnosis**
- **Culture** - need lots of feces
  - Not easy to grow
  - Rule: 5 negative cultures (1 per day, 5 days), to rule out salm. (esp. in horses). Not economically feasible in cattle
- **Postmortem:**
  - Emaciated
  - Pseudodiphtheritic membrane lining distal small & large bowel
  - Isolation from mesenteric lymph nodes, lung & colon



DDx from others:

- Higher death rate if not treated
- Dehydrated more quickly
- Feces more fetid due to protein loss
- Fibrinous casts: blood &/or mucous shreds
- Abomasum to colon m/b infected

DDx:

- Neonate
  - Viral diarrhea (p 18)
  - Colibacillosis (p 18)
- Older calves & adults
  - BVD (p 253)
  - Johne's diz (p 23)
  - Coccidiosis (p 260)
  - Parasitism (p 54)
  - Poisons (e.g., arsenic)

- **Isolate sick** (noncontact pens)

- ABs controversial
  - Clinically ill - oral & parenteral
    - . Culture & sensitivity (resistance to many)
  - Oral ABs rapidly become ineffective against enteric diz
  - Systemic ABs prolong recovery & carrier state
  - Trimethoprim/sulfa (inexpensive)
  - Resistant to pen, strep, erythromycin & tylosin
- Valuable septicemic animals

  - IV Banamine®
  - Intensive IV & oral fluids
  - Freq. feedings of milk (emaciation)
- Bacterin - problems w/ adverse reactions & lack of efficacy; No effective vaccine

Px: Poor, mortality & morbidity m/b high
- Calves: deaths m/ approach 100%

Control

- **Difficult bec. of carriers**
- **#1 adequate colostrum intake**
- Environmental hygiene, constantly clean & disinfect betw. calving (carriers shedding) One-Stroke®, Environ (difficult to eliminate)
- **Culture animal by-product feeds** (40% contaminated in USA)
- Cull chronically unthrifty animals

Controlling *S. dublin* (chronic carriers)

- ID carriers & calves
- Multiple fecal culture & milk culture (5 samples at weekly intervals)
- Cull all positive animals
- 5 negative cultures means free unless still serologically positive after 2 months
  - ELISA anti-Salmonella antibody test (not widely available)

Carriers, Endotoxins
CS: 1• Enteric (diarrhea) 2• Septicemic - Abortions
Dx: CS, Hx, Fecal cultures
Tx: Isolate, ABs, Hygiene • Px: Poor
Control: Difficult (carriers)

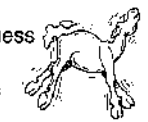
PH

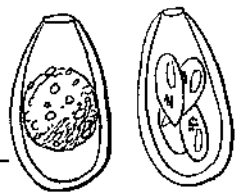
PH: Infects man

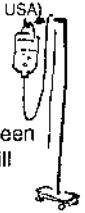
Coccidiosis

GENERALIZED CONDITIONS

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Coccidiosis C3T 599; IM 400, 1707; BR-hb 454; BR 1181; Br 243; CV/N 104; DC 177; GI 773; Pa 46; N-L 124 ***	• ***Eimeria bovis*** (cecum & colon) • *Eimeria zuernii* (small & large intestine) • Called a man-made diz • **Young & stressed animals** - Transient partial immunity • 5th most important diz of cattle • Life cycle (see box), self-limiting, but continual reinfection possible • Pathogenesis: - Extensive destruction of **intestinal epithelium** - Villous atrophy, malabsorption & protein-losing enteropathy - Synergistic w/ *Trichostrongylus colubriformis* worm	• **Mild cases** - Diarrhea - Listless & anorexic for a few days • **Severe** - **Hemorrhagic diarrhea** (mucus & sloughed intestine) - Fresh, unclotted blood from anus - Rough hair coat - Tenesmus (m/b protrusion of anus) - Myiasis (on soiled hindquarters) - Emaciation, dehydration & weak - Die or slow recovery • **Nervous coccidiosis** - High mortality - Acute diarrhea - Muscle tremors - Convulsion - Opisthotonus - Nystagmus - Occasional blindness - CS resemble hypomagnesemia	• **History, Clinical signs** • **Demonstrate parasite in clinically sick animals** - Coccidia alone not diagnostic (some apathogenic) - Oocysts m/ not be in feces in some clinical infections • Smears of hemorrhagic stool • Flotation (Sheather's sugar solution) • Sporulate in potassium dichromate solution for 1-14 days • Postmortem: - Micro exam of scrapings or sections of intestine	• **Difficult to treat & success normally limited** • Clinically affected - Anticoccidial drugs (Tx & prophylactic) . Amprolium (TOC) . Sulfonamides . Nitrofurazone (not approved in USA) - Supportive . Fluids . ± Helminths (deworm) . Isolate • **Treat others** that have been exposed, but not clinical ill **Prevention:** • Reduce oocytes - hygiene - Dry (remove feces daily from pens) - Elevated feed troughs - Avoid overcrowding • **Coccidiostats in feed before & during stressful periods** - Ionophores (Rumensin® [monensin], lasalocid) as feed additives . Narrow margin of safety







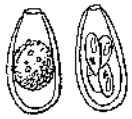
Life cycle
- Sporulated oocysts ingested
- Sporozoites released in small intestine & enter epithelial cells
- Meronts (shizonts) formed & become merogony (schizogony)
- Merozoites released into gut, penetrate epithelium & repeat process
- 2nd stage merozoites into gut & enter epithelial cells & initiate sexual stage; some become macrogametes, some microgametes which fertilize each other to become unsporulated oocyst
- Sporozont (unsporulated) passes in feces & sporulates (oocyst)

Eimeria, Young & stressed, Destruction of intestinal epith.
CS: GI (Hemorrhagic diarrhea, Emaciation); CNS (Nervous)
Dx: Coccidia in sick calf
Tx: Difficult, Amprolium to sick & exposed
Prevention: Hygiene, Coccidiostats in feed

Sarcocystosis, Sarcosporidiosis

Mk 562; IM 1043, 1511, 1562; C3T 625, 900; C1T 778; BR-hb 455; BR 1191; Br 244; DC 492

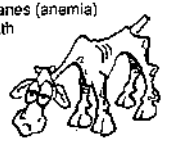
***



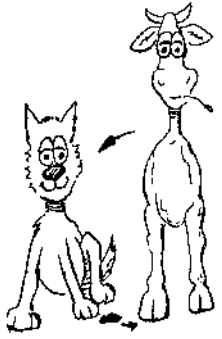
- **Coccidial protozoan** - Sarcocystis - 2-host cycles: predator/prey
  - . S. cruzi (dog-cattle), S. hirsuta (cat-cattle), carnivore definitive host
  - Sporozoites into vascular endothelia
  - . Shizonts - merozoites invade muscle to become sarcocysts
  - Carnivores eat meat w/ sarcocysts
- Transmission: ingestion of sporocysts in carnivore feces by ox
- $95,000,000 annual loss in USA

Coccidia, Predator/Prey cycle
CS: Most subclinical; "Rat tail", Emaciation
Dx: PM
Tx: None, Control (keep dogs away), Monensin

- **Most subclinical**
- Acute diz if overwhelming exposure
  - **Fever, anorexia**
  - **Emaciation**
  - **Hair loss on tail switch ("rat tail")**
  - Pale mucous membranes (anemia)
  - Arrested growth, Death
  - Sequela: Abortion
- Chronic
  - Edema of limbs, or weight gain
  - Hyperexcitability
  - Hypersalivation
  - Muscular atrophy
  - CNS: weakness, prostration & death, depression, somnolence (sleepy), blindness, ataxia, odontoprisis, blindness, nystagmus, hyperexcitability, propulsive walking, head pressing
- Carnivores - asymptomatic

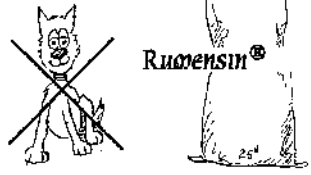


- Postmortem: merozoites in muscle



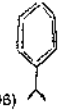
- **Therapeutic Tx ineffective**

Control:
- Don't allow dogs to eat raw meat
- Keep carnivores away from feed
- Rumensin® (Monensin [100 mg/kg 30 d]) prophylactic feeding



Exotic dizs (NOT in USA) *

Akabane diz (Mk 333; IM 973; C3T 442; Br 752)
- Tropical areas; insect transmitted Akabane viral diz affecting fetuses of cattle, sheep & goats
- CS: Congenital abnormalities - arthrogryposis, torticollis, kyphosis, scoliosis; blind, ataxia
- Tx: None



Rift Valley fever (C3T 441; IM 1068; Br 749; Pa 98)
- Only in Africa, first reported in Rift Valley of Kenya, arthropod-borne, viral diz (Phlebovirus) affecting sheep, cattle, goats & humans (people: temporarily incapacitating illness usually; in 2% hemorrhagic fever, encephalitis & retinal diz, possibly fatal)
- CS: Widespread abortions & fatal neonatal diz
- Tx: None

Bovine ephemeral fever (C3T 449; B4 747; Derm 114)
- Australia, Asia & Africa; vector (? Culicoides & mosquitoes) transmitted rhabdovirus diz of cattle; low mortality, viremia, decr. milk, immobilizes cattle, stiffness or lameness, fever, prolonged recumbency
- Tx: No specific Tx

Besnoitiosis, Elephant skin diz (C3T 596; Br 735)
- Mainly in Africa; protozoal parasite (*Besnoitia besnoiti*)
- CS: Chronic scleroderma (thickened, hardening & folding of skin)

Trypanosomiasis, Tsetse fly diz, Sleeping sickness, Surra, Nagana (C3T 604; IM 1053; BR-hb 466; BR 1212)
- Subtropical & tropical areas, Protozoal diz of people & animals transmitted by vectors
- CS: Intermittent fever & presence of parasite in blood, causing anemia, weakness, weight loss, & often hi mortality rates

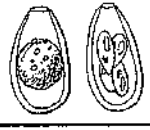
Bovine ehrlichiosis, Nofel (C3T 616)
- Tropical tick-borne rickettsiosis, seldom recognized or reported
- CS: Adults - fever, lymphadenosis, depression, loss of condition & abortion; Nofel is a fatal stress syndrome in cachectic carriers resembling heartwater

Bovine petechial fever, Ondiri diz (C3T 618; Br 743)
- Africa, rickettsiosis
- CS: Fluctuating hi fever, agalactia, petechiation, lymphadenosis, abortion & hi fatality rates

Tick born fever, Pasture fever (C3T 620; IM 1204; B4 742)
- Europe, Africa & Asia; noncontagious rickettsiosis (*Ehrlichia* spp)
- CS: Adult - fever, weight loss; death rare

Heartwater, Cowdriose, Daji (C3T 628; IM 1049; Br 707, 744)
- Africa & 3 Caribbean islands; infectious, virulent, noncontagious tick-borne rickettsial diz of ruminants
- CS: High fever, lung edema, hydropericardium, & CNS signs

East coast fever, Theileriosis, Corridor diz (C3T 627; IM 1052; BR-hb 462; BR 1207, Br 734)
- East & Central Africa; protozoal parasite; Transmission: tick
- CS: Fever, depression, anorexia, enlarged lymph nodes, photophobia, corneal opacities, constipation then diarrhea, petechiation, anemia, icterus, weakness, recumbency, terminal resp. distress, moist cough & frothy fluid from nose, "turning sickness" (CNS), high mortality
- Tx: Paraquone IM; 90% recovery
- Prevention: Tick control



Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Osteomalacia C1T321; IM 1336; 1310, 1472; BR-hb 545; BR 1438; L 404 **	• Grazing adults in P-defc areas • Pregnant & lactating at greatest risk • Calcium defc diets	• Loss of condition • Pica • Lowered fertility • Stiffness, creaking joints • Shifting lameness • Recumbency periods • Fractures (knocked down hips & ribs)	• ↑ ALP • Radiographs - Porous bones • Tx response • Analysis of diet	• **Ca/P ratio in diet** - Grazing animals - access to mineral mixes (powdered limestone) - Dairy - Ca incorporated in diet • Ca:P 50:50 incorporated w/ common salt
Osteoporosis (IM 1310; L 405): Bone fragility & spontaneous fxs; Assoc. w/ copper defc; See Cardio pg 89 **				
Rickets, Osteodystrophy, Calcium/ Phosphorus/ Vitamin D defc Mk 487; C1T 321; IM 1293, 1336; BR-hb 543; BR 1433; L 400 **	• **Uncommon** • **Defective mineralization of bone** • **Young, growing animals** • Not affected: calves on milk diet • Weaned • Pathophysiology - Defc of phosphorus or Vit D - Calcium defc & phosphorus excess (nutritional 2° Hyperparathyroidism) - Mg, Zn, manganese, Vit A defc also implicated - Not enough sunlight (winter grazing, housing) - Absence of Vit D supplementation - Young grazing green cereal crops in cloudy season - Brassica spp. (turnips, swedes, rape) - Hypophosphatemia	• Stiffness, reluctance to move • **Lameness** • Painful, enlarged joints • Arched back • Enlargement of costochondral junctions (rachitic rosary) • Long bone curvature (bowlegged) • Delayed/irregular teeth eruption • **Mottled teeth** • ↓ Weight gain	• **History (diet), CS** • Lab: - ALP (serum alkaline phosphatase) - Ca & P often normal • **Response to Tx** • **Rads:** - **Cortical thinning** - **Bowing of long bones** - Enlargement & widening of growth plate - ↑ metaphyseal bone density parallel to growth plate - Epiphyseal "lipping" - Irregular radiolucent band at metaphyseal/epiphyseal junction - Copper defc shows similar rads • Histology/biopsy: - Live costochondral junction - Necropsy - distal metatarsus/ metacarpus	• **Supplement Ca & P in diet** - Dicalcium phosphate, bone meal, limestone plus phosphorus (mono-ammonium phosphate) • Injectable Vit D (IM) + Ca & P supplementation Vit D Ca + P **Prognosis:** • **Good** for ambulatory patients **Prevention:** • **Easy**: balanced diet w/ appropriate supplementation (not excess or cause other problems) to growing animals

DDx:
- Fluorosis (p 216)
- Arthritis (p 172)
- Copper defc (p 89)
- Epiphysitis (p 175)
- Hyperparathyroidism

Defective mineralization of bone
CS: Lameness, Swellings, Mottled teeth
Dx: Hx, CS, Tx response, Rads
Tx: Supplement Ca, P, Vit D

Hereditary skeletal defects (C1T 98; BR-hb 647; BR 651; IM 1729t)

Osteopetrosis (C3T 98; R-M 182)
*
- Angus, Hereford & Simmental calves, Autosomal recessive trait, Calves born prematurely at 262 days gestation (Normal 281-292 days)
- CS: Small size & birth weight, Brachygnathia inferior (short lower jaw), Impaction of molar teeth, Misshapen coronoid & condylar processes, Open fontanelle, Thickened cranial bones, Agenesis or hypoplasia of foramen of skull
- Dx: Rads - Bone-within-bone appearance (lack of bone marrow cavities); Lethal

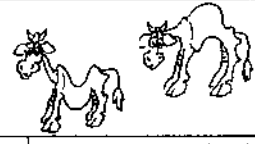
Dwarfism (R-M 182): Bulldog calves (Dexter), Hereditary defect in interstitial growth of epiphyseal, articular, basocranial cartilages resulting in short legs
*
- **Tx: Cull**

Arachnomelia (C1T 98) (arachno: spider): Simmental calves - dolichostenomelia (arachnodactyly - abnormal length & slenderness), extreme fragility of long bones, deviation of vertebral axis, arthrogryposis, brachygnathia inferior, cardiac defects
*

Brachiognathia inferior or superior (R-M 182): shortness of upper or lower jaw (parrot beak/mouth)
*

Prognathia inferior or superior: abnormal lengthening of jaws
*

Kyphosis/hunch back (R-M 183; N-L 260, 307): dors. deviation of spine
**



Lordosis/sway back: ventral deviation of spine
*

Scoliosis (R-M 183; N-L 260): lateral deviation of vertebral column
*

Torticollosis/"Wryneck" (R-M 183; N-L 271): lat. deviation of neck
*

Anury (total agenesis) & **brachyury** (partial agenesis) of caud. part of spinal column (tail missing) (R-M 183)
*

Adactyly: missing digit (shorthorn) (R-M 184)
*

Polydactyly: additional digits (R-M 184)
*

Syndactyly: fusion or nondivision of functional digits (R-M 184), Holstein/Friesian, Angus, Chianina crosses, Simmental
*

Acroteriasis congenita: born w/ all four legs amputated
*

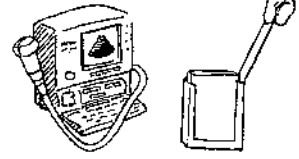
Osteogenesis imperfecta: Charolais, Reduction in bone mass leading to spontaneous fxs
*

Hypertrophic (pulmonary) osteopathy, HO, (HPO), Marie's diz
IM 1311
*

- **Rare diz in cattle**
- **Associated w/ pulmonary diz**
  - 1 case assoc w/ pulmonary lymphosarcoma
- 1° Abdominal disorders
  - 1 case assoc. w/ reticuloperitonitis & widespread abscessation
- **Formation of subperiosteal new bone growth of distal diaphyses of long bones**
- **Cause unknown**

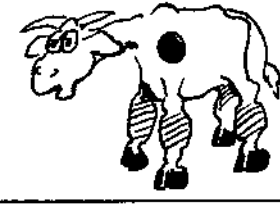
- **Nonedematous swelling of extremities**
  - Warm & throbbing
  - Asymmetrical
- **Taut skin** over dors. cannon bone
- Swelling & joint pain
- **Stiff gait**
- Pain on manipulation
- Reluctance to move
- **± Pulmonary signs**
  - **Cough**
  - **Nasal discharge**

- **History, CS**
- Radiographs:
  - **Periostitis** of long bones
  - Generalized soft tissue swelling
- **Ultrasound of abd. & thorax** for 1° thoracic or abdominal lesion



- **Tx & cure 1° problem & HO will disappear**

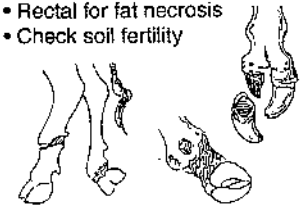
Prognosis:
- Depends on cause & its treatment

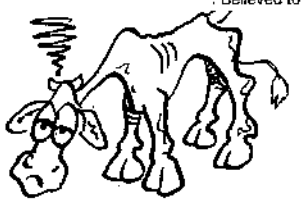


Rare, 2° to thoracic or abdominal diz
CS: Swelling of extremities
Dx: Hx, CS < Rads - periostitis of long bones
Tx: Cure 1° diz - HO disappears

Fungus

GENERALIZED CONDITIONS

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Summer slump, Fescue toxicity Mk 496; IM 1312, 257; C3T 870, 371, BR 1595; Pic 124; Derm 67 *** 	• **Tall fescue** (Festuca arundinacea Schreb) - **Major forage grass** - **Popular** bec. adaptable to many soil & climate conditions & can be grazed throughout most of winter - High quality, but also toxic - Major grass in southeast • Syndromes of toxicity - Fescue foot - late fall or winter - Summer slump - most common - Fat necrosis • Single or combination of syndromes if prolonged grazing • **Toxic agent: unknown?** - Assoc. w/ fungus (*Acremonium coenophialum*) (formerly *Epichloe typhina*) . Grows inside plant's intercellular spaces (requires special lab procedures to detect) . Believed to decr. prolactin levels	• **Fescue foot** - **Weight loss** (don't move to get food, pain) - Lameness of hindlimbs, shift wt. often lt. leg 1st, knuckling of pastern joint, reddening & swelling of coronary band - **Gangrene of feet & tail** . Sloughing of rear hooves • **Summer slump/poor prod.** - Reduced feed intake - ↓ Weight gain - ↓ Milk production - Repro problems (conception) - Failure to shed winter coat - Diarrhea - ↑ Temperature - Search for shade instead of food (heat intolerance) • **Fat necrosis** - Few clinical signs unless interferes w/ intestines or uterus - Chronic bloating - ↓ Rumination - Reduced feed intake - **Weight loss** - Scanty feces - Chronic poor doers - Dystocia	• Hx (fescue ingestion for wks or mos) • CS (clinical signs) • Serum prolactin levels < 67 mg/ml m/b helpful • Rectal for fat necrosis • Check soil fertility  DDx: • Fescue foot - Ergot (p 237) - Foot rot (p 159) - Frostbite (p 163) - Trauma • Summer slump - Molybdenum toxicosis (p 89) - OP toxicity (p 206) - Internal parasites (p 56) - Nutritional defc • Fat necrosis - Lymphoma (p 268) - Peritonitis (p 53) - Intussusception (p 45) - GI obstruction (p 44) - GI torsion	• **Usually valuable forage** • If problems - Slaughter - fescue foot or large masses of necrotic fat  - Remove fescue - Good alternate feed, rotate w/ other grasses (Bermuda grass) - Summer slump - often return to normal **Prevention:** • Graze other forage • If major forage (Southeast) - Test for endophyte fungus & in what amount . **Dilute** w/ legumes (unsuccessful) . Fungicides (unsuccessful) . Fungus-free seeds planted  *Dilution is the Solution to Pollution*



Tall fescue: Valuable forage, Fungus
CS: "Summer slump", Fescue foot, Fat necrosis
Dx: Hx, CS
Tx: Slaughter, Substitute feed

Systemic mycoses

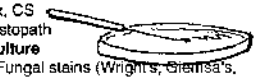
C3T 524; IM 1890

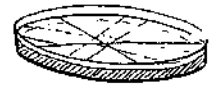
*

- Superficial skin infections (see skin)
- **Environmental mycosis**
  - Low virulence, constant inhalation or ingestion exposure
- Pathogenic factors:
  - Immunosuppression
  - Incr. environmental exposure (moldy feed)
  - Prolonged AB Tx (removes competition)
  - Entrance other than resp or GI (mammary, wounds or uterus)
- Sporadic
- Abortion & mastitis most important syndromes
- Potential pathogens to people

- Genital infections & abortions
  - 2-30% of all infectious abortions
  - Aspergillosis ≥ 2/3rds of all fungal abortions
- Mastitis

- Hx, CS
- Histopath
- **Culture**
  - Fungal stains (Wright's, Giemsa's, silver & periodic acid-Schiff [PAS])
  - Yeast stain w/ gram's stain
- **Wet mount exam**





- **Abortion**
  - No specific control measures
  - Eliminate moldy feed
- **Mastitis**
  - No established treatment
  - Many resolve in 2-4 weeks
  - No approved intramammary drug in USA
    . Europe intramammary Nystatin

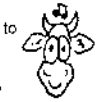
Antifungal drugs in cattle an unexplored field

Mycoses causing little problems

- Histoplasma, dimorphic (molds or yeast), Extremely rare (respiratory) not important
- *Coccidioides immitis* - dimorphic (mycelia & sporangium [spherical])
- *Cryptococcus neoformans* - in soil only, yeast form (yeast w/ mucoid capsule, buds)
- *Rhinosporidium seebri* - tropical or subtropical
- Prototheca spp - algae devoid of chlorophyll

Prognosis

- Abortion: Good, most return to normal breeding
- Mastitis: Many resolve spontaneously in 2-4 weeks

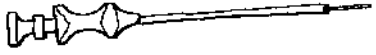


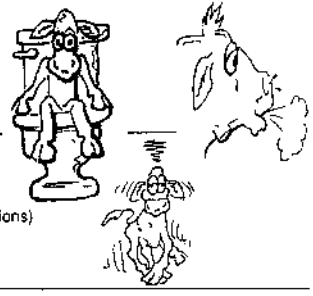
Candidiasis, Candidosis, Thrush

Mk 342; C3T 525; Br 764

*

- Mucocutaneous diz, Worldwide, Yeastlike fungus, *Candida albicans* (common inhabitant of oral mucosa & GI). Implicated in bovine oral, GI, resp. & vaginal infection, abortion & mastitis
- **CS: Mastitis; GI:** calves w/ forestomach "Thrush" - water diarrhea, anorexia & dehydration; **Respiratory:** pneumonia, dyspnea moderate, fever
- **Dx:** Scraping or biopsy of mucocutaneous lesions, Ovoid budding, Yeast cells (yeast, budding, mycelial & pseudomycelial forms - Gram's stain)
- **Tx:** Nystatin ointment or Amphotericin B, Iodine for oral or cutaneous infections.





Muromycosis, Zygomycosis

Mk 348; C3T 528

*

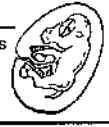
- Fungi of order Mucorales (*Mucor, Absidia, Rhizopus, Mortierella, Rhizomucor*), inhabitant of soil, manure & rotting vegetation, often 2° to metabolic disorders or immunosuppression, Granulomatous lesions in several organs, skin, GI, Lymph nodes, Placentitis & abortion in cattle
- **CS:** Nonspecific, reflecting organ involved, Pneumonia m/b, Anorexia, pyrexia, persistent diarrhea, Neonatal encephalitis
- **Dx:** Antemortem Dx uncommon; PM: fungal ID, microscopy, FA, cultures (broad, readily collapsing & twisted, nonseptate hyphae in smears or sections)
- **Tx:** No successful Tx, Surgical excision of supf. lesions, Amphotericin B

Aspergillus

C3T 527; IM 1890

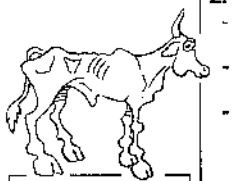
*

- Ubiquitous in nature, septated hyphae in wet mounts or stained smears, Sporadic, Young debilitated animals
- **CS:** GI & respiratory forms; > 2/3rds of all fungal abortions
- **Dx:** Antemortem Dx uncommon

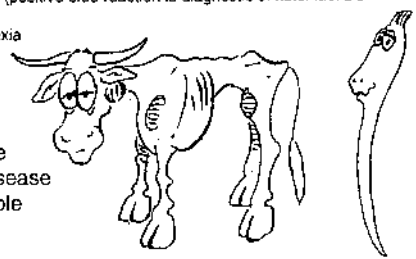


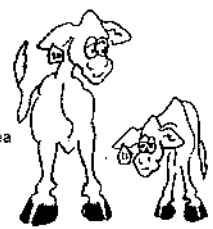
Weight Loss - Downer Cow

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Weight loss IM 191, 959 ★★★	• Associated with: **1. Anorexia - usually 2° to a 1° disease condition** - Loss of appetite (desire to eat) m/b complete or partial - Differentiate from dysphagia (difficult swallowing) by observation **2. Increased nutrient demands** - Physiologic (colds, weather, growth, exercise, pregnancy & lactation) - **Pathologic** (sepsis, parasitism, burns, peritonitis, surgery or trauma) - **Parasitism #1** . Common cause of weight loss . Competition for nutrients .. Inflammation (incr. requirements) .. Malassimilation, malabsorption .. Migration damage to organs or vessels .. Anorexia in advanced stages **3. Malnutrition** - Poor quality feed - Deficient micronutrients (copper, cobalt [Vit B12] or Vit A) **4. Poor dentition** **5. Dysphagia** (difficult swallowing) • Stress of disease increases sympathetic activity - Incr. epinephrine release, impaired insulin release & enhanced glucagon secretion - Hyperglycemia (decr. insulin release, enhanced glycogenolysis & gluconeogenesis) • **Granulomatous enteritis** - Assoc. w/ malabsorption or malassimilation syndromes - Anorexia absent, good appetite w/ wt. loss	• **Weight loss** - short or intermediate duration • **Dehydration** • **Electrolyte imbalances** &/or acid-base imbalances **Weight loss** (p 293) • Malnutrition • Parasites (p 54) • Dental abnormalities (p 7) • Pneumonia (p 62) • Viruses • Diarrhea (p 16) • Deficiencies • Cryptosporidiosis (p 19) • Lameness (p 155) • GI problems • Peritonitis (p 53) • Pasteurellosis, septicemia (p 255) • Leptospirosis (p 257) • Mastitis (p 192) • Actinobacillosis (p 13) • Actinomycosis (p 13) • Urinary problems (p 93) • Failure of passive transfer (p 246) • Fescue toxicity (p 254) • Bovine leukosis (p 268) More complete list see DD pg 293	• **Note other CS** - diarrhea, dysphagia, coughing & polyuria • **History:** - Amount of weight loss (acute loss of 5-10% significant) - Dietary Hx, quality of feed, feeding practices, esp. if fed in groups - Deworming Hx - Envir. toxic substances • **Physical exam:** - CS of concurrent disease (diarrhea), fever, dysphagia (difficult swallowing), abnormal dentition, melena, icterus, dyspnea, tachycardia - Can animal eat? - Weigh or use heart girth measurement - Nitroprusside powder test on milk (positive blue reaction is diagnostic of ketonlactia & ketonemia - Rumen pH > 7 indicative of anorexia - Check for lice & keds • **Analyze diet:** - Adequate intake - Inadequate intake . Adequate feed available .. Anorexia due to 1° disease . Inadequate feed available .. Malnutrition • **Fecal exam:** - Microscopic (flotation, sedimentation, Baerman's procedure) - parasite ova - Fecal occult blood for melena - Diarrhea • Lab - CBC, PP (plasma proteins) & fibrinogen - Inflammatory process (Incr. WBCs, Incr. PMNs, Incr. fibrinogen, Decr. PP: fibrinogen ratio) - If anemia, calculate RBC indexes - Blood selenium or glutathione peroxidase activity if Se defc area - Chemistry . Hypoalbuminemia assoc. w/ internal abscessation, malnutrition, liver, renal, granulomatous bowel diz	• **Treat 1° cause** • **Good quality feed**



#1 parasitism
Malnutrition
Bad teeth
Disease





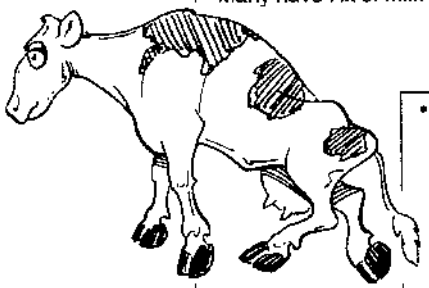
Downer

cow

C3T 321; IM 1173; BR-hb 513, 297, 220; BR 1328; Br 368, 594, 123; L 360

★★★

- **Cow unable to rise for 24 hours**
- **Most sequel to recumbency of parturient paresis**
  - Incidence incr. w/ incr. time between onset of milk fever & 1st Ca Tx
  - **Recumbency** then causes:
    . Muscle damage, or
    . Nerve damage (sciatic or peroneal)
  - Other causes of recumbency also cause muscle & nerve damage
    . Metabolic disorders 2° to milk fever
    . Systemic illnesses
    . Trauma & lymphosarcoma
- Most common betw. 2 ds before parturition & 10 ds after
- Most 5-8 yr-old high producers
- Many have Hx of milk fever



- **Sternal recumbency 24 hours after onset**
- **BAR** (bright, alert & responsive)
- Eating & ruminating, ± appetite reduced
- Defecation normal
- Some refuse to rise
- **"Creeping" or "crawling"** due to frequent attempts to rise, both hindlimbs flexed & displaced caudally
- **Nonalert downer cows**
  - Severely affected - lat. recumbency unless supported
  - Expiratory moaning
  - Mucoid feces

- Sequela:
  - Coxofemoral luxation as struggle to rise

- **R/O causes (see list)**
- History, CS
- TPR normal
- PE (sensation, crepitation, pain)

- Proteinuria
- Rectal exam
- Lab:
  - Ca normal after Ca milk fever Tx
    . Phosphorus often remains low (< 3.0 mmol/L)

  - AST, CK usually elevated indicating muscle damage
    . CK max at 48 hrs then falls
    . AST remains higher longer
  - Marked proteinuria in 24 hours
- Postmortem: Hemorrhage & degeneration of upper hind limb & nerves
- Response to repeated milk fever treatment

- **Good footing** (move from slippery area)
- **Retreat milk fever** (if postparturient)
  - Slow IV Ca, Mg, P & dextrose (monitor heart)
- **Phosphorus** IV injection (Sodaphos® or Coforta® 5% m/b)
- Vetibenzamine® (tripelennamine HCl) CNS stimulant IV
- **Stimulate to rise** - cattle goad, Knees in side
  - If attempts to rise assist by lifting tail
  - Lay in lat. recumbency, electrically stimulate tibial nerve w/ goad, roll & stim. other tibial n., few minutes rest & goad to rise again
- Lifting devices if all else fails (some resent than counterproductive)

- **Supportive care** (if all else fails)
  - Shelter, deep bedding
  - Labor intensive
    . Keep in sternal recumbency
    . Change sides ≤ 3 hours
    . Regular feed & water
    . Lifting devices used sparingly

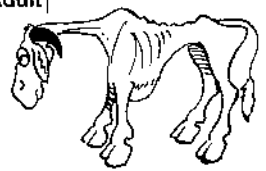
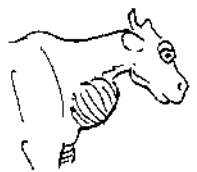
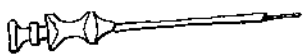
- **Causes**
  - #1 sequel to parturient paresis (p 148)
  - Recumbency due to
    . Obturator (calving) paralysis (p 137)
    . Pelvic fractures (riding by other cows) (p 167)
    . Fx of femoral neck (p 165)
    . Coxofemoral luxation (p 166)
    . Spinal injury (p 133)
    . Lymphosarcoma of vertebrae (p 135)
  - Metabolic disorder 2° to milk fever
    . Hypophosphatemia (p 88)
    . Hypomagnesemia (p 146)
    . Hypokalemia (p 306)
    . Hypoproteinemia (p 302)
    . Cerebral edema (p 139)
    . Ketosis (p 33)
    . Liver failure (p 34)
  - Systemic illness causing recumbency
    . Mastitis (p 192)
    . Metritis (p 111)
    . Peritonitis (p 53)
  - Recumbency causing nerve & muscle damage
    . Muscle damage w/ or w/o compartment syndrome
    . Ischiatic nerve damage (p 136)
    . Peroneal nerve damage (p 137)

Prognosis:

- **Good** if gets up, obviously!
  - Many will rise w/in 2 weeks if eating & drinking & good nursing
  - Poor if complication of mastitis or coxofemoral luxation

Milk fever, Recumbency
CS: Unable to rise 24 hrs
Dx: R/Os, Tx milk fever
Tx: Milk fever Tx, Phos. injec., Goad
Px: 2 wks to get up

Bovine Leukosis — GENERALIZED CONDITIONS

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Bovine leukosis, **Bovine lymphosarcoma, Malignant lymphoma** Mk 391; CST 450; IM 1237, 1437; BR-hb 375; BR 954; Br 530	• **Four forms: Calf, Thymic, Skin & Adult** - **#1 Adult form** (enzootic bovine lymphosarcoma) . **Bovine leukemia virus (BLV+) assoc. w/ form** - Other 3 not associated w/ this virus, cause unknown, very uncommon (sporadic form), incidence unknown 		**Four forms: Calf, Thymic, Skin & Adult** **#1 Adult form - virus, not other 3** **Tx: None for all, Cull** 	
1 • **Calf, juvenile, sporadic lymphosarcoma** * **1/2 yr, Rare** **CS: Lnn., Death**	• **Rare** • **3-6 month-old** dairy calves (1 month - 3 years) • Unknown cause, not BLV 	• Wt. loss, depression, weakness • **Acute generalized lymphadenopathy** (deep cervical & parotid lnn.) • Neoplasms of heart, spleen, kidney liver & lungs • Fever, tachypnea, coughing, due to space occupying lesion, ↓HR, harsh resp. sounds • **Death w/in 2-8 week** (once lnn. enlarged)	• Lab: - Biopsy or aspiration of lymph nodes (distinguish from hyperplasia) - High WBCs • Postmortem shows all organ involvement 	• None, unsuccessful
2 • **Thymic or adolescent lymphosis** * **1/2-2 yrs., Rare** **CS: Bloat, Inn.**	• **Very rare** • Beef breeds (Herefords) • **6-24 month-old** • Persistent & enlarged **thymus** (grows in cran. thorax, putting pressure on other organs)	• Brisket edema, pitting • Other lymph nodes enlarged • Distended jugular v., nonpulsating (due to compression) • **Bloat** & dysphagia (esophageal compression)  • **Die w/in 2-10 week** after CS, usually due to bloat • Generalized lymphadenopathy uncommon	• **Not easy to Dx** • ± Enlargement of peripheral lymph nodes (biopsy) • **Normal WBCs** • **Bloat** • **Normally diagnosed at postmortem**	• None, unsuccessful 
3 • **Cutaneous lymphosis** * **1-3 yrs, Most rare form** **CS: Nodules**	• **Rare** • Most common of sporadic forms, but still rare • **1-3 years old** 	• **Raised nodules** w/ necrotic centers, **ulcerated** - M/ disappear to reappear 1-2 years later • Usually regress in a few weeks • M/ recur as generalized lymphosarcoma - fatal	• **Biopsy** of nodules & lymph nodes (neoplastic lymphacytic infiltration) • Other organs cause own set of CS & disease so hard to diagnose 	• Regress in a few weeks usually **Prognosis: Guarded, if recurs, fatal** 

4 • **Adult or Multicentric/ Enzootic Lymphosarcoma, LSA**

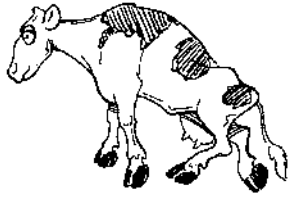
Bovine leukosis

Bovine leukemia virus (BLV)

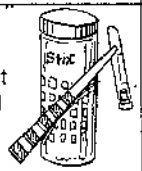
**

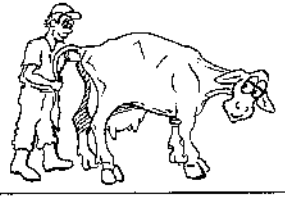
- **BLV - Retrovirus** (Bovine leukemia virus)
- Rare, but most common tumor in cattle
- Once infected, infected for life
- **Many seropositive, < 5% of seropositive get lymphosarcoma**
- Immunosuppression - 2° diz
- **> 4 year-old**
- Right atrium, Uterus, Abomasum, Kidney, Spinal cord, Spleen, Retrobulbar then other lymph nodes (lnn)
- **Economically important**
  - Embryo herds for export
  - Bull calves - for studs
- **Transmission:** contact
  - Blood & milk, colostrum
  - Vector (horseflies, mosquitos, etc.)
  - Iatrogenic (rectal palpation & blood on obstetric gloves)
- Genetic predisposition? (Some herds higher prevalence)

- Acute onset of CS
  - **Weight loss,** ↓ appetite
  - ↓ Milk production
  - **Enlarged peripheral lymph nodes** (lymphadenopathy)
- **CS depending on organ involved**
  - **Posterior paresis** (spinal cord)
  - **Exophthalmus** (protruded eyeball)
  - **Diarrhea or constipation**
  - **Heart** - Jugular pulse
  - **Abdominal tumors**
  - **Repro problems**
  - Fever, ± respiratory signs
- **Euthanized w/in 3-6 weeks** once CS

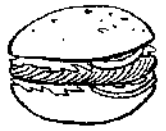


- History, CS
- Lab:
  - Elevated WBCs, but leukemia not typical
  - Antibody detection
    - . Agar gel immunodiffusion test
    - . ELISA
- Aspiration or incisional biopsies of lymph nodes, looking for neoplastic lymphocytes (not reliable, similar to infection)
- **Rectal palpation,** those w/o enlarged lymph nodes or exophthalmus
  - Multiple tumor masses (≤ 0.5 meter)
  - Uterus, rumen, colon, kidneys
  - Internal iliac lymph nodes
  - Firm (but not hard) & slightly lobulated
- **Definitive diagnosis**
  - **histopathology**



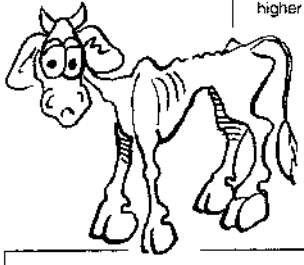


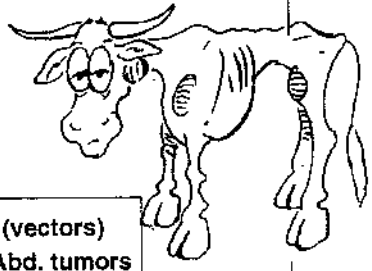
- **Cull**
- $ supportive to get calf or embryo



Prognosis: Grave

Control:
- BLV free herds
  - Test & cull (see box)





DDx:
- Internal masses
  - Carcinomas (< 15 cm)
  - Melanomas (< 15 cm, hard)
  - Fat necrosis (masses soft)
  - Internal abscess (single)

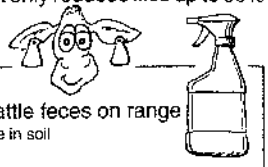
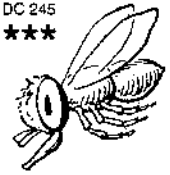
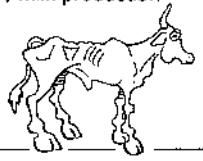
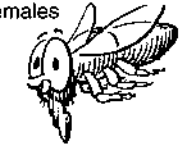
BLV seronegative herds - Impractical
- Serologically test all cattle over 6 mo at 3 month intervals
- Rapidly remove all positive
- Herd usually BLV free after 2nd or 3rd test
- Done in foreign countries & serological tests frequently incorporated into international trade regulations

- **Seropositive animals** if kept on same farm:
  - -Separated by no less than 10 meters, better to use solid partition
- **Costly program**, serological testing. Expense is worth it for seronegative herds

> 4 yrs, Virus, Contagious (vectors)
CS: Wt. loss, Large Lnn., Abd. tumors
Dx: Histopath., BLV serology
Tx: CS - Cull; Free herd programs

Flies

GENERALIZED CONDITIONS

Condition	Facts/Cause	Presentation/SC	Diagnosis	Treatment
Face flies Mk 800, IM 1426; BR-hb 505; BR 1302; DC 245 ***  **Eye irritant** **Range cattle** **Ear tags**	• ***Musca autumnalis*** • Overwinter in buildings • Females feed on facial secretions (tear fluids, nasal mucus & saliva) - Also blood from wounds & milk from calves' faces • **Range cattle** principal host (also horses) - Doesn't develop in feedlot situations	• **Irritation & mechanical damage to eye tissue**  Sequelae: • Transmit *Moraxella bovis* (infec. keratoconjunctivitis) • Vector for *Thelazia* spp. • Vector for *Parafilaria bovicola*	• Looks like house fly - 4 longitudinal stripes on abdomen - Mouthparts sponging labellae w/ rough spines  Life cycle • Breed only in fresh cattle feces on range • Eggs hatch in feces & mature in soil • Egg to adult 12-20 days	• Difficult to control • **Insecticide impregnated ear tags** best - But only reduces flies up to 80% 
Horn flies Mk 801, BR 1299, Br 725; DC 245 ***  **Always on cattle** **Easy to control**	• ***Haemotobia Irritans*** • **Major cattle pest** - Reproduce only in bovine feces - Will feed on horses, sheep & goats • Flies can fly 7-10 miles • In south m/ have thousands on 1 animal • Intermediate host of *Stephanofilaria stilesi* - Causes filarial dermatosis of cattle Life cycle • **Entirely on host**, except when depositing eggs in feces	• Pierce skin to suck blood - Pain, annoyance & blood loss in cattle • **Weight loss**/tremendous $ losses (irritation therefore less feed efficiency) • **Lesions along ventral midline** • ↓ Milk production 	• 1/2 the size of stable flies - Same color & appearance • Bayonet-type, piercing/ sucking mouth parts  	• **Relatively easy to control bec. stay on animal all the time** - Whole animal chem. sprays - Self treating devices (dust bags & back rubbers) - Insecticide feed additives to kill larval horn flies breeding in feces - Insecticide impregnated ear tags (pyrethroid or organophosphate) - Resistance to pyrethroids has developed in areas 
Horse flies Mk 802; BR-hb 499; BR 1299, Br 724; DC 245 ***  **Painful** **Control hard**	• Tabanidae family • ***Tabanus & Hybomitra*** (horse flies), *Chrysops* (deer fly) - Intermittent feeders - Need blood meal for female for ovipositing - Larvae are aquatic or semiaquatic • M/ transmit: **anthrax, anaplasmosis, tularemia** & EIA (horse)	• **Painful wound** • **Wt. loss** from irritation & pain • **Anemia** when large #s feeding • Screw worms concern in S. Mex. & Central America 	• Up to 1" long - Blade-like mouthparts of females 	• **Most difficult to control of all bloodsucking flies** because intermittent feeders  - Dust bags & back rubbers - Insecticide impregnated ear tags - Check with local regulation officials for specific controls

Stable flies

Mk 803, C3T 51, BR-hb 498; BR 1298; Br 725; DC 245

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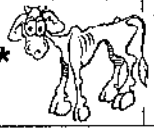
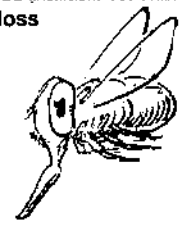


Decaying matter
Sanitation

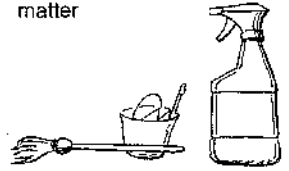
- ***Stomoxys calcitrans***
- Feed on most warm blooded animals
  - **Feed once or twice a day**
- **Develops in decaying organic matter** (grass clippings)
- Midwestern feedlots mainly (but all over)
- Mechanical vector of anthrax or surra

- **Irritation painful bite**
  - **Wt. loss** (inefficient feed utilization)
- **Blood loss**



- Looks like house fly
  - Outer of 4 thoracic stripes is broken
  - Checkered abdomen
  - Needle sharp proboscis

- **Difficult because only feed once or twice a day**
- Spray area w/ insecticides
- **#1 sanitation**, clean up decaying matter



House flies

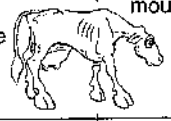
Mk 802; BR-hb 504; BR 1301; DC 245

***

Annoyance

- ***Musca domestica***
  - Breeds in manure
  - Sponge-like nonbiting mouthparts

- Annoyance even though doesn't bite
  - Reduce performance
  - **Weight loss**



- Sponge-like nonbiting mouthparts

- **Sanitation program**
  - Remove manure at least 2x/week or handle properly
- Insecticide to supplement

Screw worms

Mk 830, IM 1426; C3T 869, BR-hb 494; BR 1284, Br 726

USA free

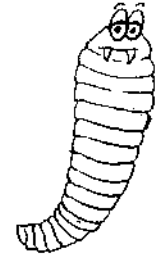
Eradicated in USA & Mex.
CS: Myiasis - Cavernous lesions
Reportable

- ***Cochliomyia (Callitroga) hominivorax***
  - **Blowfly**
  - Screw worms are larvae of blowfly
  - **Obligate myiasis***
  - **Need live tissue**, can't feed on dead tissue
- **Eradicated from USA & Mexico**
  - Sterile males released, females only mate once
- New cases from importation of infected animals & occasional case in areas bordering Mexico (?)

- **Cavernous lesion** filled w/ larvae
  - Liquefaction necrosis
  - Profuse brownish exudate
  - Objectionable odor
- Self perpetuating, more eggs laid
- 2° bacterial infection, toxemia, & fluid loss to death

- **Reportable**
- Eradication program
  - Blowfly bluish to bluish green
  - Preserve suspected larvae in 70% alcohol
    - Larvae resemble woodscrew
    - Send to eradication officials at PO Box 969 Mission, TX 78572

- Report to eradication officials
- Clip & clean wound
- **"Smears"**; wound dressing containing lindane or ronnel (hard to find in USA bec. of eradication)
- Prophylactic for other animals - spray on ronnel or dipped in coumaphos
- In cattle, SQ injection of ivermectin

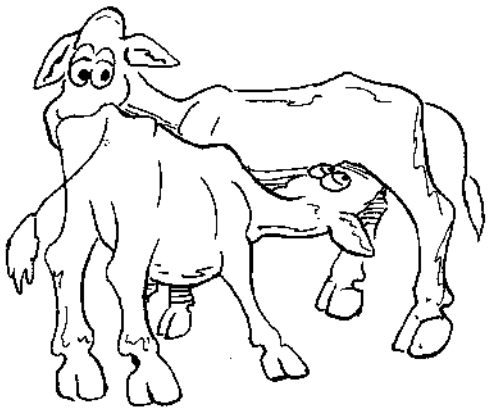


***Myiasis: infestation of body by fly larvae**

Prolonged suckling (cross-suckling) or Galactophagia

Mk 924; Br 772

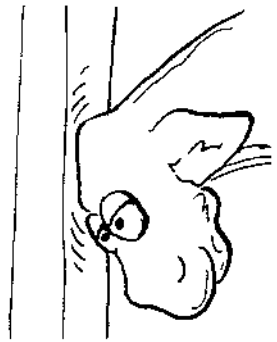
- Cause: Weaned early or orphans, group housing
- CS: Suckling another animal
- Tx
  - Automatic nursers w/ nipples 30 min
  - Tie up calves for 1 hour after bucket feeding (drive diminishes)
  - Supplemental roughage
  - Older sucklers
    - . Pointed prong devices to face & nose region (traumatize animal suckling on)
    - . Electrical shock devices on head, give animal suckling shock

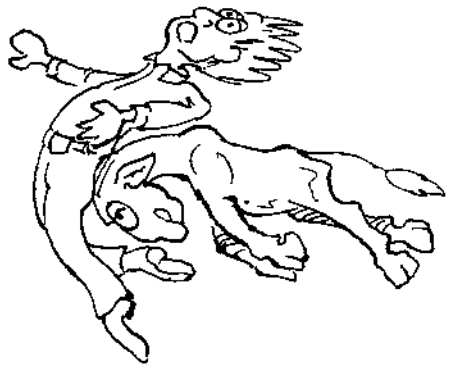


Head rubbing

Mk 921

- Cause: Cattle & pigs in chronic confinement in narrow stalls
- CS: Head rubbing
- Tx: Freedom from chronic confinement





Butting

Mk 922

- Cause: Bad disposition
  - People playing w/ head
- Butting w/ or w/o horns
- Caution when dealing w/ animal

Overgrooming (self licking)

Mk 924; Br 773

- Cause: Stress related
  - Single stall confinement
  - Pruritic diz
- CS: Excessive self licking (overgrooming)
- Clinical sequela: Hairballs (trichobezoars)

- Tx: Freedom, exercise & socialization, eliminate all causes of pruritus/parasitism before Dx overgrooming

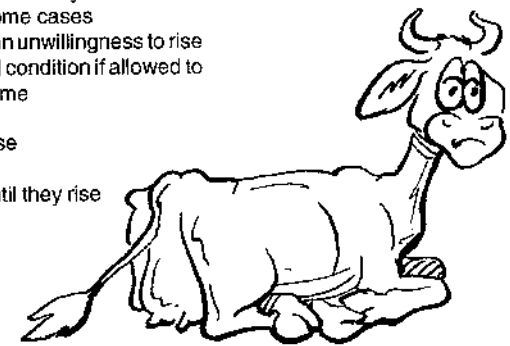
Tonic immobility

Mk 923

- Anomalous tonic immobility
- Downer cows in some cases
  - Will change from an unwillingness to rise into a pathological condition if allowed to go on for a long time

- CS: Unwilling to rise

- Tx: Irritate them until they rise



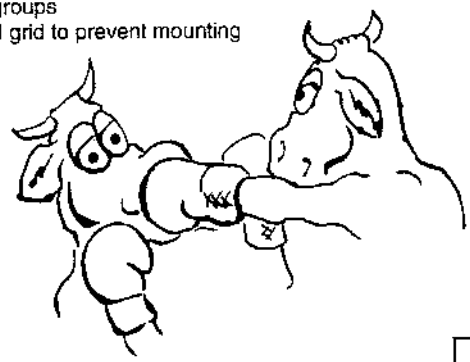
Fighting & mounting

Br 774

- Cause: beef animals, especially bulls kept in groups

- CS: Fighting & mounting
- Clinical sequelae: bruising & leg injuries

- Tx: Keep animals in stable groups
  - Overhead bars or electrical grid to prevent mounting



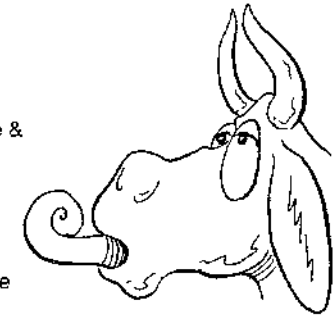
Tongue Rolling

Mk 923; Br 773

- Cause: Stall confinement
  - Copy other cattle or inherited

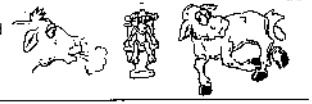
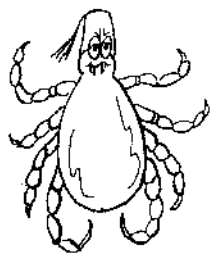
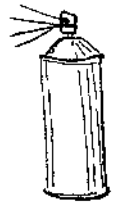
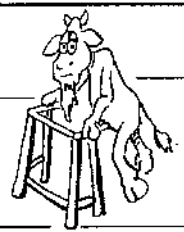
- CS: Exacerbated extruding of tongue & rolling tongue back into mouth
  - M/b gulping of air

- Tx only partially successful
- Wind-sucking straps on neck
- Metal ring through frenulum of tongue
- Salt blocks
- Freedom & forced exercise



Lyme Diz - Teat Conditions

GENERALIZED CONDITIONS

Condition	Facts/Cause	Presentation/CS	Diagnosis	Treatment
Sporadic bovine encephalomyelitis, Buss diz *	• **Rare**, See Neuro p 151, *Chlamydia psittacosis* - lymphogranuloma group, Pathophysiology: vasculitis • CS: Multisystem diz: fever, anorexia; Resp: nasal discharge, dyspnea, cough; Lameness; GI (initial diarrhea); CNS (encephalitis); Die in 4-10 d • Dx: Elementary bodies in pleural & peritoneal effusions highly suggestive, Culture chlamydia - blood & body fluids injected into guinea pig IP • Tx: Tetracyclines effective early			
Diabetes mellitus C1T 917; Br 760 *	• **Rare**, but reported in cattle • Cause: not acute pancreatitis as in dog; neoplasia, absence of beta cells & chronic pancreatitis, foot & mouth diz • CS: Hyperglycemia, glycosuria, polydipsia, polyuria, weight loss • Tx: Treatment is usually not contemplated, Protamine zinc insulin SQ BID m/b helpful • Px: Poor			
Lyme diz Mk 359; C3T 515; IM 1248; DC 491 *	• **Infectious diz of cattle, man & other animals** - Poorly understood in cattle - 1 reported case, several reports of cattle w/ antibodies to organism - Incidence unknown • Pathogenesis ? Immune? • **Tick** transmitted (*Ixodes* spp.) • Spirochete - *Borrelia burgdorferi* - Flexible, helical cells, motile - Gram-neg. Giemsa - Visible phase-contrast or darkfield microscopy **Tick, Spirochete (*Borrelia*)** **CS: 1 case: Lameness, Fever** **Dx: FA, ELISA** **Tx: ? - Antibiotics**	• **Lameness** • Arthritis • Swollen joints • Fever 	• History, CS • IFA & ELISA for antibodies to *B. burgdorferi* • Can't culture to Dx  **PH** Human Lyme diz: CS vary from mild skin rash to arthritis, CNS & cardiac manifestations	• NO studies done on AB treatment • Humans: antibiotic early helps - Chronic cases less responsive - over 2 years of Tx Control: • Spray for ticks • Check daily & remove ticks bec. don't transmit immediately 
Tularemia Mk 371 *	• **Cattle appear to be resistant**, Infectious diz of man & animals, *Pasteurella (Francisella) tularensis*; Natural host - **rabbits** & rodents, Transmission: ticks, **fleas**, deerflies; **Sheep** most commonly affected, documented in horse			
Chediak-Higashi syndrome IM 1890, 1741t, 219t; C3T 910; BR-hb 630; BR 1631 *	• **Rare**, Inherited disorder affecting PMNs & monocytes, Increased susceptibility to infections • **CS: Partial albinism** (skin & eyes), Coagulation difficulties, Infections, **Premature aging** • **Dx:** Hx, CS, Large cytoplasmic granules in PMNs			

Supernumerary teats

S-O 221; S-N 236

***

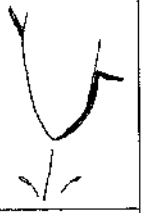
- **Extra teats**, most commonly caudal to last 2 normal teats; May or m/not have glandular tissue
- Tx: May remove for cosmetic reasons or if they interfere w/milking

Hard milkers, Contracted sphincter of teat orifice

S-O 222; DC 263

***

- Congenital or acquired (trauma)
- **CS:** small stream of milk, prolonged milking time
- **Dx:** History, CS
- **Tx:** Sx - ↑ size of sphincter w/ teat slitter/Lichy teat knife/teat bistoury & insert Larson teat tube for 5-7 days

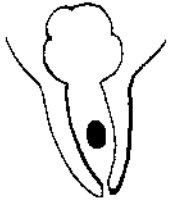


Lactoliths, Milk stones, Calculi

S-O 222, S-N 233; DC 267

**

- Foreign body in teat
- **CS:** Hinders milking
- **Dx:** Hx, CS, Palpate movable object
- **Tx:** Milk out small objects, crush w/ small forceps & milk out, or split orifice & remove



Polyps of teat

S-O 223

**

- Pea-sized protrusions w/in teat sinus
- **CS:** May interfere w/ milking
- **Dx:** History, CS
- **Tx:** Remove w/ tumor extractor or curette

Occlusion of teat orifice

S-O 223, S-N 235; DC 267

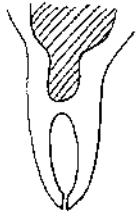
**

- Congenital or acquired
- **CS:** No milk flow
- **Tx:** Surgically open

Teat spider, Blind quarter

S-N 233

**



- Membranous obstruction of teat
- Location: high at base of teat or between teat orifice & base of teat
- **CS:** Hindrance or absence of milk flow
- **Dx:** Hx, CS, Palpate teat, if empty, obstruction high at base; if lower obstruction, milk palpated in teat above obstruction
- **Tx:** Low obstruction: Sx - open w/ teat bistoury or Hudson spiral teat instrument
  - High obstruction (no milk in teat) probe a few times, but if can't open allow quarter to atrophy

Laceration of teat

S-O 225, S-N 231

***

- Trauma - superficial or into teat sinus
- **CS:** Wound, Milk out of opening
- **Tx**
  - Superficial - suture
  - Wound into sinus
    - . Ring block base of teat
    - . Freshen edges
    - . Suture close
    - . Larson type teat tube inserted
    - . Remove sutures in 10-14 days

Amputation of mammary gland

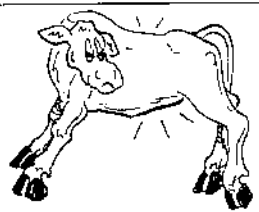
S-O 226; S-M 238

- Indication: severe mastitis refractory to treatment
  - Breeding animal w/ loss of ligamentous udder support
- Due to economics animal usually salvaged unless valuable breeder

DIFFERENTIAL DIAGNOSIS

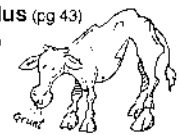
Colic/Abdominal Pain

IM 128, 31; Br112



Common causes:

- **Bloat** (accumulation of gas) (pg 26)
- **Intestinal gas/abomasal gas in calf**
- **Traumatic reticuloperitonitis** (pg 36)
- **Peritonitis** (pg 33)
- **Uterine tear w/ peritonitis** (pg 110, 35)
- **Abomasal torsion/volvulus** (pg 38)
- **Abomasal ulcers** (pg 31)
- **Intussusception** (pg 45)
- **Intestinal foreign body/obstruction** (pg 44)
- **Cecal displacement/torsion** (pg 44)
- **Urolithiasis** (pg 96)
- **Bladder rupture** (pg 96)
- **Intestinal torsion/volvulus** (pg 43)
- **Vagus indigestion** (pg 29)
- **Uterine torsion** (pg 111)



Uncommon causes:

- Acute traumatic reticulitis (pg 38)
- Indigestion: rumenitis/abomasitis/duodenitis (pg 28)
- Abomasal impaction (pg 30)
- Abomasal displacement (pg 38)
- Right displacked abomasum (pg 38)
- Ileus (pg 47)
- Enterotoxigenic colibacillosis (neonatal) (pg 18)
- Hypermotility & spasms of gut
- Hernia (pg 48)
- Atresia coli (neonate) (pg 47)

- Parturition, impending
- Hepatitis/liver abscess (pg 32)
- Cystitis/pyelonephritis (pg 95)
- Thrombophlebitis

Rare causes:

- Grain overload (pg 25)
- Water intoxication
- Intest. adhesions/incarceration (pg 46)
- Enterotoxemia (pg 14)
- Intestinal strangulation (pg 42)
- Intestinal neoplasia (pg 43)
- Torsion of descending colon
- Rectal tear (pg 51)
- Rectal prolapse (pg 51)
- Fat necrosis w/ obstruction (pg 50)
- Cholelithiasis (pg 35)
- Ovarian abscess
- Inversion of uterine horn (pg 112)
- Ruptured uterine artery
- Vaginitis (pg 115)
- Renal cysts
- Rupture of prepubic tendon (pg 113)
- Rinderpest (exotic) (pg 12)
- Rabies (pg 146)

Toxic causes:

- Plant poisonings (those that cause diarrhea)

Neonate - Distended &/or Painful Abdomen

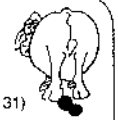
(IM 375; Br 112; DDX 13)

- Meconium impactions
- Malformation (atresia coli, recti, ani) (pg 51)
- Enteritis or abomasitis
- Intussusception (pg 45)
- Obstruction (pg 44)
- Volvulus/torsion (pg 45)
- Ruptured bladder (pg 96)
- Torn necrotic urachus (pg 102)
- Peritonitis (pg 53)
  - Devitalized bowel
  - Perforated ulcer
  - Generalized infection
  - Umbilical infec. (pg 102)
- Gas accumulation
- Ileus (pg 48)
- Necrotizing enterocolitis
- Aerophagia
- Ulcers (pg 31)
- Congenital tumors
- Ruptured umbilical vessels (pg 102)
- Severe hypoproteinemia
- Ruptured liver
- Ruptured spleen

We hope this section will be used as a reference (don't memorize); Ideal method of DDx

1. **Identify clinical syndrome**
2. **Understand pathophysiology to produce clinical syndrome**
3. **Determine cause of pathophysiology**
4. **Determine best case/herd management**

Melena (IM 130)



Common causes:

- **Abomasal ulcers** (pg 31)
- **Intussusception** (pg 45)

Uncommon causes:

- Gastroenteritis w/ bleeding
- Intestinal parasites (pg 54)
- Coccidiosis (pg 260)
- Postpartum ingestion of blood
- Abomasal torsion/volvulus (pg 40)

Rare causes:

- Hemophilia A (factor VIII) (pg 234)
- Duodenal ulcers
- Bacillary hemoglobinuria (pg 90)

Toxic causes:

- Oak (acorn) toxicity (pg 234)
- NSAIDs
- Arsenic toxicity (pg 202)
- Sulfur toxicity
- Warfarin poisoning (pg 214)

Diarrhea (IM 123; Br 121; GI 755; DDX 62)

Common causes:
- **Parasitism** (pg 21)
- **Salmonellosis** (pg 20,22)
- **Winter dysentery** (pg 22)
- **BVD** (pg 24)
- **Johne's diz** (pg 23)
- **Coccidiosis** (pg 19)
- **Enteritis** (pg 19-25)
- **Colitis/typhlitis** (pg 50)
- **Displaced abomasum** (pg 42)
- **Abomasal torsion** (pg 38)
- **Indigestion** (pg 28)
- **Peritonitis** (pg 33)
- **Sepsis/toxemia/entero-toxemia** (pg 149)
- **Intussusception** (pg 45)
- **Grain overload** (pg 25)
- **Malignant catarrhal fever** (pg 10)
- **Liver failure** (pg 34)
- **Heart failure** (pg 76)
- **Parasympathomimetics**
- **Molybdenosis/copper defc** (pg 89)
- **Uremia, Renal failure** (pg 95)
- **Large doses of xylazine**
- **Cathartic/laxatives**
- **Toxins or Poisonous plants**

Uncommon causes:
- Giardiasis (pg 19)
- Cecal dilation (pg 49)
- Liver abscess (pg 36)
- Bluetongue (pg 10)

- Brisket diz (pg 80)
- White muscle diz (pg 78)
- Bovine leukosis
- Intestinal obstruction, partial (pg 44)
- Intestinal tumor (pg 51)
- Traumatic reticulopericarditis (pg 76)
- Vagal indigestion (pg 29)
- Amyloidosis (pg 94)
- Sarcocystosis (pg 123)

Toxic causes:
- Lincomycin
- Arsenic (pg 202)
- Monensin (pg 203)
- Herbicides
- Zinc (pg 215)
- Copper (pg 203)
- Phosphorus fertilizers (pg 215)
- Levamisole (pg 216)
- Aflatoxin (pg 233)
- Nicotine (pg 213)
- Chlorpyritfos (Dursban®)
- Trichothecene
- Sodium bicarbonate
- Propylene glycol
- Sulfur

Plants
- Acorn (oak) (pg 234)
- Selenium accumulator (pg 226)
- Solanum (pg 239)
- Pyrrolizidine alkaloids (pg 232)
- Brassica (pg 231)
- Oleander (pg 230)
- St. John's wort (pg 233)
- Fungal toxicity
- Pokeweed (pg 241)
- Rattlebox (pg 221)
- Mushroom (pg 233)
- Many more: see IM pg 124

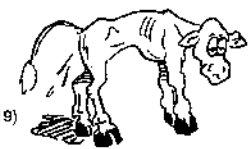
Rare causes: see IM pg 123

Neonatal Diarrhea

(IM 396; GI 755)

- Bacterial (pg 16)
  - *E. coli* (enterotoxigenic, enteropathogenic) (pg 18)
  - Salmonella (pg 21, 23))
  - *Clostridium perfringens* (pg 21, 250)
  - *Campylobacter fecalis, C. jejuni*
  - *C. sordelli*
- Viral

  - BVD (pg 253)
  - Rotavirus (pg 18)
  - Coronavirus (pg 19)
  - Bredavirus
  - Calicivirus
  - Astrovirus
  - Parvovirus
- Parasitic



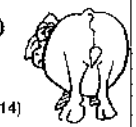
  - Coccidiosis (pg 19)
  - Cryptosporidia (pg 19)
  - Giardia (rare) (pg 19)
- Nutrition
  - Milk malabsorption (bicarbonate fluids PO)
  - Milk replacers

Blood, Fibrin &/or Mucus in Feces

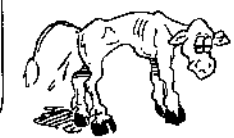
(IM 131)

Common causes:
- **Intussusception** (pg 45)
- **Coccidiosis** (pg 260)
- **Salmonellosis** (pg 259)
- **Foreign body**

Uncommon causes:
- Volvulus of root of mesentery (pg 45)
- Enterotoxemia (pg 18, 250)
- Abomasal torsion (pg 40)
- Malignant catarrhal fever (pg 10)
- Rectal palpation - rectal tears (pg 51)
- BVD (pg 253)

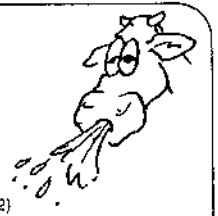


Toxicity:
- Arsenic toxicity (pg 202)
- Warfarin poisoning (pg 214)
- Castor bean toxicity (pg 235)
- Solanum poisoning (pg 239)
- Rattlebox poisoning (pg 233)
- Tung tree poisoning



Regurgitation/Vomiting

(IM 134; BR-hb 65; DDX 158)



Common causes:

- **Choke** (pg 15)
- **Esophageal trauma** (pg 15)
- **Obstruction of oral cavity/pharnyx** (trauma, FB, abscess) (pg 14)
- **Salt toxicity** (pg 205)
- **Mass in rumen/esophagus** (tumor, papilloma)
- **Toxins & poisonous plants** (see below)

Uncommon causes:

- Megaesophagus (pg 15)
- Esophageal diverticulum (pg 15)
- Hypoderma reaction in esophagus (pg 134)
- Hiatal/diaphragmatic hernia (pg 46)
- Hydrocephalus (pg 143)
- CNS trauma (pg 132, 138)
- Meningitis, meningoencephalitis (pg 151)
- Ruminal lactic acidosis (pg 25)

Rare causes:

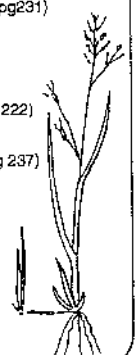
- Traumatic reticulitis (pg 38)
- Tetanus (pg 145)
- Peritonitis (pg 53)
- Pseudorabies (pg 186)
- Tick paralysis (pg 142)
- Intestinal neoplasia (pg 51)
- Persistent rt. aortic arch (pg 79)
- Blue tongue (pg 10)
- Rift valley fever (exotic) (pg 246)

Toxic causes:

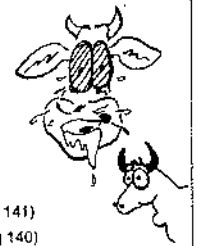
- Arsenic (pg 202)
- Methanol or ethanol
- Nitrates (pg 231)
- Crude oil (pg 213)
- Diesel fuel toxicity (pg 213)
- Phosphorus toxicity (pg 215)
- Acute oral copper toxicity (pg 203)
- Snake bite (pg 242)

Plant toxicity:

- Larkspur (pg 235)
- Nitrate accumulators (pg231)
- Helenium (pg 221)
- Rhododendron (pg 221)
- Castor bean (pg 235)
- Cyanogenic plants (pg 222)
- Solanum (pg 239)
- Tremorgenic toxins (pg 237)
- Hymenoxys (pg 241)
- Hellabore
- Laurel
- Azalea
- Death camus (pg 239)
- Chinaberry
- Others: see IM 135



Dysphagia/Difficulty in Swallowing (IM 136; BR-hb 63; GI 705)



Common causes: Pain, Obstruction, Neuromuscular:

- Choke (Foreign body) (pg 15)
- Oral vesicles, erosions, ulcers
  - Vesicular stomatitis (pg 11)
  - BVD (pg 12, 253)
  - Bovine papular stomatitis (pg 8)
  - Traumatic or irritant stomatitis (pg 8)
  - Bristle grass/plant awns (pg 8)
  - Oral foreign body (pg 8)
  - Bluetongue (pg 10)
- Pharyngeal abscess/cellulitis (pg 14)
- Snake bite (pg 242)
- Actinobacillosis (pg 13)
- Actinomycosis (pg 13)
- Teeth problems (pg 7)
  - Periodontal diz (pg 7)
  - Worn/missing teeth (pg 7)
  - Tooth root abscess (pg 7)
- Calf diphtheria (pg 9)
- Mandibular/maxillary fractures (pg 67)
- White muscle diz (pg 78)
- Ruptured/damaged esophagus (pg 15)
- Megaesophagus (pg 15)
- Diaphragmatic hernia (pg 46)
- Cleft palate (pg 7)
- Bovine leukosis
- Listeriosis (pg 143)
- Botulism (pg 145)
- Tetanus (pg 145)

- Rabies (pg 144)
- Pseudorabies (pg 141)
- Brain abscess (pg 140)
- Paralysis of masseter m. (mandibular n.)
- Meningitis (pg 151)
- Encephalitis (pg 154)
- Tick paralysis (pg 142)
- Atlanto-axial subluxation (pg 134)
- Otitis media & interna (pg 142)
- Hypocalcemia (pg 148)
- Pituitary abscess

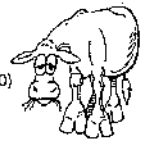
Toxic causes:

- Fireweed (pg 231)
- Locoweed (pg 236)

Abdominal Distention/Constipation (IM 132;BR-hb 56, 57; GI 712; Br 112, 121; DDX 11)

Common causes:
- **Pregnancy** (pg 106)
- **Bloat** (pg 26)
- **Grain overload** (pg 25)
- **Vagal indigestion** (pg 29)
- **Obesity**
- **Peritonitis** (pg 53)
- **Omasal obstruction/foreign body**
- **Ruptured bladder** (pg 96)
- **Pelvic mass** (tumor/abscess)
- **Intestinal obstruction** (pg 44)
- **Hypocalcemia** (pg 148)
- **Cecal volvulus/dilation w/ ileus** (pg 49)
- **Fat necrosis (rectum or colon)** (pg 50)

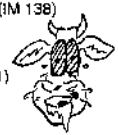
Uncommon causes:
- Abomasal volvulus (pg 40)
- Abomasal impaction (pg 30)
- Abomasal bloat (calf)
- Intussusception (pg 45)
- Anticholinergics



Rare causes:
- Ascites
- Hydrops (pg 113)
- Bovine leukosis
- Abomasal adenocarcinoma
- Perforating abomasal ulcer (pg 31)
- Displacement of intest. to lt. of rumen
- Adhesions of intestines (pg 46)
- Stenosis of duodenum
- Intestinal volvulus (pg 44)
- Atresia ani, rectum, colon or intes. (pg 51)
- Internal herniation (pg 46)
- Torsion of descending colon
- Omental bursitis

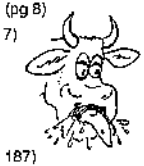
Toxic causes:
- Zinc toxicity (pg 215)
- Propylene glycol toxicity
- Larkspur toxicity (pg 235)
- Crude oil toxicity (pg 213)
- Diesel fuel toxicity (pg 213)

Oral Vesicles, Erosions, Ulcers (IM 138)



Common causes:
- **Vesicular stomatitis** (pg 11)
- **BVD** (pg 12)
- **Actinobacillosis** (pg 13)
- **Traumatic/irritant stomatitis** (pg 8, 240)
- **Bristle grass/plant awns** (pg 8)
- **Oral foreign body** (pg 8)
- **Bovine papular stomatitis** (pg 8)
- **Others: see Oral vesicles**

Uncommon causes:
- Cheek abscess
- Actinomycosis (pg 13)
- Oak (acorn) toxicity (pg 234)
- Malignant catarrhal fever (pg 10)
- Caustic or irritant chem. (pg 8)
- Periodontal gingivitis (pg 7)
- Bluetongue (pg 10)



Rare causes:
- Calf diptheria (pg 9)
- Oral neoplasia
- Bovine herpes 2 mammillitis (pg 187)
- Lead toxicity (pg 152)

Icterus (IM 141)

Common causes
- **Liver**
  - **Aflatoxicosis** (pg 233)
  - **Pyrrolizidine alkaloid toxicosis** (pg 232)
  - **Fatty liver** (pg 32)
- **Hemolytic anemia**
  - **Leptospirosis** (pg 257)
  - **Bacillary hemoglobinuria** (pg 90)
  - **Anaplasmosis** (pg 92)

Uncommon causes:
- Liver
  - Liver abscess (pg 36)
  - Black diz (pg 37)
  - Liver flukes (pg 37)
  - Acute hepatitis (pg 34)
  - Cholangiohepatitis (pg 35)
- Hemolytic anemia
  - Immune-mediated hemolytic anemia (pg 92)
  - Postparturient hemolytic anemia (pg 88)
  - Neonatal isoerythrolysis (pg 91)
  - Transfusion reaction
  - Snake bite (pg 242
  - Copper toxicity (pg 203)\

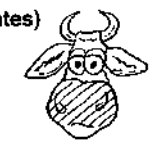
Rare causes:
- Liver
  - Sarcocystosis
  - Ruptured gallbladder
  - Biliary obstruction
  - Cholelithiasis
  - Hepatic neoplasia
  - Lantana toxicity
- Hemolytic anemia
  - Eperythrozoonosis
  - Iron toxicity (pg 202)
  - Trichloroethylene toxicity
  - Onion poisoning (pg 89)
  - Fireweed toxicity
  - Zinc toxicity (pg 215)
  - Phosphorus poisoning (pg 215)
  - Mercury (pg 202)
  - Brassica sp. toxicity (pg 89)
  - Bee sting
  - Mycotic lupinosis
  - Babesiosis (pg 91)

Dental Cavities, Discolored Teeth (IM 139)

- **Fluoride toxicity** (pg 216)
- **Actinomycosis** (pg 13)
- **Broken mouth (old teeth)** (pg 7)
- **Tooth root abscess w/ osteomyelitis** (pg 7)
- **Periodontal diz** (pg 7)
- **Black walnut stains**
- **Osteomalacia, osteodystrophy** (pg 7)
- **Teeth fx** (pg 7)
- Skeletal neoplasia
- Bovine erythropoietic porphyria
- Osteogenesis imperfecta (Friesians) (pg 7)

Serous Nasal Discharge (IM 61)

Common causes:
- **Pneumonia** (pg 62)
  - **Shipping fever** (pg 63)
  - **Enzootic calf pneumonia** (pg 66)
  - ***H. somnus* pneumonia** (pg 71)
  - **Atypical interstitial pneumonia** (pg 67)
  - **Early bacterial pneumonia**
  - **Verminous pneumonia** (pg 69)
- **IBR** (pg 252)
- **BRSV** (pg 64)
- **Parainfluenza-3 virus** (pg 65)
- **Debilitating illness** (don't lingually clean nose)
- **Trauma - to resp. passagway**
- **Abscess - oral, pharyngeal, retropharyngeal** (pg 14)
- **Choke** (pg 15)
- **Septicemia (neonates)**



Uncommon causes:
- Pneumonia
  - Aspiration (pg 69)
  - Inhalation (pg 69)
  - *C. psittaci* pneumonia (pg 68)
- Viruses
  - BVD (pg 253, 64)
  - Bluetongue (pg 10)
  - Rhinovirus (pg 65)
  - Adenovirus (pg 65)
  - Malignant catarrhal fever (pg 10)
  - Herpes virus DN-599 (pg 65)
- Allergies
  - Anaphylaxis (pg 674, 251)
  - Drug reactions
  - Milk allergies (pg 188)
  - Farmer's lungs (molds) (pg 68)
- Burns - chem. or thermal (pg 184)
- Vagal indigestion (pg 29)
- Abomasal impaction (pg 30)
- Paranasal sinus infection (pg 60)
- Foreign body

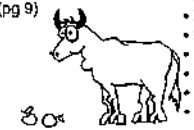
Rare causes:
- Granulomas
  - "Summer snuffles" (pg 59)
  - Fungal granuloma (p 58)
- Fungal
  - Phycomycosis, pythiosis (pg 66)
  - Pulmonary aspergillosis (pg 66)
  - Zygomycosis, Mucormycosis (pg 66)
- Sarcocystosis
- Winter dysentery (pg 23)
- Rinderpest (pg 12)
- Nasal actinobacillosis
- Pregnancy toxemia
- Buss diz (chlamydial) (pg 70)
- Lymphosarcoma (pg 198)
- Neoplasia
- Bronchobiliary fistula (pg 74)
- Nasal actionbacillosis
- Immune deficiency states

Toxic causes:
- Organophosphate/carbamate (pg 206)
- Ammonia (pg 210)
- Mercury (pg 202)
- Formaldehyde
- Iodine
- Thallium (pg 215)
- Trichloroethylene-extract feed
- Oxalate (pg 224)
- Sneezeweed (pg 221)
- Acorn, oak (pg 234)
- Hairy vetch (pg 239)
- Rubberweed (pg 241)
- Perennial broomweed

Purulent Nasal Discharge

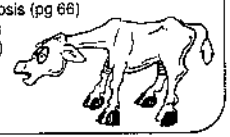
(IM 63; DDX 107)

Common causes:
- Debilitating illness (don't clean nose w/ tongue)
- 2° bact. to viral illness
- Pneumonia (pg 62)
  - Pasteurella spp
  - *H. somnus* (pg 141)
  - Lung worms (pg 69)
  - Chronic bact. pneumonia
- Calf diphtheria (pg 9)
- Choke (pg 15)
- Trauma
- Abscess
- Septicemia



Uncommon causes
- Pneumonia
  - Inhalation (pg 69)
  - Aspiration (pg 69)
  - *C. psittaci* pneumonia (pg 68)
- Foreign body (oral or resp. passages)
- Paranasal sinus infection (pg 60)
- Pulmonary embolism - caud. vena cava (pg 70)
- Malignant catarrhal fever (pg 10)
- Burns - chem. or thermal (pg 184)
- Vagal indigestion (pg 29)
- Abomasal impaction (pg 30)

Rare
- Bluetongue (pg 10)
- Summer snuffles (pg 59)
- Fungal granuloma (pg 58)
- Salmonellosis (pg 259)
- Sarcocystosis (pg 123)
- Tuberculosis (pg 70)
- Bronchobiliary fistula (pg 74)
- Zygomycosis, mucormycosis (pg 66)
- Immune deficiency states
- Lymphosarcoma (pg 198)
- Neoplasia
- Phycomycosis (pg 66)
- Nasal actinobacillosis



Ingesta in Nasal Discharge

(IM 64; DDX 105)

Common causes:

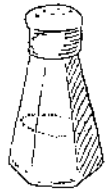
- **Choke** (pg 15)
- **Pharyngeal trauma** (pg 14)
- **Retropharyngeal abscess** (pg 14)
- **Megaesophagus** (pg 15)

Uncommon causes:

- Diaphragmatic hernia (pg 46)
- Lacerated esophagus (pg 15)
- Cleft palate (pg 7)
- Salt toxicity
- Glossopharyngeal nerve paralysis (vagus)
- Tetanus (pg 145)

Rare causes:

- Vascular ring anomaly (pg 79)
- Listeriosis (pg 143)
- Neoplasia - esophagus or rumen
- Congenital defect of Kodiac Island calves



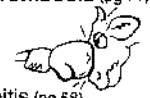
Toxic causes:

- Oleander poisoning (pg 230)
- White snakeroot poisoning (pg 238)
- Sneezeweed poisoning (pg 221)
- Geigeria poisoning
- Rubberweed poisoning (pg 241)

Epistaxis (IM 69; DDX 105)

Common causes:

- **Pharyngeal, retropharyngeal trauma** (pg 14)
- **Nasal trauma** (pg 59)
- **Infection of paranasal sinuses** (pg 60)
- **Foreign body** (resp. or upper GI tract)
- **Dehorning** (adult) (pg 60)
- **Caud. vena cava thrombosis** (pg 71)



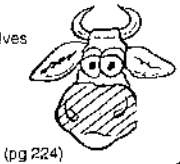
Uncommon causes:

- Granulomas
  - Nasal, atrophic rhinitis (pg 58)
  - Fungal granuloma (pg 58)
- Gunshot
- Skull fractures
- Vesicular stomatitis
- IBR (pg 252)
- BVD (pg 253)
- Malignant catarrhal fever (pg 10)
- Neoplasia (nasal, paranasal sinuses)

Rare causes:

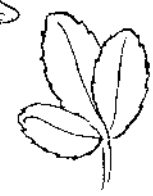
- Acute anthrax (pg 247)
- Black's diz (pg 37)
- Bacillary hemoglobinuria (pg 90)
- Acute renal failure (pg 100)
- Liver fluke diz (pg 37)
- Snake bite (pg 242)
- Endocarditis (pg 81)
- Hemophilia A (VIII deficiency)
  - Factor XI deficiency
- Trypanosomiasis (pg 246)
- Endemic ethmoid carcinoma

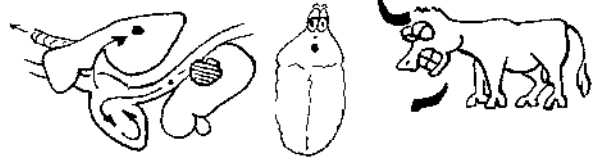
- Cardiomyopathy in polled Hereford calves
- Pulmonary neoplasia



Toxic causes:

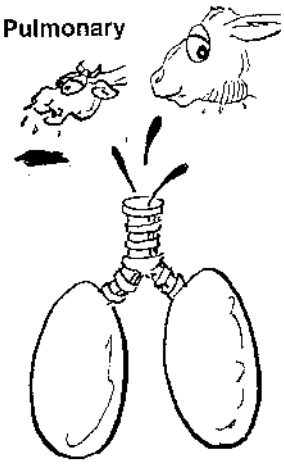
- Oak/acorn poisoning (pg 234)
- Moldy sweet clover (pg 86)
- Oxalate (Halogeton, Sarcobatus spp.) (pg 224)
- Phytogenous selenium poisoning (Astragalus spp.)
- Warfarin (pg 214)
- Trichlorethylene extract feed
- Arsenic (pg 202)

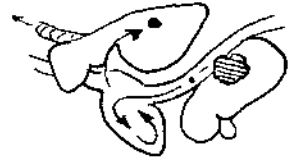




Hemoptysis (Bronchial or Pulmonary hemorrhage) (IM 69)

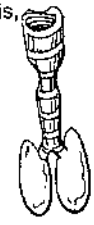
- Aspiration pneumonia (pg 69)
- Caud. vena cava thrombosis (pg 71)
- Foreign body
- Pulmonary aspergillosis (pg 66)
- Thoracic trauma
- Pharyngeal/retropharyngeal abscess/trauma (pg 14)





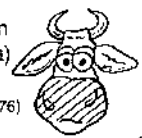
Neonatal Respiratory Distress (IM 363, 373)

- Airway obstruction
  - Laryngeal edema (pg 60)
  - Choanal atresia
- Tracheal malformation - stenosis, collapse (pg 61)



- Developmental
  - Diaphragmatic hernia (pg 46)
  - Pulmonary hypoplasia
- Lung diz
  - Pneumonia (pg 62)
  - Hyaline membrane diz (pg 73)
  - Aspiration syndrome (pg 69)
  - Pulmonary edema, congestion
  - Atelectasis
  - Pulmonary hemorrhage (pg 71)
  - Pneumothorax (pg 73)
  - Transient tachypnea syndrome

- Nonpulmonary causes
  - Severe anemia (pg 82)
  - Hypovolemia (pg 195)
  - Excitement
  - Pleural effusions (pg 72)
  - Pain
  - Birth asphyxia
  - Persistent pulmonary hypertension
  - Metabolic (acidosis, hypoglycemia)
  - Central nervous system problems
  - CHF (congestive heart failure) (pg 76)
  - Endotoxemia/sepsis



Coughing

(IM 55; DDX 51)

Common causes:

- **Pneumonia** (pg 62)
  - **Pasteurella spp.** (pg 63)
    - **Shipping fever** (pg 63)
    - **Enzootic calf pneumonia** (pg 66)
  - **Haemophilus pneumonia** (pg 71)
  - **Atypical interstitial pneumonia** (pg 67)
  - **Chronic bact. pneumonia** w/ abscesses (*Actinomyces pyogenes*)

- **IBR** (pg 252)
- **Bovine resp. syncytial virus** (pg 64)
- **Parainfluenza-3 virus** (pg 65)
- **Calf diphtheria** (pg 61)
- **Abscesses** - oral, lingual, laryngeal, bronchial, chest wall, tracheal
- **Trauma**
- **Choke** (pg 15)
- **Septicemia** (neonate)

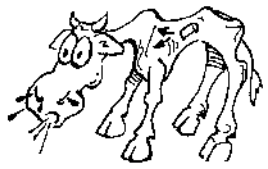
Less common causes:

- Viruses
  - Rhinovirus (pg 65)
  - Adenovirus (pg 65)
  - Herpes virus DN-599 (pg 65)
- Pneumonia (pg 62)
  - Inhalat./Aspiration pneumonia (pg 69)
  - *Chlamydia psittaci* pneumonia (pg 68)
- Pulmonary embolus of caud. vena cava (pg 71)

- Anaphylaxis (pg 74)
- Milk allergies (pg 188)
- Anthelmintic reaction to dead parasites (pg 134)
- Pneumothorax (pg 73)
- High altitude diz (pg 80)
- Enzootic bovine leukosis (pg 79)
- Left heart failure (pg 79)
- Malignant catarrhal fever (pg 10)
- Pleuritis (pg 72)
- Pleural effusion (pg 72)
- Farmer's lung diz (pg 68)
- FB in pharynx, larynx, trachea, bronchi or lungs (pg 14)

Rare causes:

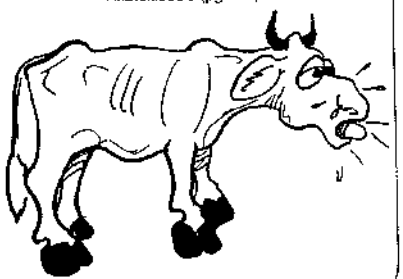
- Tuberculosis (pg 70)
- Rinderpest (pg 12)
- Tularemia (pg 245)
- Neoplasia
- Esophageal problems (pg 15)
- Postpartum hemolytic uremic syndrome (pg 88)
- Cor pulmonale (pg 80)
- Phycomycosis (pg 66)
- Tracheal collapse (pg 61)
- Tracheal actinomycosis
- Sarcocystosis (pg 123)
- Pleural mesothelioma (pg 74)



- Diaphragmatic hernia (pg 46)
- Sporadic bovine leukosis (pg 268)
- Zygomycosis, Mucormycosis (pg 66)
- Pulmonary listeriosis (pg 68)
- Buss diz (exotic) (pg 670)
- Winter dysentery (pg 23)

Toxic causes:

- Organophosphate/carbamate (pg 206)
- Levamisole (pg 216)
- Hairy vetch (pg 239)
- Iodine (pg 205)
- Mercury (pg 202)
- Nitrogen dioxide (pg 211)
- Sneezeweed (pg 221)
- Aflatoxicosis (pg 233)



Respiratory Distress, Dyspnea (IM 75; Br 128; DDX 82)

Common resp. causes:

- **Pneumonia** (pg 62)
  - Pasteurella (pg 63)
  - Bacterial pneumonia (pg 63)
  - *H. somnus* pneumonia (pg 71)
  - Aspiration/FB pneumonia (pg 69)
  - Bovine atypical interstitial pneumonia (pg 67)
  - Parasitic pneumonia (lung worms) (pg 69)
- **IBR** (pg 252)
- **Pulmonary edema & emphysema** (pg 67)
- **Farmer's lung diz** (pg 69)
- **Necrotic laryngitis** (pg 81)

Common nonresp. causes:

- **Hyperthermia**
- **Pain**
- **Acidosis**
- **Hypovolemic, cardiac, & septic shock** (pg 195)
- **Fluid & electrolyte loss**
  - Acute diarrhea, GI obstruction, etc.
- **Electrolyte aberrations**
  - **Hypocalcemia** (pg 148)
  - **Hypomagnesemia** (pg 146)

- **Endotoxemia**
  - **Coliform mastitis** (pg 195)
  - **Enteritis** (pg 18-25)
  - **Salmonellosis** (pg 259)
  - **Septicemia**
  - **Metritis** (pg 111)
- **Anemia** (pg 82)
  - **Postparturient hemoglobinuria** (pg 89)
  - **Hemolytic anemia** (pg 89)
  - **Anaplasmosis** (pg 92)
  - **Eperythrozoonsis**
  - **Iron deficiency** (pg 87)
- **Distended abd. organs**
  - **Bloat - frothy or free** (pg 26)
  - **Other**
- **White muscle diz** (pg 78)
- **Anaphylaxis/allergy** (pg 251)
- **Neonatal septicemia**

Uncommon resp. cause:

- Viruses
  - Resp. syncytial virus (pg 64)
  - Parainfluenza-3 (pg 65)
  - Adenovirus (pg 65)
  - Rhinovirus (pg 65)
  - Herpes virus DN-599 (pg 65)

- Bluetongue (pg 10)
- Tumors
  - Nasal (pg 58)
  - Paranasal sinuses
  - Oral cavity
- Trauma: laryngeal, nasal, thoracic (pg 14)
- Abscess (laryngeal, oral, pharyngeal, retropharyngeal) (pg 14)
- Tracheal stenosis/stricture (pg 61)
- Pneumothorax (pg 73)
- Pleuritis/pleural effusion (pg 72)
- Smoke inhalation (pg 212)
- Foreign body, oral, nasal, pharyngeal, laryngeal (pg 14)
- *Ascaris suum* migration (pg56)
- Congenital cystic nasal conchae

- Sinusitis (pg 60)
- Nasal granulomas, fungal, atopic rhinitis (pg 59)
- Pulmonary embolus from caud. vena cava (pg 71)

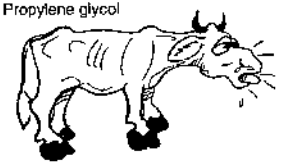
Uncommon nonresp.:

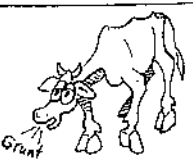
- Cardiac anomalies (VSD, tetralogy of Fallot, PDA, transposition of great vessels) (pg 79)
- Cardiac failure (Valvular problems, bact. endocarditis, cardiomyopathies, pericarditis) (pg 76)
- CNS (pseudorabies, encephalomalacia, meningoencephalitis, trauma, louping ill)
- Clostridial diz (enterotoxemia, Black's diz, tetanus, bacillary hemoglobinuria, blackleg)
- Choke (pg 15)
- Anthrax (pg 247)
- Salt poisoning (pg 205)
- Pulmonary edema (fluid therapy)
- Tick paralysis, Bee sting, snake bite (pg 142, 242)
- Photosensitization (pg 232)
- Blood transfusion reaction
- Toxoplasmosis (pg 123)

Rare causes: see IM 79

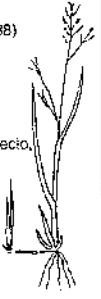
Toxic causes:

- Strychnine (pg 215)
- Sulfur
- Lead (pg 152)
- Selenium (pg 226)
- Organophosphates/carbamate (pg 206)
- Chlorinated hydrocarbons (pg 207)
- Bromide
- Nitrates (pg 231)
- Oxalate, ethylene glycol (pg 224)
- Propylene glycol





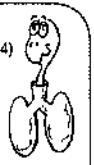
- Sodium fluoroacetate (pg 215)
- Potassium
- Arsenic (pg 202)
- Phosphate fertilizers (pg 215)
- Warfarin (pg 214)
- Metaldehyde (pg 207)
- Formaldehyde
- Ammonia (pg 204)
- Hydrogen sulfide (pg 210)
- Copper toxicity (pg 203)
- Levamisole
- Insect fogger pneumonia
- Monensin/Gossypol (pg 203, 229)
- Ergot (pg 237)
- Aflatoxicosis (pg 233)
- Cyanogenic plants (pg 222)
- Moldy sweet clover (pg 229)
- Brassica spp.
- Larkspur (pg 235)
- Hairy vetch (pg 239)
- White snakeroot (pg 6238)
- Oleander (pg 230)
- Nightshade (pg 239)
- Cocklebur (pg 220)
- Locoweed (pg 236)
- Water hemlock
- Hepatotoxic plants (Senecio, Amsinkia) (pg 232)
- Rubberweed (pg 241)
- Sneezeweed (pg 221)
- Lupine (pg 220)
- Rhododendron (pg 221)
- Fescue (pg 221)
- Milkweed (pg 230)
- Foxglove (pg 230)
- Ryegrass (pg 237)
- Many other poisonous plants (IM 79)



Cyanosis (IM 84)

Common causes:
- **Pneumonia** (pg 62)
  - **Bacterial** (Pasteurella, Actinomyces, *C. pseudotuberculosis* & others) (pg 63)
  - **Viral** (BRSV & others) (pg 64)
  - **Parasitic pneumonia** (pg 69)
  - **Aspiration** (pg 69)
- **Pulmonary edema & emphysema** (pg 67)
- **Heart defects** (VSD, tetralogy of Fallot) (pg 79)
- **Anaphylaxis** (pg 251)
- **Bloat** (pg 26)
- **Toxic methemoglobinemia**
- **Shock** (cardiac, hypovolemic, septic)

Rare causes: (See IM 84)



Toxic causes:
- Arsenic (pg 202)
- Strychnine (pg 215)
- Nitrate/nitrite (pg 231)
- Organophaophate/carbamate (pg 206)
- Chlorinated hydrocarbons (pg 207)
- Metaldehyde (pg 207)
- Hydrogen sulfide (pg 210)
- Selenium toxicosis (pg 228)
- Sudan grass
- Locoweeds (pg 236)
- Rhododendron (pg 221)
- Oleander (pg 230)
- Milkweed (pg 230)
- Pigweed (pg 234)
- Lamb's quarters (pg 224)
- Many other poisonous plants (IM 84)

Uncommon causes:
- Obstruction (nasal passages - neoplasms, granulomas, abscess) (pg 58)
- Laryngeal abscess (pg 61)
- Pneumothorax (pg 73)
- Pulmonary contusions
- Diaphragmatic hernia (pg 46)
- Prematurity (neonate) (pg 73)
- Inhalation pneumonia (smoke) (pg 212)
- Tracheal collapse/stricture, stenosis/ rupture (pg 61)
- Hemothorax (pg 73)
- VSD + pulmonary stenosis (pg 79)
- Postparturient hemoglobinuria (pg 88)
- Clostridial diz (blackleg, tetanus, malignant edema) (pg 145, 244)
- Obstructive urolithiasis (pg 96)

Cyanosis, Neonate (IM 374)

- **Respiratory**
  - **Alveolar hypoventilation**
    - **CNS trauma or hemorrhage**
    - **Pneumothorax** (pg 73)
    - **Diaphragmatic hernia**
    - **Hypoglycemia or hypocalcemia**
    - **Drug induced CNS depression**
    - **Upper airway obstruction** (pg 60)
    - **Hemothorax** (pg 73)
    - **Pleuritis** (pg 72)
    - **Spinal nerve dysfunction to resp. muscles**
  - **Hypoplastic lungs?**
- **Cardiovascular**
  - **Ventricular septal defect** (pg 79)
  - **Patent ductus arteriosus** (pg 79)
  - **Tetralogy of Fallot** (pg 79)
  - **Truncus arteriosus** (pg 79)
  - **Double outlet rt. ventricle**
  - **Single ventricle**
  - **Eisenmenger complex** (pg 79)

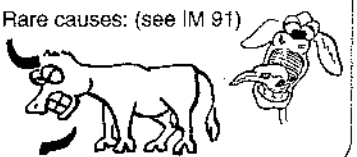
- **Impaired infusion**
  - **Pulmonary**
    - **Pneumonia** (pg 62)
    - **Edema**
    - **Atelectasis**
  - **Shunting**
  - **Congenital heart defects** (pg 79)
  - **Pulmonary hypertension**
  - **Ventricular perfusion mismatch**

Stridor (IM 91)

Common causes:
- **Calf diphtheria** (pg 9)
- **Actinobacillosis**
- **Trauma** (oral, nasal, pharyngeal, retropharyngeal, laryngeal) (pg 14)
- **Sinusitis** (pg 60)
- **Foreign body** (oral, nasal, pharyngeal, tracheal) (pg 14)
- **Anaphylaxis** (pg 251)
- **Abscess** (oral, pharyngeal, retropharyngeal, laryngeal) (pg 14)

Uncommon causes:
- Tracheal stenosis (pg 61)
- Actinomycosis (lumpy jaw) (pg 13)
- IBR (pg 252)
- Malignant catarrhal fever (pg 10)
- Shipping fever (pg 63)
- Enzootic calf pneumonia (pg 66)
- Vesicular stomatitis (pg 11)
- Pulmonary embolism from caud. vena cava (pg 71)
- Nasal granulomas (pg 658)
- Atrophic rhinitis (pg 59)
- Honker syndrome (pg 61)
- Neoplasia
- Inhalation pneumonia (smoke) (pg 212)
- Snake bite, bee sting (pg 215)
- Clostridial infec. (head)
- Thymic lymphosarcoma
- Bovine leukosis

Rare causes: (see IM 91)



Dysrhythmias, Cardiac (IM 106)

Common causes:
- Myocarditis/myocardial diz (pg 77)
- Cardiomyopathies (pg 77)
- GI diz
- Valvular heart diz (pg 81)
- Brisket diz (pg 80)
- Excitement
- Fever
- Pericarditis (pg 76)
- Toxemia
- Foot rot (pg 159)
- Cor pulmonale (pg 80)
- Electrolyte abnormalities

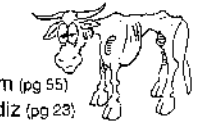
Muffled Heart Sounds

(IM 109)

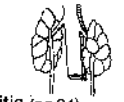
Common causes:
- Obesity
- Pericarditis (pg 76)
- Lymphosarcoma (pg 79)
- Congestive heart failure (pg 76)
- Pleural effusions
- Abscess (pg 71)
- Emphysema

Rare causes:
- Pneumothorax (pg 73)

Peripheral Edema/Pleural Effusion/Ascites (IM 103)



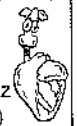
- Heart problems
  - Congestive heart failure (pg 76)
  - AV valve regurgitation
  - Vegetative endocarditis (pg 81)
  - Congenital defects (pg 79)
  - Chronic atrial fibrillation (pg 81)
  - Cardiomyopathy (pg 77)
  - Pericarditis (pg 76)
  - Heart based tumor (pg 87)
- Cor pulmonale
- High altitude diz (pg 80)
- Pleuritis (pg 72)
- Liver diz (pg 34)
- Starvation
- Kidney diz
  - Glomerulonephritis (pg 94)
  - Amyloidosis (pg 94)
- GI malabsorption



- Parasitism (pg 55)
- Johne's diz (pg 23)
- Lymphosarcoma
- Hemodilution
- Monensin/lasalocid toxicity (pg 203)
- Lymphatic obstruction
- Urolithiasis - rupture (pg 96)
- Thrombophlebitis (pg 80)
- Peritoneal or pleural effusion (pg 72)

Rare causes:
- Vasculitis
- Trauma
- Copper deficiency (pg 89)
- Infectious myocarditis (pg 77)
- Angioneurotic edema (pg 188)
- Gossypol toxicity (pg 229)
- Locoweed toxicity (pg 229)
- Caud. vena cava thrombosis (pg 71)

Cardiac Murmur (IM 108)



Common causes:
- Heart problems
  - Degenerative valvular diz
  - Congenital defects (pg 79)
  - Bact. endocarditis (pg 81)
- Pericarditis (Hardware diz) (pg 76)
- Anemia (pg 82)
- Excitement
- Fever
- Young animal
- Lymphosarcoma (pg 79)

Rare causes:
- Myocarditis (pg 77)
- Cardiomyopathy (pg 77)

Jugular Venous Distention/Pulsation

(IM 113; Br 126)

Common causes:
- Rt. heart failure (pg 76)
- Pericarditis (pg 76)
- Congestive heart failure (pg 76)
- Rt. AV valve insufficiency
- Cardiomyopathy (pg 77)
- Jugular venous phlebitis/ thrombosis (pg 80)
- Heart base tumor/abscess (pg 79)
- Brisket diz (pg 80)
- Cor pulmonale (pg 80)
- Monensin toxicity (pg 78)
- White muscle diz (Se) (pg 78)

Rare cause:
- Overhydration

Abnormal Peripheral Pulse

(IM 117)

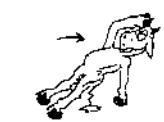
Common causes:
- Toxemia
- Dehydration
- Shock
- Electrolyte imbalances
- Congestive heart failure (pg 76)
- Acid base disorders
- Cardiac dysrhythmias

Rare causes:
- Aortic insufficiency
- Patent ductus arteriosus (pg 79)
- Peripheral arteriovenous shunts

Syncope/Weakness

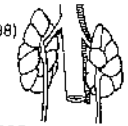
(IM 111)

Common causes:
- Congestive heart failure (pg 76)
- Cardiac dysrhythmias
- Myocardial diz (pg 77)
- Congenital heart defects (pg 79)



Acute Renal Failure (IM 240)

- Septic causes
  - Pyelonephritis (pg 98)
  - Renal necrosis
  - Mastitis (pg 192)
  - Metritis (pg 111)
- Hemodynamic causes
  - Severe bloat (pg 26)
  - Shock (pg 248)
  - Heart failure (pg 76)
  - Renal vein thrombosis
- Toxic plants
  - Oak (acorn) toxicity (pg 234)
  - Amaranthus spp (pg 234)
  - Rumex
  - Halogeton glomeratus (pg 225)
  - Greasewood (pg 225)
  - Oxalate (pg 224)
  - Others (see IM 200)

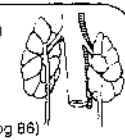


- Drugs
  - Aminoglycosides (pg 217)
  - Oxytetracycline
  - Monensin (pg 203)
  - Sulfonamides
- Chemicals
  - Mercury (pg 202)
  - Arsenic (pg 202)
  - Paraquat (pg 208)
  - Ethylene glycol (pg 209)
  - Chlorinated hydrocarbons (pg 207)
  - Sodium fluoride
  - Gassypol (pg 229)
- Endogenous
  - Myoglobin
  - Hemoglobin
- Mycotoxins
  - Citrinin
  - Ochratoxin

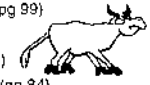
Dysuria/Stranguria (IM 199)

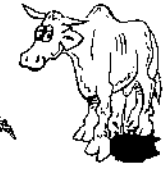
- Urethral calculi (pg 96)
- Cystitis (pg 96)
- Pelvic bladder
- Hemorrhage into urinary tract
- Urethral swelling (calving)
- Penile or preputial problems (pg 126)
- Sacral fractures
- Spinal cord injury (pg 157)
- Extradural lymphosarcoma (pg 268)

Hematuria (IM 200)



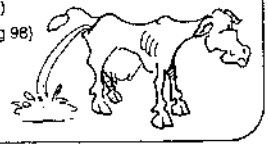
- Calculi (pg 96)
- Trauma
- Bracken fern toxicity (pg 86)
- Malignant catarrhal fever (pg 10)
- Pyelonephritis (pg 98)
- Infarction of kidney (pg 99)
- Cystitis (pg 95)
- Bladder polyps (pg 84)
- Papilloma (bladder) (pg 84)
- Urethritis (pg 96)





Chronic Renal Failure (IM 205)

- Tubulointerstitial causes:
  - Any cause of acute renal failure (pg 100)
  - Chronic obstruction (pg 96)
  - Chronic pyelonephritis (pg 98)
- Glomerular causes:
  - Amyloidosis (pg 94)
  - Glomerulonephritis (rare) (pg 94)



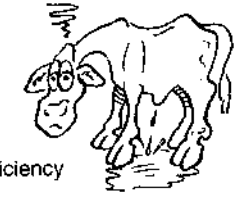
Pain on Urination (IM 34)

Common cause:
- **Urolithiasis** (pg 96)

Uncommon causes:
- Cystitis (pg 95)
- Vaginitis (pg 117)
- Preputial problems (pg 127)
- Pyelonephritis (pg 98)

Polyuria (IM 206)

Renal failure - acute & chronic
- Diabetes mellitus/D. insipidus
- Steroid administration
- Fluid administration
- Diuretics
- Salt deficiency
- Salt toxicity (pg 205)
- Hyperglycemia
- Severe Cl, K or urea deficiency



Bull - Sexual Malfunction (IM 243; Br 484)

Common causes:

- Penile/preputial problems (pg 126)
  - Trauma, hematoma, abscess (pg 126)
  - Deviation (pg 127)
  - Balanoposthitis (pg 127)
  - Paraphimosis (pg 127)
  - Phimosis (pg 126)
  - Penile hair ring
  - Penile- preputial adhesions
  - Persistent penile frenulum (pg 128)
  - Papillomatosis (pg 6127)
  - Herpes vulvovaginitis (pg 117)
  - IBP (infec. B. pustular vulvovaginitis) (pg 117)
  - Ruptured urethra (pg 196)
  - Urethral calculi (pg 196
- Prepuce
  - Trauma
  - Preputial stenosis (pg 126)
  - Prolapsed prepuce (pg 127)
  - Abscess/cellulitis
  - Foreign body
- Testicles, spermatic cord & scrotum
  - Orchitis (pg 129)
  - Epididymitis (pg 130)
  - Sperm granuloma
  - Spermatocele
  - Testicular degeneration, hypoplasia, atrophy (pg 128)
  - Varicocele (pg 130)
  - Testicular tumors (pg 129)
  - Testicular trauma (pg 129)
  - Cryptorchidism (pg129)
  - Segmental aplasia
  - Brucellosis (pg 122)
  - Zinc deficiency (pg 189)
  - Actinomyces
  - Weaver syndrome (pg 135)

Lack of Libido - Bull

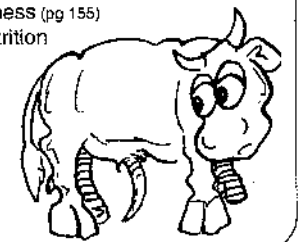
(IM 243; Br 484)

- Malnutrition
- Lameness (pg 155)
- Penis/prepuce problems (pg 126)
  - Trauma - hematoma (pg 126)
  - Prolapsed prepuce (pg 127)
  - Loss of penile sensation
  - Corpus cavernosum vascular shunts
  - Persistent penile frenulum (pg 128)
  - Posthitis (inflam. of prepuce) (pg 127)
- Vertebral osteophytosis/ spondylosis
- Zinc deficiency (pg 189)
- Iodine deficiency
- Psychogenic impotency
- Epididymitis (pg 130)
- Orchitis (pg 129)
- Weaver syndrome (pg 135)

Infertility - Bull (IM 243; Br 484)

- Malnutrition
- Testicles
  - Degeneration (pg 128)
  - Orchitis (pg 129)
  - Hypoplasia/atrophy (pg 128)
  - Cryptorchidism (pg 129)
  - Trauma (pg 126)
  - Tumors (pg 129)
- Sperm
  - Sperm granuloma
  - Hemospermia
  - IBR, BVD contaminated semen
  - Abnormalities of spermatogenesis
- Penis/prepuce
  - Balanoposthitis (pg 127)
  - Paraphimosis (pg 126)
  - Trauma
  - Hematoma, hematocele (pg 126)
  - Penile preputial adhesion (pg 126)
  - Penile deviation (pg 127), corkscrew penis
  - Loss of penile sensation
  - Micropenis, short penis, hypoplasia
  - Persistent penile frenulum (pg 128)
  - Penile hair ring (pg 127)
  - Prolapsed prepuce (pg 127)
  - Papillomatosis, warts (pg 127)
  - Bovine herpes virus-1, IBR - dermatitis
  - Dermatophilosis
- Urethra & erectile tissue
  - Urolithiasis (pg 196)
  - Corpus cavernosum vascular shunts
  - Urethral fistula

- Scrotum
  - Frostbite
  - Inguinal scrotal hernia (pg 46)
  - Dermatophilosis
  - Abscess
- Seminal vesiculitis (pg 130)
- Varicocele (pg 130)
- Deficiencies
  - Iodine defc
  - Zinc defc (pg 189)
  - Manganese defc
  - Vit A defc (pg 189)
- Psychologic impotency
- Vertebral spondylosis (pg 135)
- Hereditary
  - Inbreeding
  - Bulls co-twin w/ freemartins (pg 107)
  - Chromosomal abnormalities
  - Segmental aplasia of repro tract
    - Hermaphrodism, pseudohermaphrodism (pg 113)
    - Short retractor penis m. (Dutch Friesian)
    - Weaver syndrome (pg 135)
- Environmental
  - Heat stroke (pg 128)
  - Cold weather infertility
- AI (artif. insemin.) assoc. infertility (pg 106)
- Lameness (pg 155)
- Malnutrition



Cyclic Irregularities
(IM 246)

Common causes:
- Poor heat detection (pg 105)
- Intra-uterine therapy
- Endometritis (pg 111)
- Heat stress
- Cystic ovaries (pg 108)
- BVD (pg 121, 253)
- IBR (pg 118, 252)
- Leptospirosis (pg 121)
- Campylobacteriosis (pg 119)
- Trichomoniasis (pg 120)

Rare cause:
- BVD, IBR- infected semen

Prolonging Gestation
(IM 260)

- High environmental temp.
- BVD
- Fescue toxicity (pg 254)
- Autosomal recessive gene holsteins & guernseys
- Hypothalamo-hypophyseal-adrenal axis disorders
- Fetal mummification (pg 107)
- Bluetongue (pg 123)
- Hydrops amnii (pg 113)
- Akabane (exotic)

Repeat Breeding (IM 249)

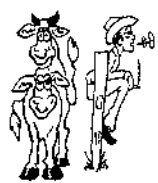
Common causes:
- **Erroneous heat detection** (pg 105)
- **Malnutrition** (pg 265)
- **Heat stress**
- **Erroneous AI timing** (pg 106)
- **Bad IA technique** (pg 106)
- **Follicular cysts** (pg 108)
- **Leptospirosis** (pg 121)
- **Campylobacteriosis** (pg 119)
- **Trichomoniasis** (pg 120)
- **Inadequate uterine involution**
- **Endometritis** (pg 111)

Uncommon causes:
- Urine pooling (pg 113)
- Ureaplasmosis (pg 123)
- Pneumovagina (pg 113)
- Uterine tumors (pg 113)
- Oviduct bursal adhesions (pg 109)
- Parovarian cyst
- Poor semen quality (pg 106)
- Inadequate number of bulls
- BVD (pg 121)
- IBR (pg 118)
- Brucellosis (pg 122)
- Anaplasmosis (pg 92)
- Bluetongue (pg 123)
- Phosphorus defc
- Fescue toxicity (pg 254)
- Zearalenone toxicity
- Selenium defc (pg 226)

Rare causes:
- Hydrosalpinx (pg 109)
- Segmental aplasia (pg 113)
- Chromosomal abnormalities
- Ovarian tumors
- Johne's dz (pg 23)
- Oophoritis (pg 108)
- Tuberculosis
- Weaver syndrome (pg 135)
- Crooked cervix
- Salpingitis (pg 113)
- Fat necrosis (pg 50)
- Cobalt defc (pg 189)
- Molybdenum toxicity (pg 203)
- Iodine defc
- Iodine toxicity (pg 205)
- Fluoride toxicosis (pg 216)
- Brassica toxicity (pg 231)
- Copper defc (pg 203)
- Manganese defc (pg 146)
- Zinc defc (pg 189)
- Polybrominated biphenyl toxicity (pg 213)
- Phytoestrogen toxicity

Anestrus (IM 249)

Common causes:
- **Pregnancy** (pg 106)
- **Erroneous heat detection** (pg 105)
- **Pyometra** (pg 111)
- **Postpartum period**
- **Nursing beef cows**
- **Luteal cysts** (pg 108)
- **Freemartinism** (pg 107)
- **Poor footing**
- **Heat stress**
- **Malnutrition** (pg 265)



Uncommon causes:
- Macerated/mummified fetus (pg 107)
- Hydrometra
- Mucometra

Rare causes:
- Segmental aplasia (pg 113)
- Ovarian tumor

Retained Fetal Membranes
(IM 265; DDX 117)

Common causes:
- Abortion (pg 118)
- Dystocia (pg 115)
- Induced parturition
- Hypocalcemia (pg 148)
- Stillbirth
- Abnormal gestation length
- Placentitis (bacterial or fungal)
- Multiple births (pg 107)

Uncommon causes:
- Uterine atony
- Uterine torsion (pg 112)
- Cesarean section (pg 114)
- Placentomes - injury, inflammation, edema or necrosis
- Entrapment of separated placenta
- Dropsy of fetal membranes (pg 113)
- Excessive wt. gain in dry period
- High milk production
- Incr. age
- Heat stress
- Late winter/early spring calving
- Vit A defc

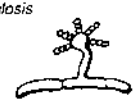
Abortion (IM 256; Br 469; DDX 20)



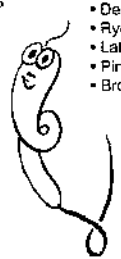
Common causes:
- **Brucellosis** (pg 122)
- **IBR** (pg 118)
- **BVD-MD** (pg 121)
- **Trichomoniasis** (pg 120)
- **Leptospirosis** (pg 121)
- **Epizootic bovine abortion** (pg 123)
- **Maternal stress**
- **Campylobacteriosis** (pg 119)
- **Mycotic abortions** (pg 120)

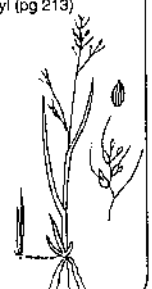
Uncommon causes:
- **Tuberculosis** (pg 70)
- Twinning (pg 107)
- Mycoplasma (pg 123)
- Salmonellosis (pg 119)
- Uterine torsion (pg 112)
- White muscle diz (pg 78)
- Q fever (pg 254)
- Umbilical cord abnormalities (pg 102)
- Placental abnormalities
- Fetal abnormalities
- Chromosomal abnormalities
- Malnutrition (pg 265)
- Bluetongue (pg 123)
- Anaplasmosis (pg 92)
- *Hemophilus somnus* (pg 258)
- Drug induced
- Manganese defc (pg 148)
- Vit A defc (pg 189)
- Salt toxicity (pg 205)
- Iodine defc

Rare causes:
- Johne's diz (pg 23)
- Liver flukes (pg 37)
- Bacillary hemoglobinuria
- Milk allergy (pg 188)
- Lice (pg 180)
- Ureaplasma (pg 123)
- Anthrax (pg 247)
- *Yersinia pseudotuberculosis*
- Copper defc (pg 189)



Toxic causes:
- Lead toxicity (pg 202)
- Ergotism (pg 237)
- Nitrate poisoning (pg 231)
- Phosphatic fertilizer toxicity (pg 215)
- Aflatoxicosis (pg 233)
- Chlorinated naphthalene (pg 213)
- Zearalenone (pg 241)
- Polybrominated biphenyl (pg 213)
- Locoweed (pg 236)
- Death camas (pg239)
- Ryegrass (pg 237)
- Lathyrus
- Pine needles (pg 241)
- Broomweed (pg 220)



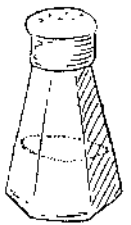


Dystocia

(IM 263)

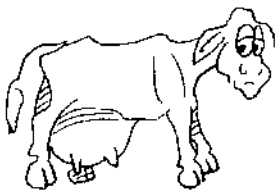
Common causes:
- **Malpresentation** (pg 115)
- **Malposition** (pg 115)
- **Malposture** (pg 115)
- **Fetoplevic disproportion** (pg 115)
- **Twins** (pg 157)
- **Uterine torsion** (pg 112)
- **Lymphedema**
- **Cervix undilated**
- **Periparturient hypocalcemia**

Rare causes:
- Rupture of prepubic tendon (pg 113)
- Prolonged gestation
- Uterine rupture (pg 113)
- Abd. inguinal hernias (pg 46)
- Fetal tumors
- Hereditary edema - Ayreshire calves
- Rectovaginal constriction - Jersey cattle
- Lipomatosis
- Polybrominated biphenyl toxicity (pg 213)
- Phytoestrogen toxicity

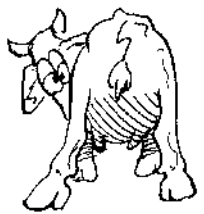


Uncommon causes:
- Triplets
- Hydrops of fetal membranes (pg 113)
- Retained fetus
- Mummification/maceration (pg 107)
- Emphysematous fetus
- Hydrocephalus
- Ankylosis of extremities
- Congenital defects (monsters)
- Hydrops of fetal membranes
- Immature small females
- Preterm parturition
- Abortion (pg 118)
- Obesity
- Uterine inertia
- Vaginal prolapse (pg 116)
- Uterine, cervical, vaginal obstruction
- Pelvic fractures


Enlarged Mammary Glands (IM 267)



Common causes:
- Mastitis (pg 192)
- Blind quarter
- Periparturient udder edema
- Trauma
- Abscess
- Pendulous udder



Uncommon causes:
- Photosensitization (pg 232)
- Sunburn (pg 184)
- Frostbite (pg 184)
- Eczema
- Urticaria (pg 188)
- Milk allergies (pg 188)
- Cowpox (pg 186)
- Pseudopox (pg 186)
- Bovine herpes mammillitis
- Foot & mouth diz (exotic) (pg 11)
- Tuberculosis (pg 70)
- Sarcoptic & psoroptic mange (pg181)
- Papillomatosis, warts (pg 190)
- Furunculosis/abscess (pg 183)
- Staph. folliculitis (pg 183)
- Ovarian neoplasia
- Enzootic mycobacterial nodular-ulcerative mammillitis
- Cutaneous lipomatosis
- Primordial mammarian tissue swelling
- Neoplasia
- Zearalenone toxicity (pg 239)

Udder Edema (IM 268)

- Periparturient udder edema
- Obesity
- Excessively long dry period
- Anemia
- Excess dietary sodium, potassium
- Excessive dietary protein
- Overfeeding grain prepartum
- Hereditary
- Hypomagnesemia (chronic udder edema)
- Disruption of udder blood & lymph circulation

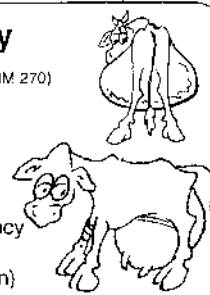
Agalactia/Hypogalactia

(IM 269; DDX 21)

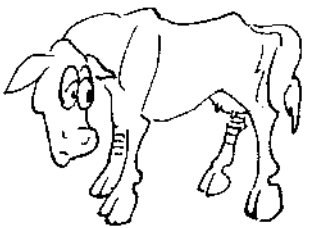
Common causes:
- Mammary aplasia, hypoplasia
- Abscess
- Mastitis (pg 192)

Uncommon causes:
- Trauma
- Neoplasia (lymphosarcoma, SCC)
- Salt toxicity (pg 205)
- Malnutrition (pg 266)
- Chapped teats/irritation
- Fescue syndrome (pg 254)
- Anemias (pg 82)
- Toxicities
- Papillomatosis (pg 190)
- Milk allergies (pg 188)
- Self suckling (pg 272)

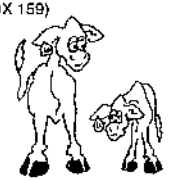
Precocious Mammary Gland Development (IM 270)



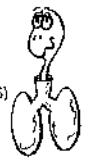
- Abortion (pg 118)
- Pregnancy (pg 106)
- Suckling
- Ovarian tumors
- Ascending infec. during pregnancy
- Zearalenone toxicity (pg 239)
- Spontaneous (prolactin secretion)



Decreased Weight Gain Growth (IM 181; GI 804; DDX 159)

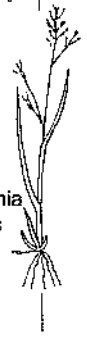


Common causes:
- **Malnutrition**
- **Parasites** (pg 54)
  - **Ostertagiasis** (pg 55)
  - **Flukes** (pg 37)
  - **GI worms** (pg 55, 56)
  - **Lungworm** (pg 69)
  - **Coccidiosis** (pg 260)
  - **Sarcoptic mange** (pg 181)
  - **Lice** (pg 180)
- **Pneumonia** (Pasteurella, Hemophilus) (pg 62)
- **Viruses**
  - **BVD** (pg 253)
  - **Rotavirus** (pg 18)
  - **Coronavirus** (pg 19)
- **Diarrhea**
  - **Undifferentiated**
  - **Salmonellosis** (pg 20,21)
  - **Enterotoxigenic *E. coli*** (pg 18)
- **Deficiencies**
  - **Selenium defc** (pg 89)
  - **Copper defc** (pg 89)
- **Cryptosporidiosis** (pg 19)
- **Lameness** (pg 155)



Uncommon causes:
- Deficiencies
  - Thiamine defc
  - Cobalt defc
  - Zinc defc
  - Vit A defc
- Viruses
  - Parvovirus
  - Adenovirus
- Bacteria
  - Johne's diz (pg 23)
  - Pharyngeal abscess (pg 14)
  - Urachal/bladder abscess
  - Abomasal ulcers (pg 31)
- Peritonitis (pg 53)
- Parasites
  - Tick infestation
  - Giardiasis
  - Sarcocytosis
  - Myiasis
  - Eperythrozoonosis
- Hydrocephalus
- Rickets
- Arthrogryposis
- Ammonia toxicity
- Goiter
- Cardiac anomalies
- Immune-mediated anemia
- Neonatal isoerythrolysis

Rare causes: see IM 180

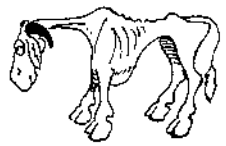


Toxic causes:
- Pyrrolizidine alkaloid (pg 232)
- Zinc toxicity (pg 215)
- Selenium toxicity (pg 226)
- Ergotism (pg 237)
- Iodine toxicity (pg 205)
- Fluorosis (pg 216)
- Herbicide toxicity
- Aflatoxicosis (pg 233)
- Bracken fern (pg 84, 86)
- Oxalate toxicity (pg 224)
- Fescue toxicity (pg 254)

Weight Loss (IM 191; Br 122)

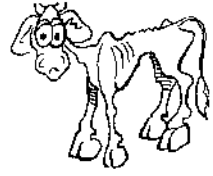
Common causes:
- Malnutrition/starvation
- Parasites (pg 54)
  - Ostertagiasis (pg 55)
  - Flukes (pg 37)
  - GI worms (pg 55, 56)
  - Lungworm (pg 69)
  - Lice (pg 180)
  - Coccidiosis
  - Sarcoptic mange (pg 181)
  - Lice (pg 180)
  - Anaplasmosis (pg 85)
- Dental abnormalities (pg 7)

- Pneumonia (Pasteurella, Hemophilus) (pg 62)
- Viruses
  - BVD (pg 253)
  - Rotavirus (pg 18)
  - Coronavirus (pg 19)
  - IBR (pg 252)
  - Bluetongue (pg 10)
- Diarrhea
  - Undifferentiated
  - Salmonellosis (pg 20, 21)
  - Enterotoxigenic *E. coli* (pg 18)
- Deficiencies
  - Selenium defc (pg 89)
  - Copper defc (pg 89)
- Cryptosporidiosis (pg 19)
- Lameness (pg 155)
  - Pedal osteomyelitis
  - Footrot (pg 159)
  - Septic arthritis (pg 172-3)
  - Sole abscess (pg 157)
- GI problems
  - Johne's diz (pg 23)
  - Displaced abomasum (pg 38)
  - Hepatic abscess (pg 36)
  - Abomasal ulcer (pg 31)
  - Traumatic reticuloperitonitis (pg 38)
  - Vagal indigestion (pg 29)
  - Salmonellosis (pg 259)
  - Winter dysentery (pg 23)
  - Fat necrosis (pg 50)
  - Pharyngeal, retropharyngeal abscess (pg 14)



- Enterotoxigenic *E. coli* (pg 18)
- Intussusception (pg 45)
- Peritonitis (pg 53)
- Pasteurellosis, septicemia
- Leptospirosis (pg 257)
- Mastitis (pg 192)
- Actinobacillosis (pg 13)
- Actinomycosis (pg 13)
- Metabolic problems
  - Lactic acidosis (pg 25)
  - Ketosis (pg 33)
- Urinary problems
  - Urolithiasis (pg 96)
  - Pyelonephritis/cystitis (pg 95)
- Failure of passive transfer (neonates)
- Fescue toxicity (pg 254)
- Bovine leukosis

Uncommon, rare & toxic causes: see IM 190



Limb Pain (IM 33)

Common causes:
- **Foot rot** (pg 159)
- **Sole abscess** (pg 157)
- **Sole ulcer** (pg 156)
- **Degenerative arthritis** (pg 170-2)
- **Interdigital fibroma** (pg 160)
- **Laminitis** (pg 163)
- **Laceration**
- **Traumatic gonitis** (pg 166)
- **Hoof cracks** (pg 158)

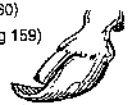
Less common causes:
- Septic arthritis (pg 172)
- Hip luxation (pg 166)
- Tenosynovitis (digit) (pg 168)
- Septic navicular bursitis
- Rupture of cranial cruciate (pg 167)
- Upward fixation of patella (pg 166)

Uncommon causes:
- Bicipital bursitis
- Fractures
- Neoplasia
- Nerve paralysis (pg 136)
- Toxins & plant poisonings
- Bone abscess
- Fescue foot (pg 254)
- Sacroiliac luxation

Lameness/Stiffness (IM 277)

Common causes:

- **Sprain** (pg 175)
- **Bruised foot** (pg 156)
- **Puncture wounds** (pg 157)
- **Foot rot** (pg 159)
- **Infections of foot**
- **Granuloma of sole** (pg 156)
- **Corkscrew claw** (pg 160)
- **Underrun heel** (pg 159)
- **Hoof defects** (pg 158)
- **Overgrown feet**
- **Interdigital fibroma** (pg 160)
- **Interdigital dermatitis** (pg 159)
- **Laminitis** (pg 163)
- **Septic arthritis** (pg 172)
- **Contracted tendons** (pg 168)
- **Ruptured cran. cruciate lig.** (pg 167)
- **Ligament rupture**
- **Arthrogryposis**
- **Fractures**
- **Osteomyelitis** (pg 174)
- **Muscle abscess**
- **Blackleg** (pg 244)



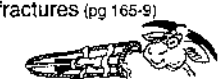
Uncommon causes:
- Luxation (pg 164)
- Hygroma (pg 165)
- DJD (pg 170)
- Osteomalacia (pg 262)
- Septic tendosynovitis (pg 168)
- Angular limb deformities
- Ruptured tendon (pg 168)
- Dors. fixation of patella (pg 167)
- Muscle injury
- Vesicular stomatitis (pg 11)
- Spinal abscess (pg 134)
- Spinal lymphosarcoma (pg 135)
- Malignant catarrhal fever (pg 10)
- Malignant edema (pg 245)

Rare causes
- Physeal injuries
- Hemimelia
- Salmonellosis (pg 259)
- Ulcerative lymphangitis
- BVD (pg 253)
- Dactylomegaly in shorthorn cattle
- Clotting factor deficits
- Neoplasia
- Melioidosis
- Sporadic bovine encephalomyelitis (pg 151)
- Phycomycosis
- Hyperparathyroidism

Toxins
- Copper defc (pg 89)
- Zinc defc (pg 89)
- Polybrominated biphenyl (PBB) (pg 2213)
- Acorn (oak) toxicity (pg 254)
- Locoweed toxicity (pg 152)
- Lupine alkaloid poisoning (pg 220)
- Hemlock poisoning (pg 238)
- Nicotine toxicity (pg 213)
- Calcinosis (from poisonous plants)
- Fescue foot (ergot) (pg 254)
- Kaley-pea poisoning

Spontaneous Fractures

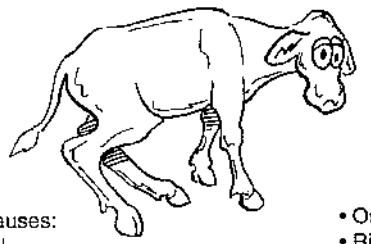
(IM 275)



- Pathological fractures (pg 165-9)
- Infections
- Tumors
- Osteoporosis (pg 262)
- Osteomalacia (pg 262)
- Osteodystrophy (rickets) (pg 262)
- Lactation
- Advanced pregnancy
- Rapid growth
- Copper defc (pg 89)
- Phosphorus defc
- Protein defc
- Molybdenum excess (pg 89)

Postural Deformities

(IM 280)



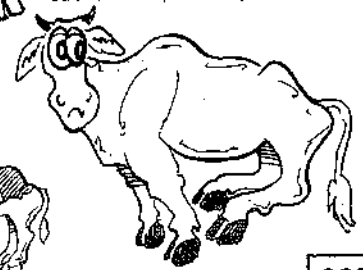
Common causes:

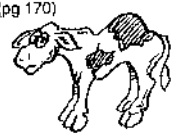
- Congenital
  - Contracted tendons (pg 168)
  - Angular limb deformities
  - Crooked calf syndrome (Lupinosis)
  - Acorn calves (shortened long bones) (pg 234)
  - Syndactyly (pg 263)
  - Idiopathic deformities & abortion
  - Osteogenesis imperfecta (pg 263)
  - Dactylomegaly - shorthorns
- Fractures (pg 165)
- Luxation (pg 164)
- 2° contracted tendons (pg 168)
- Severed tendons (pg 168)
- Septic tenosynovitis (pg 168)
- Ruptured gastrocnemius (pg 168)
- Ruptured peroneus tertious (pg 168)
- Septic arthritis w/ ankylosis (pg 172)
- Arthritides (pg 172-3)
- DJD (degenerative joint diz) (pg 170)
- Physitis (pg 175)
- Osteomalacia (pg 262)

- Osteomyelitis (pg 174)
- Rickets (pg 262)
- Hypertrophic osteopathy
- Muscle atrophy from denervation
- Infection of foot (pg 159)
- Hyperparathyroidism
- Chronic laminitis (pg 163)

Toxic causes:

- 2° copper defc (molybdenosis) (pg 89)
- Fluoride poisoning (pg 216)
- Selenium poisoning (pg 226)
- Monensin toxicity (pg 203)
- Phosphorus defc (pg 215)
- Calcinosis from poisonous plants





Swellings of Limbs

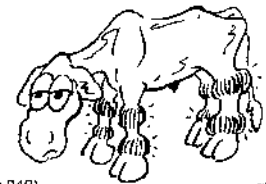
(IM 282)

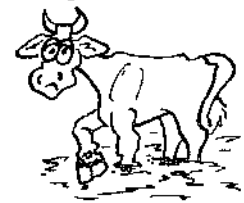
Soft tissue

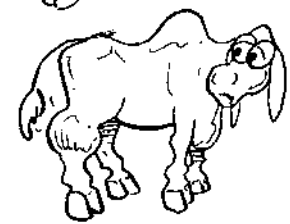
- Footrot (pg 159)
- Fescue foot (pg 159)
- Gangrene of foot (pg 161)
- Interdigital fibroma (pg 160)
- Interdigital papilloma
- Capped hock (pg164)
- Septic arthritis (pg 172)
- Mycoplasma arthritis
- Ruptured tendon (pg 168)
- Chronic tendonitis (pg 168)
- Tenosynovitis (pg 168)
- Hygroma (pg 165)
- Neoplasia
- Hematoma
- Abscess
- Granulomas
- Phycomycosis
- Habronemiasis
- Bee sting/snake bite (pg 242)

Hard tissue

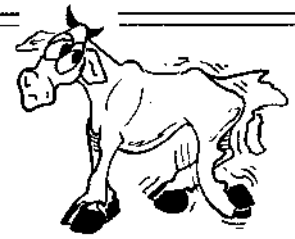
- DJD (pg 170)
- Septic arthritis (pg 172)
- Epiphysitis (pg 175)
- Osteomyelitis (pg 174)
- Sequestrum (pg 174)
- Fracture (pg 165-9)
- Osteosarcoma
- Tumor calcinosis
- Calcinosis circumscripta
- 2° copper defc (molybdenosis) (pg 89)



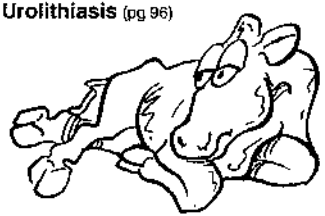




Paresis & Weakness (IM 285)

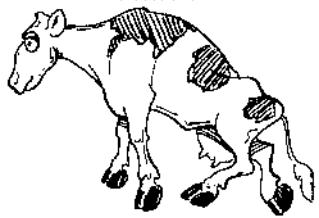


Common causes:
- **Malnutrition** (pg 266)
- **Parturient paresis** (pg 148)
- **Nonparturient hypocalcemia**
- **Hypomagnesemic tetany** (pg 146)
- **Alert downer cow syndrome** (pg 267)
- **Toxic mastitis** (pg 192)
- **Ruminal lactic acidosis** (pg 25)
- **Abomasal ulcers** (pg 31)
- **Lt. displaced abomasum** (pg 42)
- **Vagal indigestion** (pg 29)
- **Ketosis** (pg 33)
- **Diarrhea in calves** (pg 16)
- **Colibacillosis (neonates)** (pg 18)
- **Salmonellosis** (pg 20, 259)
- **Cryptosporidiosis** (pg 19)
- **Parasitism** (pg 55)
- **Anaplasmosis** (pg 92)
- **Peritonitis** (pg 53)
- **Pneumonia** (pg 62)
- **Polioencephalomalacia** (pg 140)
- **Urolithiasis** (pg 96)



Uncommon causes:
- Winter dysentery (pg 33)
- BVD (pg 22, 253)
- Johne's diz (pg 23)
- Cecal torsion (pg 49)
- Rt. displaced abomasum (pg 40)
- Botulism (pg 145)
- Renal failure (pg 100)
- Postparturient hemoglobinuria (pg 88)
- Vit defc (pg 189)
- Trace mineral defc (pg 189)
- Water intoxication
- Snake bite (pg 242)
- Rabies (pg 144)
- Pseudorabies (pg 141)
- Focal symmetrical encephalomalacia
- CNS, spinal abscess (pg 134)
- Tick paralysis (pg 142)
- Vertebral, spinal abscess
- TEME (pg 141)
- Blackleg (pg 244)
- Malignant edema (pg 245)
- Listeriosis (pg 122)
- Black diz (pg 37)
- Ruptured uterus (pg 113)
- Neoplasia
- Lightening strike
- Gunshot
- Hemorrhage (pg 84)
- Hemolytic anemia
  - Leptospirosis (pg 257)
  - Anaplasmosis (pg 92)
  - Onion, rape, kale (pg 89)
- Goiter (pg 223)
- Hypothermia
- Acute pulmonary edema

Rare cause:
- Sporadic bovine encephalomyelitis (pg 151)
- Piroplasmosis (rare) (pg 91)
- Other GI, Neurological, renal, cardiovascular or toxins

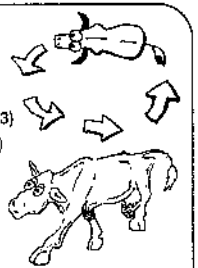


Paresis & Generalized Weakness (IM 283)

Fever/sepsis
- Toxicities
- Cardiovascular diz
- Neuromuscular diz
- Chronic inflammatory diz
- Anemia (pg 82)
- Electrolyte disorders
- Tumors
- Exhaustion
- Drug related
- Endocrine/metabolic disorders

Circling

DDx 38



- Listeriosis adult #1 (pg 143)
- Otitis media (calf) (pg 142)
- Encephalomalacia
- Encephalitis
- Brain abscess (pg 140)
- Brain neoplasia (pg 143)
- Pseudorabies (pg 141)
- Cervical vertebral osteomyelitis (pg 143)
- Brain trauma
- Sporadic encephalomyelitis (pg 151)
- East coast fever(exotic) (pg 261)

Blindness (DDX 28)

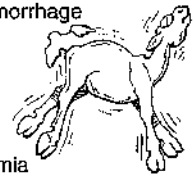
- Lead poisoning (calf > adult) (pg 152)
- Pinkeye (pg 178)
- Keratoconjunctivitis
- Brain edema
- Brain abscess (pg 140)
- Encephalomalacia, idiopathic
- Poisonings plants
- Salt poisoning (pg 205)
- Selenium (blind staggers) (pg 226)
- Encephalitis
- Inherited blindness
- Metaldehyde poisoning (pg 207)
- Idiopatic hepatitis (pg 34)
- Phenothiazine poisoning
- Malignant catarrhal fever (pg 10)
- Hydrocephalus (pg 143)
- Lupinosis (pg 220)
- Carbon tetrachloride (pg 217)
- Lightening strike
- Enterotoxemia (pg 250)
- Brain tumor (pg 143)
- Chediak-Higashi syndrome (pg274)

Rare causes
- Haemophilus spp septicemia (pg 254)
- Listeriosis (pg 143)
- Meningitis (pg 151)
- Acidosis (pg 25)
- Mucosal diz, acute (pg 12)
- Tick paralysis (pg 142)
- Grain overload (pg 25)
- Brisket edema (pg 80)

Seizures - Neonate

(IM 386, 389)

- Perinatal complications
  - Hypoxic-ischemic brain injury
  - Cerebral concussion
  - Intracranial hemorrhage
- Metabolic
  - Hypoglycemia
  - Hyponatremia
  - Hypernatremia
  - Hypocalcemia
  - Hypomagnesemia
  - Metabolic acidosis
- Infectious
  - Generalized sepsis
  - Meningitis/encephalitis (pg 151)
  - Botulism (pg 145)
  - CNS parasite migration
- Drugs
  - Theophylline
  - Intracarotid injection
  - Ingestion or injection of toxins
  - Premature withdrawal of Anticonvulsants Rx
- Develop. malformations
  - Hypomyelinogenesis
  - Hydrocephalus
  - Hydranencephaly (pg 143)
  - Storage diz
  - Amino acid metabolism defects
  - Congenital myoclonus
- Liver failure (pg 34)
- Idiopathic epilepsy (pg 154)
- Heat stroke
- Rabies (pg 144)



Convulsions (BR-hb 213; Br 129; DDX 44)

Common causes:
- Lactation tetany (pg 146)
- Lead (calf) (pg 152)
- Brain neoplasm (pg 143)
- Acetonemia (pg 33)
- Tetanus (pg 145)
- Brain trauma/abscess/tumor (pg 140)
- Cyanide poisoning (pg 222)
- Meningitis (pg 151)
- Encephalitis
- Alkalosis (pg 25)
- Toxemia
- Congenital conditions (hydrocephalus, Doddler calf)
- Hypomagnesemia (calf) (pg 146)
- Colibacillosis (calf) (pg 18)
- Polioencephalomalacia (pg 140)
- Rabies (pg 144)
- Electrocution/lightening strike
- Ryegrass staggers (pg 237)
- Anthrax (pg 247)
- Epilepsy (pg 154)

Toxic causes:
- Strychnine (pg 215)
- Nicotine (pg 213)
- Red squill
- Carbon tetrachloride (pg 217)
- Chlorinated hydrocarbons (pg 207)
- Fluoride (pg 216)
- Mercury (pg 202)
- Phosphorus (pg 215)
- Nitrite (pg 231)
- Organophosphates (pg206)
- Sulfur
- Arsenic (pg 202)

Muscle spasm & myoclonus (IM 287)

Common causes:
- **Hypomagnesemic tetany** (pg 146)
- **Grass tetany** (pg 236)
- **Hypocalcemia** (pg 148)
- **Tetanus** (pg 145)

Uncommon causes:
- Meningitis (pg 151)
- Rabies (pg 144)
- Pseudorabies (pg 141)
- Nervous coccidiosis (pg 150)
- Hypoglycemia

Rare causes:
- Maple syrup urine diz in calves (pg 135)
- Hereditary neuralaxial edema - Herefords
- Hereditary paralysis - red Danish calves
- Congenital brain edema - Herefords
- Lethal spasms - Jersey & Hereford calves
- Ephemeral fever (exotic)

Toxic causes:
- Strychnine (pg 215)
- Chlorinated hydrocarbons (pg 207)
- Buckeye poisoning (pg 147)
- Cocklebur poisoning (pg 240)

Weak/Depressed Neonates (IM 361)

Bacterial infections
- Joint & bone
- Pneumonia (pg 62)
- Enteritis (pg 18)
- Meningitis (pg 151)
- Septicemia
- Peritonitis (pg 53)

Congenital viral infection
- BVD (pg 253)
- IBR (pg 252)
- Parainfluenza (pg 65)
- Bluetongue (pg 10)
- Akbane virus

Prematurity
- Weak calf syndrome
- Placentitis
- Intra-uterine growth retardation

Birth asphyxia
- Dystocia (pg 115)
- Premature placental separation
- Cesarean section (pg 114)
- Induced parturition

Birth trauma
- Fractured ribs, pneumothorax/ hemothorax
- Brachial plexus injuries (pg 136)

Liver diz
- Hepatitis (pg 34)
- Severe hypoxic insult

GI diz
- GI ulceration (pg 31)
- Necrotizing enterocolitis

Metabolic derangements
- Hyponatremia
- Hypoglycemia
- Hypocalcemia (pg 184)
- Hypokalemia/hyperkalemia
- Acidosis (pg 25)
- Kidney diz (pg 100)
- Renal failure (pg 100)
- Uroperitoneum (pg 96)

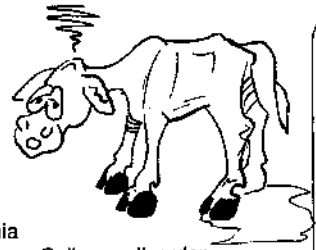
Anemia
- Severe anemia (pg 82)
- Blood loss (pg 84)
- Isoerythrolysis (pg 91)

Brain diz
- Meningitis (pg 151)
- Trauma
- Hemorrhage (pg 84)
- Malformations
- Narcolepsy (pg 154)
- Ischemia/edema/necrosis

Spinal cord diz
- Vertebral malformation (pg 134)
- Vertebral abscess/ osteomyelitis (pg 134)
- Vertebral fracture/trauma (pg 133)

Peripheral nerve/muscle diz
- Tetanus (pg 145)
- Congenital myopathy, polymyositis
- Collagen-disorder
- White muscle diz (pg 78)
- Aminoglycosides neuromuscular blockade? (pg 101)
- Neuropathy of spinal roots
- Disorders of metabolism
- Shaker calf syndrome
- GM-1 gangliosidosis
- Citrullinemia
- Maple syrup urine diz

Drugs & toxins
- Over sedation of neonate
- Transplacental anesthesia or sedation



Staggers, Adult (DDX 139)

- Nervous acetonemia (pg 33)
- Lactation tetany (pg 146)
- Ryegrass staggers (pg 237)
- Paspalum staggers (pg 237)
- Poisonous plant incoordination
- Hypocalcemia, nonparturient
- Transit tetany (pg 146)
- Milk allergies (pg 188)
- Phalaris staggers
- Brain neoplasm (pg 143)
- Organophosphates (pg 206)
- Cyanide toxicity (pg 222)
- Pseudorabies (pg 141)
- Selenium toxicity (pg 236)
- Cobalt toxicity
- Brain edema
- Metaldehyde toxicity (pg 207)
- Urea toxicity (pg 204)
- Brain trauma
- Ethylene glycol toxicity (pg 209)
- Vit A defc (pg 189)
- Salt toxicity (pg 205)

Calf Staggers (DDX 141)

- Lead poisoning (pg 152)
- Ryegrass staggers (pg 237)
- Paspalum staggers (pg 237)
- Cerebellar hypoplasia (pg 143)
- IBR - CNS form (pg 154)
- Acorn calf (pg 234)
- Phalaris staggers
- Atlanta-occipital malformation (pg 134)
- Inherited congenital spasms
- Organophosphates (pg 206)
- Cyanide poisoning (pg 222)
- Selenium toxicity (pg 236)
- Pseudorabies (pg 141)
- Brain edema
- Metaldehyde toxicity (pg 207)
- Urea toxicity (pg 204)
- Ethylene glycol toxicity (pg 209)
- Brain trauma

Sudden Death (IM 291; Br 124; DDX 149)

Infectious & parasitic causes:

- Anthrax (pg 247)
- Salmonellosis (pg 259)
- Botulism (pg 145)
- Blackleg (pg 244)
- Black diz (pg 37)
- Red water (*Cl. hemoyticum*) (pg 90)
- Enterotoxemia (*Cl. perfringens*) (pg 250)
- Abscess rupture - liver (pg 36)
- Abscess rupture - pituitary
- Leptospirosis (pg 257)
- Septic metritis (pg 111)
- Pseudorabies (pg 141)
- Liver flukes (pg 37)
- Anaplasmosis (pg 92)
- TEME (pg 141)

Physical causes:

- Choke (pg 15)
- Bloat (pg 26)
- Abomasal bloat (calves)
- Ulcers, perforating or bleeding (pg 31)
- Reticuloperitonitis/pericarditis (pg 38)
- Gunshot
- Heatstroke
- Myocardial infarction
- Ruptured uterine artery
- Tracheal edema feeder cattle) (pg 61)

Metabolic or nutritional causes:

- Hypocalcemia (pg 148)
- White muscle diz (Se defc) (pg 78)
- Grain overload (pg 25)
- Polioencephalomalacia (pg 140)
- Grass tetany (pg 146)
- Heart failure - molybdenosis (pg 89)

Toxic causes:

- Arsenic (pg 202)
- Botulism (pg 145)
- Salt toxicity (pg 205)
- Copper (pg 203)
- Lead toxicity (pg 152)
- Monensin (pg 203)
- Nicotine toxicity (pg 213)
- Organophosphates (pg 206)
- Carbamates (pg 206)
- Chlorinated hydrocarbons (pg 207)
- Gossypol (pg 229)
- Hydrogen sulfide gas (pg 210)
- Metaldehyde (pg 207)
- Selenium toxicity (pg 226)
- Urea (NPN) toxicity (pg 204)
- Nitrogen dioxide gas (pg 211)
- 4-Methyl-imadozole (bonkers syndrome)
- Crude oil (pg 213)
- Anticoagulants (pg 214)
- 4-aminopyridine (Avitrol)

Toxic plants

- Blue green algae (pg 237)
- Larkspur (pg 235)
- Nightshades (pg 239)
- Death camus (pg 239)
- Lupine (pg 220)
- Halogeton (pg 225)
- Water hemlock (pg 238)
- Poison hemlock (pg 238)
- Milkweed (pg 230)
- Monkshod (pg 147)
- Greasewood (pg 225)
- Tobacco (pg 221)
- Oleander (pg 230)
- Golden chain tree
- Canary grass
- Cocklebur (pg 240)
- Nitrate accumulaters (pg 231)
- Cyanogenic plants (pg 230)
- Inkweed
- Laurels

Miscellaneous causes:

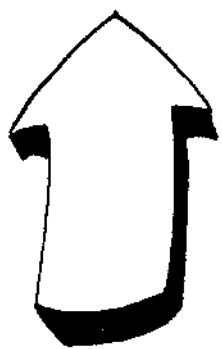
- Anaphylaxis (pg 251)
- Acute pulmonary edema & emphysema (pg 67)
- Sudden death syndrome (feeder cattle)
- Blood transfusion reactions
- Immune mediated hemolytic anemia (calves) (pg 92)

Increased PCV (Erythrocytosis) (IM 478)

- Relative erythrocytosis
  - Dehydration
  - Endotoxic shock
    - . Strangulation obstruction (pg 45)
    - . Salmonellosis (pg 34, 42)
    - . Septic metritis (pg 111)
    - . Septic mastitis (pg 193)

- Absolute erythrocytosis
  - Common causes
    - . Residence in high altitudes
    - . Congenital cardiovascular diz (pg 76)
  - Less common cause
    - . Hepatoma
    - . Chronic hepatic diz (pg 34)
    - . Hemangioblastoma (pg 84)

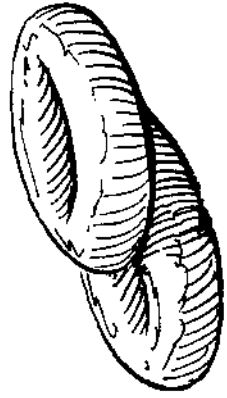
From *Large Animal Internal Medicine*, Smith pg 424 for uncommon causes

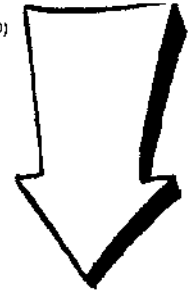


Anemia (IM 477; C3T 695, 696; DDX 24)

Common causes:
- Blood loss
  - Parasites (pg 55)
    - . Intestinal (pg 55)
    - . External (ticks & lice) (pg 180)
  - Abomasal ulcer (pg 31)
    - . Moldy sweet clover toxicity (pg 229)
- Hemolysis
  - Anaplasmosis (pg 92)
  - Leptospirosis (pg 257)
  - Bacillary hemoglobinuria (pg 90)
  - Onion toxicosis (pg 89)
  - Brassica toxicity (pg 89)
- Inadequate RBC production
  - Liver abscess (pg 36)
  - Johne's diz (pg 23)
  - Chronic pneumonia (pg 62)
  - Chronic BVD (pg 253)
  - Chronic abscess
  - Lymphosarcoma (pg 268)

Uncommon causes:
- Blood loss
  - DIC (pg 85)
  - Severe pyelonephritis (pg 98)
  - Pulmonary abscess
- Hemolysis
  - Immune mediated hemolytic anemia (pg 92)
  - Postparturient hemoglobinuria (pg 88)
  - Chronic copper toxicosis (pg 88)
- Inadequate RBC production
  - Bracken fern toxicity (pg 86)
  - Radiation toxicosis
  - Chronic renal failure (pg 100)





Neutrophilia (Incr. PMNs)

(IM 484)

Common causes:
- Stress
- Corticosteroid administration
- Peritonitis (pg 53)
- Liver abscess (pg 34)
- Internal abscess
- Umbilical abscess (pg 46)
- Chronic metritis (pg 111)
- Chronic pyelonephritis (pg 98)
- Septic arthritis (pg 172)
- Neonatal septicemia
- Enteritis (pg 16-23)

Uncommon causes:
- Toxins
- Autoimmune hemolytic anemia (pg 92)
- Bovine granulocytopathy syndrome

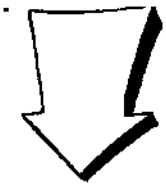
Neutropenia (Decr. PMNs)

(IM 484)

Common causes:
- Septic metritis (pg 111)
- Gram neg. septicemia/endotoxemia
- Peritonitis - diffuse (pg 53)
  - Rupture abomasal ulcer (pg 31))
  - Ruptured uterus (pg 113)
- Septic mastitis (pg 194, 195)
- Acute pneumonia (pg 62)
- Fat cow syndrome (pg 32)
- Clostridial infec. (pg 250)
- Acute salmonellosis (pg 259)
- Bone marrow suppression - toxic

Uncommon causes:
- Bracken fern toxicity (pg 86)
- BVD (pg 253)
- Idiopathic aplastic anemia
- Trichloroethylene toxicity
- Radiation toxicity

Lymphopenia (Decr. Lymphocytes) (IM 485)



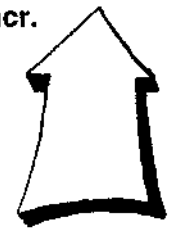
Common causes:
- Stress
- Steroid injections
- Diffuse peritonitis (pg 53)
  - Ruptured abomasal ulcer (pg 31)
- Acute pneumonia (pg 62)
- IBR (pg 252)
- Gram negative endotoxemia/septicemia (pg 258)

Uncommon causes:
- Immunodefc.
- BVD (pg 253)

Monocytosis (Incr. Monocytes) (IM 432)

Chronic bact. infections
- Granulomatous disease (pg 23)

Lymphocytosis (Incr. Lymphocytes) (IM 485)



Lymphocytic leukemia
- Persistent lymphocytosis

Eosinophilia (Incr. Eosinophils) (IM 486)

Uncommon causes:
- Migrating parasites
  - Lungworms (pg 89)
  - Flukes (pg 37)
  - Hypoderma (pg 182)
  - Ascarids (pg 56)
  - Trichostrongyles (pg 56)
- Toxoplasmosis
- Milk allergies
- Sarcocystosis (pg 261)
- Atypical interstitial pneumonia (pg 67)
- Acute bovine pulmonary emphysema (pg 67)

Hyperproteinemia (IM 413)

- Panhyperproteinemia - dehydration

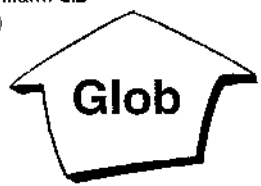
Common causes:
- Ruminal acidosis (pg 25)
- Peritonitis (pg 53)
- Salmonellosis (pg 259)
- Salt toxicity (pg 205)
- Coccidiosis (pg 260)
- Vagal indigestion (pg 29)
- Abomasal torsion (pg 40)
- Sepsis toxemia
  - . Mastitis (pg 194-5
  - . Metritis (pg 111)
- Diarrhea (pg 16-23)
- Toxins

Uncommon causes:
- Rabies (pg 144)
- Lymphosarcoma (pg 268)
- Renal amyloidosis (pg 94)
- Pregnancy toxemia (pg 32)

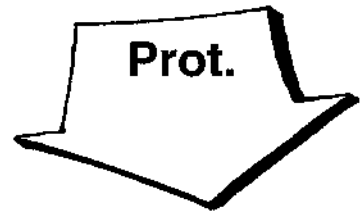
Hyperglobinemia

Common causes: chronic inflam. diz
- Chronic pneumonia (pg 62)
- Lymphosarcoma (pg 268)
- Abdominal abscess
- Umbilical abscess (pg 46)

Less common causes:
- Parasitism (pg 55)
- Pregnancy (pg 106)



Hypoproteinemia (Decreased Protein) (IM 495)



- Hypoalbuminemia

Common causes:
- Amyloidosis (pg 94)
- Glomerulonephritis (pg 94)
- Pyelonephritis (pg 98)
- Johne's diz (pg 23)
- Trichostrongyle infec. (pg 56)
- Salmonellosis (pg 259)

Uncommon causes:
- Chronic liver failure (pg 34)
- Intestinal lymphosarcoma (pg 268)
- Intestinal lymphangiectasis

- Panhypoproteinemia

Common causes:
- Acute blood loss (pg 84)
- Gastrointestinal ulceration (pg 31)
- Parasites, internal & external (pg 55, 180)
- Excessive IV fluid or water intake

Uncommon causes:
- Pyelonephritis (pg 98)
- Strangulation/infarction of intestine (pg 45)
- Congestive heart failure (pg 76)
- Caustic chemical ingestion
- Urinary tract blood loss

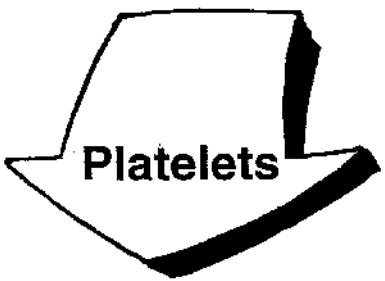
Hyperfibrinogenemia (IM 496)

Acute inflammatory diz
- Acute mastitis (pg 192)
- Pneumonia (pg 62)
- Omphalophlebitis (pg 102)
- Pleuritis (pg 72)
- Traumatic reticuloperitonitis/pericarditis (pg 38)

Thrombocytopenia (Decr. Platelets)
(IM 499)

Common causes:
- Bracken fern toxicity (pg 86)
- DIC (disseminated intravascular coagulation) (pg 85)
- Septic mastitis (pg 3192)
- Septic metritis (pg 111)
- DVD

Uncommon causes:
- Plasma cell myeloma
- Lymphosarcoma (pg 268)
- Gram neg. sepsis (pg 258)
- Salmonellosis (pg 259)
- Stachybotryotoxicosis
- Immune mediated thrombocytopenia



Prolonged PT (ProthrombinTime) (IM 500)

Common causes:
- Moldy sweet clover (pg 229)
- DIC (Disseminated intravascular coagulation) (pg 85)

Uncommon causes:
- Warfarin toxicity (pg 214)
- Aflatoxicosis (pg 233)
- Rubratoxicosis
- Pyrrolizidine alkaloid toxicosis (pg 232)
- Chronic hepatic fibrosis (pg 34)
- Bitterweed toxicity (pg 241)

Prolonged APTT (IM 501)

Common causes:
- Moldy sweet clover toxicity (pg 229)
- DIC (Dissemin. intravas. coagulation) (pg 85)

Uncommon causes:
- Warfarin toxicosis (pg 214)
- Hepatotoxins
  - Pyrrolizidine alkaloids (pg 232)
  - Aflatoxins (pg 233)
  - Bitterweed (pg 241)
- Congenital defc factor XI

Elevated FDPs (Fibrin/Fibrinogen Degradation Products) (IM 502)

Common causes:
- DIC (Disseminated intravascular coagulation) (pg 140)
- Thrombophlebitis (pg 127)
- Severe inflammatory disorders
- Postoperative states
- IMTP (Immune-mediated thrombocytopenia) (pg 142)

Uncommon causes:
- Massive internal hemorrhage
- Primary hyperfibrinolysis

Reduced antithrombin III (IM 450)

Common causes:
- DIC (Disseminated intravascular coagulation) (pg 85)
- Renal amyloidosis (pg 94)
- Johne's diz (pg 23)

Less common causes:
- Starvation (pg 266)
- Venous thrombosis (pg 80)
- Hepatic failure (pg 34)

Serum Enzyme Elevation

(IM 461)

↑ SDH (Sorbitol Dehydrogenase)

Common causes:
- **Acute liver failure** (pg 34)
- **Liver abscess** (pg 36)
- **Damaged bowel**
  - **Strangulation** (pg 45)
  - **Acute toxic enteritis**

SDH

Uncommon causes:
- Chronic liver failure (pg 34)
- Acute & severe anemia (pg 82)
- General anesthesia
- Anorexia

↑ GGT (Gamma-Glutamyl Transferase)

Common causes:
- **Acute liver failure** (pg 34)
- **Chronic liver failure** (pg 34)
- **Pyrrolizidine alkaloid toxicity** (pg 35)
- **Aflatoxicosis** (pg 233)
- **Normal range in young**

Uncommon causes:
- **Fatty liver** (pg 32)
- **Cholangiohepatitis** (pg 35)
- **Cholelithiasis** (pg 35)

GGT

↑ AP (Alkaline Phosphatase)

Not a good test for ruminants!

↑ CPK (Creatine Phosphokinase)

Common causes:
- **Nutritional myodegeneration** (Se/Vit E defc) (pg 78)
- **Alert downer cow** (pg 267)
- **Malignant edema** (pg 245)

Uncommon causes:
- Sarcosporidiosis (pg 261)
- Cardiomyopathy (pg 277)
- IM injection
- Tying up (muscle damage)
- Malignant hyperthermia

CPK

LDH (Lactate Dehydrogenase)

Common causes:
- **Muscle disease**
  - **Nutritional myodegeneration** (Se/Vit E defc) (pg 78)
  - **Alert downer cow** (pg 267)
  - **Malignant edema** (pg 245)
- **Liver disease**
  - **Acute liver failure** (pg 34)
  - **Chronic liver failure** (pg 34)
  - **Liver flukes** (pg 37)
- **Hemolysis** (pg 53)

LDH

Uncommon causes:
- Acute cardiomyopathy (pg 77)
- Hemolytic anemia (pg 91)
- Sarcosporidiosis (pg 261)
- Purpura hemorrhagica (pg 140)
- IM injection
- Fatty liver (pg 32)
- Cholangiohepatitis (pg 35)
- Cholelithiasis (pg 35)
- Tying up (muscle damage)
- Malignant hyperthermia

↑ AST, GOT

(Aspartate Aminotransferase)

- **Same as for LDH**

AST

↓ BUN (Blood Urea Nitrogen)

(IM 466)

Common causes:
- Liver failure (pg 34)
- Normally lower in neonates
- Low-protein diet

Uncommon cause:
- Anabolic steroids

↑ BUN (Blood Urea Nitrogen)

(IM 466)

Common causes:
- Prerenal azotemia
  - Hypovolemia
  - Congestive heart failure (pg 76)
  - Reduced renal perfusion
  - Dehydration
- Renal azotemia
  - Acute renal failure (pg 100)
  - Chronic renal failure (pg 100)
- Postrenal azotemia
  - Urolithiasis (renal, ureteral, urethral calculi) (pg 96)
  - Ruptured bladder (pg 96)

Uncommon causes: (complete list IM 411)
- Aminoglycoside tocicity (pg 101)
- Heavy metal poisoning

↑ Serum Bilirubin (IM 464)

Common causes:
- Hemolytic anemia (pg 82)
- Liver failure (pg 34)
- Systemic disease
- Fasting/anorexia

Uncommon cause:
- Chronic liver failure (pg 34)

• ↑ Indirect Bilirubin

Common causes:
- Hemolytic anemia (pg 82)
- Liver failure (pg 34)
- Systemic disease
- Fasting/anorexia

Uncommon cause:
- Chronic liver failure (pg 34)

• ↑ Direct Bilirubin

Common causes:
- Liver failure (pg 34)
- Neonatal isoerythrolysis (pg 91)

Uncommon causes:
- Hemolytic anemia (pg 82)
- Cholelithiasis (pg 35)
- Cholangiohepatitis (pg 35)

Hypoglycemia (IM 464)

Common causes:
- Pregnancy toxemia
- Anorexia in newborn
- Late endotoxic shock

Uncommon cause:
- Invitro glycolysis of RBCs

Hyperglycemia (IM 464)

Common causes:
- Excitement & stress
- Xylazine administration
- Glucocorticoid administration

Uncommon causes:
- Rapid dextrose administration
- Diabetes mellitus (pg 274)

↑ Creatine (IM 465)

Common causes:
- Prerenal azotemia
  - Hypovolemia
  - Congestive heart failure (pg 76)
  - Reduced renal perfusion
  - Dehydration
- Renal azotemia
  - Acute renal failure (pg 100)
  - Chronic renal failure (pg 100)
- Postrenal azotemia
  - Urolithiasis (renal, ureteral, urethral calculi) (pg 96)
  - Ruptured bladder (pg 96)

Uncommon causes: see IM 410)

Hyponatremia (↓ Na) (IM 450)

Common causes:

- **Decr. fluid volume**
  - **Diarrhea** (pg 16-23)
  - **Blood loss** (pg 82)
  - **Excessive sweating**
  - **Fluid drainage**
    - **Pleural drainage**
  - **Sequestration of fluid in 3rd space**
    - **Ascites**
    - **Peritonitis** (pg 53)
    - **Ruptured bladder** (pg 96)
    - **Torsion or volvulus or gut**
  - **Hyperglycemia**
    - Excitement & stress, Steroid &/or xylazine admin.
  - **Excessive 5% dextrose to renal diz patient**

Uncommon causes:

- Water retention (normal circulatory volume)
  - Renal disease (pg 100)
  - Psychogenic polydipsia

Hypernatremia (↑ Na) (IM 450)

Common causes:

- **Water loss**
  - **Water deprivation** (pg 205)
- **Sodium excess** (water restriction/salt poisoning) (pg 205)

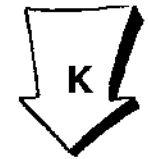
Uncommon causes:

- Water loss >> electrolyte loss
  - Diarrhea (pg 16-23)
  - Vomition
  - Burns
  - Intrinsic renal diz
  - Hypertonic saline or NaCO3 administration
  - Mineralocorticoid excess

Hypokalemia (↓ Potassium) (IM 451)

Common causes:

- **Diarrhea** (pg16-23)
- **Gut torsion/volvulus** (pg 45)
- **Peritonitis** (pg 53)
- **Metabolic alkalosis**
- **Dietary deficiencies**
- **Prolonged anorexia**
- **Vomition**



Uncommon causes:

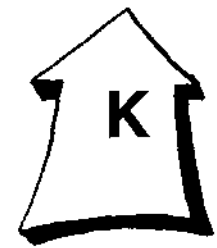
- Renal tubular acidosis
- Diuretics
- Postobstructive diuresis
- Excessive NaCO2 administration
- Excess catecholamines

Hyperkalemia (↑ potassium)

(IM 451; DC 38)

Common causes

- **Hypovolemia w/ renal shutdown**
- **Metabolic acidosis**
- **False hyperkalemia**
  - **In vitro hemolysis**
  - **Prolonged storage**



Uncommon causes

- Renal disease (pg 100)
- Tissue necrosis
- Diabetes mellitus (pg 274)

Hypochloremia (↓ Cl) (IM 452)

Common causes:
- Diarrhea (pg 16-23)
- Blood loss (pg 84)
- Fluid drainage
- Peritonitis (pg 53)
- Ruptured bladder (pg 96)
- Ascites
- Gastric reflux
- Intestinal block

False hypochloremia:
- Hyperglycemia
- Hyperproteinemia
- Hyperlipidemia (pg 91)

Uncommon causes:
- Psychogenic polydipsia

Hypochloremia w/o hyponatremia

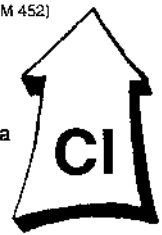
Common causes:
- Metabolic alkalosis
- Abomasal torsion (pg 40)
- Vagal indigestion w/ int. vomiting (pg 29)

Hyperchloremia (↑ Cl) (IM 452)

Common causes
- Water deprivation (pg 205)
- Salt poisoning (pg 205)

Hyperchloremia w/o hypernatremia

Common causes:
- Hyperchloremic metabolic acidosis
- Renal tubular necrosis



Hypophosphatemia (↓ Phosphorus [P]) (IM 455)

Common causes:
- Parturient paresis (pg 148)

Uncommon causes:
- Postparturient hemoglobinuria
- Brassica toxicity
- Hyperparathyroidism
- Starvation

Hyperphosphatemia (↑ Phosphorus[P]) (IM 455)

Common causes:
- Acute renal failure (pg 100)
- Excessive phosphate intake
- Hi normal range in neonates
- Endurance exercise

Uncommon cause:
- Vit D toxicity

Hypomagnesemia (↓ Magnesium) (IM 455)

Common causes:
- **Grass tetany** (pg 146)
- **Winter tetany** (pg 146)
- **Mg defc diet (milk only)** (pg 146)

Hypermagnesemia (↑ Magnesium) (IM 455)

No common cause

Uncommon causes:
- Epson salt overdose (orally or enema)
- Excessive IV Mg

Hypocalcemia (↓ Ca)

Common causes: (IM 454; BR-hb 541; BR 1426)
- Parturient paresis (milk fever) (pg 148)
- Grass tetany (pg 146)
- Fat necrosis (pg 50)
- Anorexia in lactating cattle
- Blister beetle toxicosis (pg 240)
- Acute renal failure (pg 100)

Uncommon causes: (full list IM 399)
- Acute toxemia of anorexic lactating dairy cows
- Hypoparathyroidism

Hypercalcemia (↑ Ca) (IM 454; 1470)

Common causes:
- Excessive, rapid IV calcium

Uncommon causes: (full list IM 400)
- Hypervitaminosis D
  - Excessive supplementation
- Neoplasia praathryroid gland
- Hyperparathyroidism

Metabolic Acidosis (IM 457)

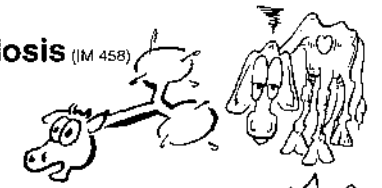
Common causes:
- Rumen overload
- Ketosis (pg 33)
- Pregnancy toxemia (pg 32)
- Acute diarrhea (pg 16-23)
- Abomasal torsion (pg 40)
- Strangulate bowel (pg 45)
- Peritonitis (pg 53)
- Ruptured bladder (pg 96)

Uncommon causes:
- Renal failure (pg 100)
- Renal tubular acidosis
- Ethylene glycol toxicity (pg 209)
- Salicylate toxicity
- Urea toxicity (pg 204)
- Methanol toxicity

Respiratory Acidosis (IM 458)

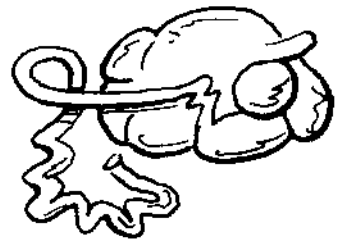
Common causes:
- Obstruction of upper respiratory tract
- Laryngeal edema (pg 60)
- Pneumonia (pg 62)
- Pneumothorax (pg 73)
- Depression of resp. center of CNS
  - General anesthesia
  - Drugs (opiates, anesthetics & tranquilizers)
  - CNS disease

Respiratory Alkalosis (IM 458)



Common causes:
- Hypoxemia
  - Pulmonary disease
  - Severe anemia (pg 82)
  - Congestive heart failure (pg 125)
- Stimulation of CNS respiratory center
  - Neurologic disorders
  - Psychogenic hyperventilation
  - Septicemia
  - Transport, pain, fear, excitement

Metabolic Alkalosis (IM 457)



Common causes:
- Abomasal sequestration of fluid
- Diuretic
- Chloride &/or potassium depletion

Uncommon cause:
- Vomiting

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NOTES

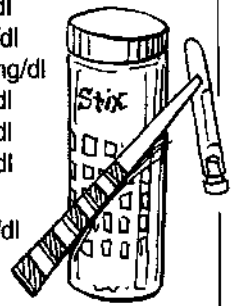
Abbreviations

a., aa.	artery (ies)
abd.	abdomen
abnorm.	abnormal
ABs	antibiotics
bact.	bacterial, bacteria
BID	twice/day
bilat.	bilateral
caud.	caudal
CCS	corticosteroids
CHO	carbohydrate
CN	cranial nerve
conc.	concentrate
cran.	cranial
CS	clinical signs
d(s)	day, days
decr.	decrease
DDx	differential dx
defc	deficiency
dist	distal
diz	disease
DJD	degen. joint diz.
dors.	dorsal
Dx	diagnosis
elev.	elevated
envir.	environment
esp	especially
FB	foreign bodies
Feds	Federal agents
fx(s)	fracture (s)
gen	general
hi	high
hr(s)	hour (s)
HR	heart rate
Hx	history
incr.	increase
IM	intramuscular
IN	intranasal
infec.	infection (ous)
inflam.	inflammation
IP	incubation period
IV	intravascular
lat.	lateral
lb	pound
lg	large
lig, ligg	ligament (s)
LMNs	lower motor neurons
ln, lnn	lymph node(s)
lt.	left
m/	may
m/b	maybe
med.	medial
membr.	membrane
metab.	metabolic
min	minute
MLV	modified live virus
mo (s)	month, months
n, nn	nerve (s)
neg	negative
norm.	normal
PCV	packed cell volume
PM	postmortem
PMNs	neutrophils
pos.	positive
preg.	pregnancy
prblm.	problem
prox.	proximal
Px	prognosis
QID	four times/day
repro.	reproduction
resp.	respiratory
RR	respiratory rate
rt.	right
sm.	small
spec	spectrum
SQ	subcutaneous
supf.	superficial
Sx	surgery
thru.	through
TID	three times/day
TP	total protein
Tx	treatment
UMNs	upper motor neurons
usu.	usually
unilat.	unilateral
vac.	vaccination
ventr.	ventral
v, vv	vein (s)
w/	with
w/i	within
w/o	without
wk(s)	week, weeks
wt.	weight
yr(s)	year, years
$	expensive
#	number

Note: SQ is used instead of SC not to be "cute", but for ease of recognition

Clinical chemistry: normal range

Total bilirubin	0-0.4 mg/dl
Direct recting	0.04-0.4 mg/dl
Indirect reacting	0-0.5 mg/dl
Cholesterol	80-140 mg/dl
Creatinine	0.7-2 mg/dl
Glucose	45-75 mg/dl
Fibrinogen	200-800 mg/dl
Protein	6.3-8.4 g/dl
Albumin	2.5-4.0 g/dl
Globulin	2.9-4.9 g/dl
A/G ratio	0.8-0.95
BUN (Urea nitrogen)	10-18 mg/dl
Enzyme	
ALP (Alkaline phosphatase)	20-550 IU/L
AST, GOT (Aspartate aminotransferase)	40-140 IU/L
CPK (Creatine phosphokinase)	60-250 IU/L
GGT (Gamma-glutamyl transferase)	13-35 IU/L
LDH (Lactate dehydrogenase)	170-870 IU/L
SDH (Sorbitol dehydrogenase)	18-46 IU/L
Electrolyte	
Sodium	132-152 mEq/L
Potassium	3.9-5.8 mEq/L
Chloride	97-111 mEq/L
Calcium	8.6-11.5 mg/dl
Phosphorus	4.3-6.6 mg/dl
Magnesium	1.6-2.9 mg/dl

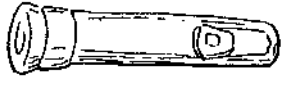


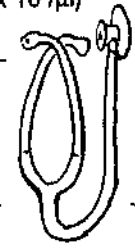
Normal values for RBCs & WBCs

PCV (%) (hematocrit)	24-46%	
RBCs (Erythrocytes)	5-10 x 10^6/µl	
Hgb (Hemoglobin)	8-15 g/dl	
MCV (mean corpuscular vol.)	40-60 fL	
MCH (mean corpuscular Hgb)	11 - 17 pg	
MCHC (mean corpuscular Hgb conc.)	28-34 g/dl	
Reticulocytes	0 %	
Thrombocytes	100,000-800,000	
WBC		4-12 x 10^3/µl
PMNs (Neutrophils)	15-45%	(0.6-4 x 10^3/µl)
Bands	0-2%	(0-.3 x 10^3/µl)
Lymphocytes	45-75%	(2.5-7.5 x 10^3/µl)
Monocytes	2-7%	(0.025-0.85 x 10^3/µl)
Eosinophils	2-20%	(0-2.4 x 10^3/µl)
Basophils	0-2%	(0-0.2 x 10^3/µl)
Neutrophil:lymphocyte (N/L) ratio	0.3-0.6	

Acid-Base (venous blood)

pH	**7.31-7.53**
PCO_2	35-44 mm Hg
HCO_3 (bicarbonate)	17-29 mEq/L
Total CO_2	20-32 mEq/L





Rectal temperature	
Beef	**101°F (38.3 °C)**
Dairy	**101.5 (38.6 °C)**
Heart rate (HR)	**60-70 beats/min**
Resp. rate (RR)	**30 breaths/min**
Urine volume	**17-45 ml/kg BW/d**