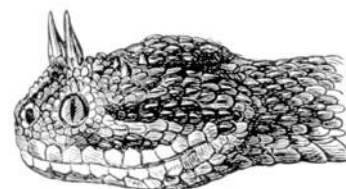


Top 20 Toxicology Review



"I always keep a supply of stimulant handy in case I see a snake.....which I also keep handy. " - WC Fields

The Top 10 (in no particular order....)

1. **Bracken fern** *Pteridium aquilinum* –**THINK** bloody urine cows, ataxic horse
2. **Copper** –**THINK** hemolytic crisis, port wine urine, gunmetal kidneys
3. **Cyanide**—**THINK** Bright red blood, like bright red cherries
4. **Anticoagulant rodenticides**---**THINK** hemolytic crisis
5. **Ethylene glycol** (antifreeze) –**THINK** kidney failure
6. **Insecticides** (esp. OPPs, carbamates) –**THINK** miosis, drool, vomiting, diarrhea, seizure
7. **Lead**---**THINK** GI signs + Neuro Sx (blindness)
8. **NITRATE / NITRITE** Toxicity –**THINK** Dark Chocolate blood
9. **Mycotoxins** Aflatoxins –**THINK** hepatotoxic, carcinogenic
Zearaloxone / moldy corn –**THINK** estrogenism, repro dysfunction
10. **Nonprotein nitrogen** (NPN) 'Ammonia tox' (urea, ammonia, etc) –**THINK** Bov Bonkers

I. Pathognomonics, weird names, weird smells, NOEL

1. **Gunmetal grey kidneys**-Cu tox *Trifolium subterraneum*, cz mineral imbal

Senecio, *Heliotropum* damage liver cz Cu retention

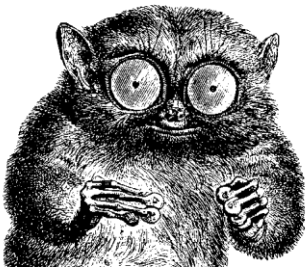
2. **Port wine urine**-Cu tox see above

3. **Cherry-red blood**-Cyanide pitted fruits

4. **Chocolate-brown blood**- Nitrates

5. **"SPECTACLES"** Depigmentation around eyes- molybdenum tox

6. Smells



- a. **Garlicky breath**- selenium tox

- b. **Bitter almonds** in rumen-cyanide

- c. **"Mouse-like odor"** to crushed leaves- *Conium maculatum* (poison hemlock)

7. Diseases

- a. **"Alkali disease"**- selenium toxicity (*Astragalus*, *Oxytropis*)

- b. **"Blind staggers"**-selenium tox

- c. **"Cracker heels"** clicking dewclaws w/ *Astragalus*-miserotoxin

- d. **"Milk sickness"** in early American settlers- *Eupatorium* (white snakeroot)

- e. **"Crooked calf"** syndrome- torticollis, carpal flexure, scoliosis in calves exposed in utero d. 40-70 to *Lupinus* (Lupine, bluebonnet)

- f. **"Limberleg"** posterior ataxia - *Acaia berlandieri* (Guajillo)

- g. **"Walking dz"** – hepatic encephalopathy from pyrrolizidine alkaloid (PA) toxicosis –*Senecio* (tansy ragwort, groundsel), *Crotalaria*

- h. **"Bright blindness"** in sheep- retinal atrophy- *Pteridium* (bracken fern)

- i. **“Peat scours”** or “teart”- liq feces with gas bubbles – Molbdenum
 - j. **“Epidemic hyperthermia”** – Moldy fescue
 - k. **“Black patch”** dz= SLOBBERS moldy red clover slaframine tox
 - l. **“Bovine Bonkers**, Ammonia toxicosis” from Non-prot nitrogen tox
8. **NOEL- “No Effect Level”** how much toxic factor you can take with “no effect”

II. The Top Ten Toxicities (no particular order)

1. Bracken fern *Pteridium aquilinum*

a. Ptaquiloside in all parts of fern

- i. Cattle-, sheep

1) Acute hemorrhagic syndrome

2) Bone marrow depression, bladder tumors

3) “enzootic” HEMATURIA

4) “bright blindness in sheep- retinal atrophy

b. Thiaminase (anti vit B1) activity

- i. **Horses-**
- ii. **Ataxia, incoordination, crouching**
- iii. Also thiaminase in *Equisetum avense* (Horsetails, scouring rush) and *Beta vulgaris* (turnip)
- iv. DDX w/ the PA toxicosis / hepatic encephalopathy of *Crotalaria*, *Senecio* (ragwort)

2. Copper

- a. **SHEEP** (& Bedlington terriers --inher. sensitivity to Cu-- Zn in diet to help?)
- b. Generally builds up in LIVER until stress (transport, lactation, strenuous exercise etc) cause massive release



- c. **HEMOLYTIC** crisis, (+/- GI sx if acute toxicity)
- d. **Swollen GUNMETAL KIDNEYS**
- e. **PORT-WINE** colored urine (hematuria)
- f. Due to primary ingestion- in drenches, improperly mixed rations
- g. **Also Due to PLANTS**
 - i. ***Trifolium subterraneum* -subterranean clover**
 - 1) Cz mineral imbalance- get Cu retention
 - 2) Think estrogenism also ii. ***Senecio* (ragweed),**
Heliotropium – Hepatic damage, get Cu retention

3. Cyanide a. Plant sources

- i. **Pitted fruits Prunus (cherries, peaches, almonds, apricots)**
 - ii. **Pomes (apples, pears)**
 - iii. **Grasses (Johnson grass, Sudan grassSorghums, corn)**
 - iv. **Elderberry *Sambucus***
 - v. **Birdsfoot trefoil, white clover, vetch**
 - vi. **Eucalyptus sp.**
- b. Toxic chemical = **Prussic acid (cyanogenic glycoside)**
- i. Conc in seeds, leaves, bark
 - ii. Young rapidly growing plants highest conc of Toxin
 - iii. Drought, frost, stress incr Toxic conc
 - iv. **Cyanide combines with iron in cytochrome oxidase, preventing release of oxygen to cells.**
- c. **BRIGHT CHERRY-RED BLOOD**
- i. Test rumen contents post mortem, whole blood ante moretem
 - ii. Rx w/ **Na-nitrite and thiosulfate** iii. **“Bitter almond”** smell in rumen

4. Anticoagulant rodenticides

- a. **Mechanism : Antagonize vit. K, which interferes with normal synth of clotting proteins** (factors 1,2,7,9,10- for you clin path dweebs)
- b. **Once existing clotting factors are used up, can't convert prothrombin to thrombin**
- c. Clin Sx- Hemorrhage, INCR prothrombin time
- d. Second-generation brodifacoum (6 day half life), bromadiolone (12-15 day half life) HIGHLY toxic to dogs, cats after only 1 feeding
- e. Rx is **Vit K1**

5. Ethylene glycol

- a. Dogs, cats
- b. Renal tubular epithelial damage due to
- c. Ca-oxalate crystals- Maltese cross, 6-side prism, envelopes)
- d. **Renal failure** sx, crystalluria, Hx
- e. Dog Rx with 4-methyl pyrazole (4-MP)
 - inactivates methyl dehydrogenase, to decr metab of EG
 - Or ethanol if you don't have 4-MP
- f. Cat Rx- 4-MP if early after ingestion-much higher dose 125 mg/kg than dogs, or ETHANOL to competitively inhibit alc dehydrogenase.
- g. Na-bicarb to correct metab acidosis assoc w EG metab

6. Insecticides (esp. OPPs, carbamates)

- a. LABELS CHANGE- ALWAYS READ LABEL
NEWER LABEL ALWAYS SUPERSEDES OLD LABEL
- b. Carbamates
 - i. **Inhibit cholinesterase at nerve junctions, (like OPPs)**
 - ii. Rx w/ atropine +/- new chem.- alloxine, a cholinesterase reactivator

- c. **OPPs** (“thion”, or “phos” often at end of name-ie Coumaphos, malathion)
 - i. Anti -cholinesterase-
 - ii. get **cholinergic (muscarinic) OVERSTIMULATION**
 - iii. Drool, miosis, vom, diarrhea, tremors, szrs (see carbamates, also)
 - iv. Rx w/ cholinesterase RE-activator (**2-PAM**) pralidoxime chloride
 - v. Rx w/ emetic, and **atropine** also

7. Lead

- a. Most comm. in **DOGS, CATTLE**
- b. Acute tox most comm. In **YOUNG** animals
- c. Oil, Old paints, batteries
- d. Think **Gastroenteritis** from caustic lead salts (anorexia, colic, rumen stasis, diarrhea)
- e. Think **NEURO** signs ie: **BLIND cows**, inccordinated
- f. Highest conc of Pb apparently in kidney.
 - Also find in liver, blood (>.4 ppm is too high in blood)
- g. **Basophilic stippling in RBCs** of some species, +/- NRBCs
- h. Rx w/ Ca-EDTA to chelate + thiamine

8. NITRATE / NITRITE Toxicity

- a. *Amaranthus*, *Avena sativa* (oats), *Beta vulgaris* (beets) *Chenopodium album* (lambs quarter), *Sorghum*, *Zea mays* (corn)
- b. Toxin accum in leaves, stalks, **NOT** grain
 - a) **Drought favors** nitrates
 - b) Highest levels **prior to flowering**
 - c) “Silo gasses”- oxides of nitrogen accum during ensiling and may kill livestock
 - d) Nitrite ion (reduced nitrate) oxidizes ferrous iron in hemoglobin to ferric state, forming methemoglobin, which is INCAPABLE of oxygen transport
 - e) **Anoxia** f) **DARK CHOCOLATE-BROWN blood**

g) **Ocular fluids to test for nitrates**

- c. RX: **Methylene blue**, charcoal lavage
- d. Nitrates from fertilizers can contaminate **GROUND** water

9. **Mycotoxins (esp aflatoxins !)** (see also Sorghum/Fescue)

a. Aflatoxins

- i. Think ***Aspergillus*** molds on cereals, esp PEANUTS, SOY, corn
- ii. Toxin= B1, B2, G1, G2 metabolites are **M1**, M2
- iii. **AF toxin B1** metabolized to **M1**, found in **MILK**, urine, tissues
- iv. Think **young growing animals**
- v. Young **POULTRY**, **PIGLETS**, calves, preg sows
- vi. Adult cows, sheep, goats relatively resis to acute dz
- vii. **HEPATOTOXIC**, carcinogenic
- viii. **AFs** pass into **MILK**- ~ 1% of dietary concentration
- ix. **DX “Black light test”- Bright Green-yellow fluorescence in contaminated grain under UV light**
- x. Rx shows promise with **Na-calcium aluminosilicates (HSCAS)** in feed. Decr aflatoxin metabolites in milk of cows on contam feed

b. Ergotism

- i. *Claviceps* mold on grains
- ii. Agalactia
- iii. Periph vasoconstriction, lameness- dry gangrene of extremities

- c. Estrogenism & vulvovaginitis
 - i. Toxin=**Zearlonone** (a resorcyclic acid lactone- RAL)
 - ii. *Fusarium molds* on grains, (corn,oats, barley, wheat), sorghum and silage corn
 - iii. Think **REPRODUCTION dysfunction**-
 - 1) uterine, vulvar hypertrophy, testicular atrophy, nymphomania
 - 2) abortion, freq retn to service, pseudo preg, decr litter size
 - iv. Mostly PIGs and COWs
- d. Facial eczema (pithomycotoxycosis)
 - i. *Pithomyces* fungus on pasture litter
 - ii. Toxin= Sporodesmins
 - iii. Think HEPATIC damage w 2ndary photosens, esp FACIAL
 - iv. Failure to excrete phyloerythrin in bile czs photosensitization
- e. Fescue poisoning (see Fescue)
 - i. *Fusarium and Acermonium* mold fescue
 - ii. In summer, assoc with “Epidemic hyperthermia”
- f. Mycotoxic lupinosis
 - i. *Phomopsis* mold on Lupines
 - ii. Hepatic injury- photosensitization
 - iii. Icterus, copious transudates
- g. Slaframine toxicosis= SLOBBERS
 - i. *Trifolium pretense* (red clover)
 - ii. moldy with *Rhizoctonia leguminicola* (“Black patch” dz)
 - iii. Toxin= Slaframine, swainsonine
 - iv. Profuse salivation
 - v. Rx Atropine

10. Nonprotein nitrogen (NPN) 'Ammonia toxicosis'

(urea, ammonia, etc)

a. Sources

- i. Low prot feedstuffs treated w./ ammonia
- ii. NPN in rations, molasses, blocks
- iii. Fertilizers

b. **CATTLE** are the **MOST** sensitive

c. Toxin= 4-methylimidazole formed by action of NH₃ on sugars

NOTE: blood NH₃ **NOT** thought to cz toxic sx, in spite of the name

d. Toxin chem. Excreted in MILK, can affect calves

e. **High ph in rumen, (≥ 7.5)** in recently dead cow highly suggestive

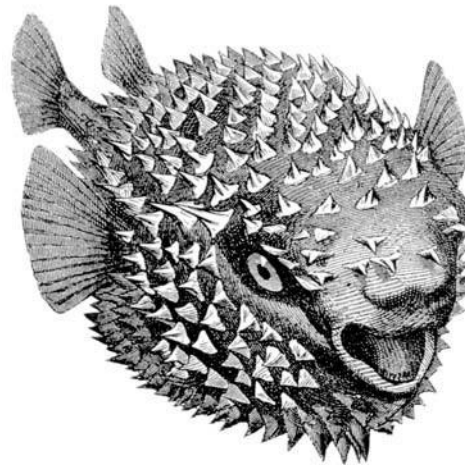
f. **"Bovine Bonkers"** wild agitation, tremors

g. Rx w cold water in rumen, acetic acid

Ten More Toxicities to skim (and a bonus tox....)

“One man's poison Ivy is another man's spinach.”

-George Ade



11. Pyrrolizidine alkaloids

- a. **Senecio** (tansy ragwort, groundsel, *Crotalaria*)
- b. *Amsinckia intermedia* (fiddleneck), *Symphytum* (comfrey)
- c. Flowers most toxic
- d. Sheep resistant
- e. icterus, depression, anorexia
- f. “Walking dz” – due to hepatic encephalopathy
- g. May get secondary hepatog. photosens

12. Mercury

- a. Organic (thermometers) and Inorganic (ie methyl mercury in river silt, fish) fo
- b. Bioaccumulate in BRAIN, kidneys, +/- muscle
- c. Think, CATS who eat contaminated fish
- d. CNS stimulation, cerebellar ataxia, hypermetria
- e. Rx Chelation therapy w/ 2,3 dimercaptosuccinic acid (DMSA) –or-
- f. Or w/ Dimercaprol (BAL- more toxic than DMSA)

13. Molybdenum

- a. Ruminants most vulnerable
- b. Micronutrient assoc w/ Cu- too much Mb= low copper
- c. Usu assoc with alkaline, peat, muck soils, XS fertilizer, or industrial contam
- d. "Peat scours" or "teart"- liq feces with gas bubbles
- e. Unthriftiness
- f. **DECREASED Fertility (so usu supp diet with COPPER)**
- g. **"SPECTACLES" Depigmentation around eyes**

14. Salt toxicity = water deprivation

- a. PIGS most sensitive, sheep most resistant.
- b. Toxin not understood, but Sodium (NA) is etiologic agent
- c. Think NEUROLOGIC pigs, cows

15. Selenium

- a. Think foraging animals- Cows, horses, sheep
- b. Usu from diets high in Se accumulating plants
- c. **"garlicky"** odor on breath
- d. Chronic SE toxicity- 2 types
 - i. **"Alkali Dz"** Lameness, cracked hooves (or claws in pigs)
 - ii. **"Blind staggers"** cows, sheep only

16. Sorghum

- a. ***Fescue arundinacea* (Kentucky 31 tall fescue)**
- b. **Endophytic fungus *Acremonium coenophialum***
- c. Altered peripheral circulation (*Think fungus=fescue)
- d. **Toxin=Fungus makes ergot alkaloids**
- e. "Fescue foot" dry gangrene of extremities
- f. worse in cold weather
- g. also Bovine fat necrosis
- h. also "Summer syndrome" "summer slump" decr production
- i. Sudan grass poisoning-

- i. almost exclusively in HORSES
pyelonephritis, teratogen, abortions from
- ii. Toxic forage NOT moldy

17. Strychnine

- a. Toxin= Indole alkaloid from Indian tree *Strychnos nuxvomica*
- b. Found in pesticides, often dyed RED or GREEN
- c. Competitively inhibits the inhibitory neurotransmitter **glycine**
- d. Sx: Stiff, **TETANIC**, seizures
- e. **Death by ASPHYXIATION**
- f. Rx with pentobarb for szrs, emesis, charcoal

18. Sweet clover-

- a. **Hemolytic probs** from moldy clover
- b. *Melilotus officinalis*, *M. alba* (sweetclover)
- c. **Molds** metabolize coumarin glycosides in clovers that are improperly cured for hay or silage
- d. **Form toxic DICOUMAROL-interferes w/ clotting, vit. K**
- e. **Cattle**
- f. **Rx w/ vit K-1**

19. Algae (blue-green)

- a. ***Microcystis aeruginosa* (Blue-green algae=cyanobacteria)** and others
 - i. Toxin=Neurotoxic alkaloids-Anatoxins,
 - ii. Toxin= Hepatotoxic saxitoxins
 - iii. Blooms on ponds
 - iv. Monogastrics less sensitive
 - v. Animals that survive acute tox may get secondary photosens
 - vi. *Clostridium botulinum* may use algae as growth medium
- b. Rx pond w/ CuSO4 or other algicides

20. Arsenic

- a. Inorganic
 - i. Pesticides, ant baits, wood preservative. Less use today
 - ii. GI tract, Cardiovascular effects
 - iii. Test stomach contents
 - iv. Rx with DSMA (Disodium methanearsenate) and DMPS
- b. Organic Arsenicals
 - i. Less toxic than inorganics
 - ii. Aliphatics- old time stimulant, not comm. Now
 - iii. Aromatics- Thiocetarsamide- old heartworm RX- not comm. Today
 - iv. Phenylarsonics- **feed additives poultry, PIGS**
 - v. **Demyelinating NEURO dz**
 - vi. Posterior paresis-quadruplegia, BLIND
 - vii. But alert, w good appetite

21. Fluoride

- a. Fertilizers, mineral supplements, gasses, dust from nearby steel, aluminum manufacturing
- b. Fluoride has high affinity for calcium & replaces hydroxyl groups in bone
- c. Bones, teeth, become brittle, weak
 - i. Lameness, exostoses,
 - ii. Mottled teeth if exposed while teeth growing



I. Tomato
(*Lycopersicon esculentum*).

“Part of the secret of success in life is to eat what you like

and let the food fight it out inside.”

- Mark Twain

III. Plant toxicities organized by system affected (key plants in **BOLD**)

1. Neurotoxicants

b. Seizures/ Incr CNS activity

1. *Asclepias* (milkweed)-also has cardiac glycosides
2. *Cicuta maculata* (water hemlock) resem strychnine sx.
3. *Dicentra culcullaria* (Dutchman's breeches)

c. Incoordination, bizarre behavior

1. **Astragalus** (Locoweed)

- a) Miserotoxin-“Cracker heels” clicking dewclaws
- b) Swainsonine-neuro sx, repro-abortions, “contracted tendon”
- c) Selenium accumulation w/ some sp.- “alkali dz”, blind staggers

d. CNS depressants

1. ***Eupatorium rugosum* (white snakeroot)**

- a) Toxin=Trematol toxin passed in milk,
- b) “milk sickness” in early American settlers
- c) Cardiac effects(congestive heart failure) also

e. Anticholinergics (Dry, big eye)

- 1. *Atropa belladonna* (deadly nightshade) *Solanaceae*-nightshade family
 - a) Toxin is atropine
- 2. *Datura stramonium* (Jimson weed, angel's trumpet)
- 3. *Solanum tuberosum*, (potato) *S. nigrum* (black nightshade)

f. Anticholinesterase effects

- 1. *Solanaceae*-nightshade family
- 2. Including (*Lycopersicon sp.* –tomato, *Physalis sp.* groundcherry, and *Solanum sp.*)

g. Neuromuscular (nicotinic) effects

- 1. ***Conium maculatum* (poison hemlock)**
 - a) Toxin=Coniine-pyridine-type alkaloids
 - b) rapidly dead
 - c) Teratogenic- crooked limbs, tails, cleft palates
 - d) “Mouse-like odor” to crushed leaves
 - e) Younger plants more toxic
- 2. *Delphinium* (Larkspur)
- 3. ***Lupinus* (Lupine, bluebonnet)**- Think neuro sheep, crooked calves
 - a) NeuroToxin=- Quinolizidine alkaloid
 - b) ReproToxin=-Anagyrine alkaloid causes
“Crooked calf” syndrome- torticollis, carpal flexure, scoliosis
in calves exposed in utero d. 40-70

h. Weakness/paralysis

1. *Sorghum* (Sorghum, Sudan grass, Milo, Johnson grass)

- a) Toxin=*B*-cyano alanine
- b) **Equine sorghum cystitis-ataxia syndrome**
 - i Urine dribbling, open/close vulva
 - ii cystitis

2. *Cassia* (Coffee senna, sicklepod)

- a) Muscle necrosis, myoglobinuria, incr AST

2. Gastrointestinal toxicants - many, including

- a. Ranunculus (buttercup)
- b. Ricinus (Castor bean) ricin, 1 seed kills a medium sized dog
- c. Urtica (stinging nettle)
- d. Brassica (mustards)

3. Hepatotoxic

- a. Primary hepatic damage

1. *Microcystis aeruginosa* (Blue-green algae) and others

- a) Toxin=Anatoxins, saxitoxins
- b) Blooms on ponds
- c) Monogastrics less sensitive
- d) Animals that survive acute tox may get secondary photosens
- e) *Clostridium botulinum* may use algae as growth medium
- f) Rx pond w/ CuSO₄ or other algicides

2. *Amanita phalloides* (Death angel, deadly amanita mushroom)

b. Secondary hepatotoxic Pyrrolizidine alkaloid (PA) toxicosis

***Senecio* (tansy ragwort, groundsel)**

Crotalaria

Amsinckia intermedia (fiddleneck), *Symphytum* (comfrey)

1. Flowers most toxic
2. Sheep resistant
3. icterus, depression, anorexia
4. "Walking dz" – due to hepatic encephalopathy
5. May get secondary hepatogenous photosens

c. Secondary (hepatogenous) photosensitization

1. *Agave lechiguilla* (agave)
2. *Lantana camara* (lantana)
3. *Tetradymia glabrata* (horshbrush) others

4. Nephrotoxic

a. Oxalate toxicosis

***Chenopodium album* (Lamb's quarters)**

***Beta vulgaris* (Beets) *Rheum rhaponticum* (rhubarb)**

1. Toxin=Soluble oxalates complex w/ serum calcium, make Ca-oxalate
2. Hypocalcemia
3. Ca-oxalates damages renal tubules

b. Cholecalciferol (vitamin D) toxicity

***Cestrum diurnum* (day/night-blooming jessamine)**

***Trisetum flavescens* (golden oats, yellow oat grass)**

Solanum malacoxylon (Hawaii, S. America)

1. "Enzootic calcinosis" (also caused by soil mineral imbalances)
2. Toxin= 1,25 dihydroxycholecalciferol (calcitriol)
3. hypercalcemia, calcinosis (esp forelimbs)
4. Stiff gait, calcification soft tissue, esp heart, aorta, pleura

c. Kidney failure

1. ***Amaranthus retroflexus* (redroot pigweed)**

- a) Nephrosis-causing toxin unknown
- b) Though plants accum oxalates and nitrates also

2. *Lillium* (lilies), *Hemerocallis* (Daylily)

d. *Quercus* (Oak) poisoning

- 1. Oak buds, acorns, esp sprouted acorns
- 2. Cows, primarily
- 3. Toxin=Gallotannin
- 4. Rx w/ ration of 10-15% Ca-oxide in grain: aids precip of oak tannins

5. Cardiotoxic

a. Digitalis glycoside poisoning

***Digitalis purpurea* (foxglove)**

***Nerium oleander* (oleander)**

***Convallaria majalis* (Lily of the valley)**

***Apocynum* (dogbane)**

Digitalis-like

Aconitum (monkshood, ranunculaceae-buttercup family,)

Asclepias (milkweed)

- 1. GI signs,
- 2. Bradycardia, conduction block

b. Misc cardiac

1. ***Taxus cuspidata*** (Japanese yew), ***T. baccata*** (English yew)

- a) Toxin=Taxine alkaloids A & B
- b) Highly toxic to herbivores- whole plant except for fruit
- c) Bradycardia, block
- d) Atropine if indicated, charcoal

2. *Zygdenus* (death camus)

c. Altered peripheral circulation (*Think fungus, fescue and walnuts)

1. ***Fescue arundinacea* (Kentucky 31 tall fescue)**

a) Endophytic fungus *Acremonium coenophilialum*

b) Toxin=Fungus makes ergot alkaloids

c) "Fescue foot" dry gangrene of extremities, worse in cold weather

d) Bovine fat necrosis

e) "Summer syndrome" "summer slump" decr production

2. *Juglans nigra* (Black walnut)

a) Laminitis in horses

b) walnut shavings, sawdust sometimes used as bedding

d. Andromedotoxicosis

Kalmia (Laurel, Lambkill, calf kill)

Rhododendron, Azalea

Pieris japonica

1. Toxin=Andromedotoxins in flowers, nectar and honey from these

2. Effects similar to digitalis

3. Atropine w/ bradycardia

4. Isopratnenol or Na channel blockers (ie: quinidine) w hrt block

6. Pulmonary toxicoses

Brassica (Rape, canola)

Ipomea batata (sweet potato)

Perilla frutescens (purple mint, beefsteak plant)

a. Mixed function oxidases (MFOs) appear to activate plant furans

b. Causing lung damage

7. Blood toxicants

- a. Hematopoietic depression *Pteridium aquilinum* (bracken fern)
 - 1. Ptaquiloside in all parts of fern
 - 2. Cattle- Bone marrow depression, bladder tumors
 - 3. Horses- Thiaminase(anti vit B) activity- ataxia
- b. Hemolysis
 - 1. *Acer rubrum* (red maple) Heinz bodies
 - 2. *Allium* (onions) (Toxin=N-propyl disulfide)
 - 3. *Brassica* (Canola, rapeseed)
 - a) S-methyl cysteine sulfoxide reduced to dimethyl disulfide
 - b) Oxidizes hemoglobin-Heinz body anemia
- c. Hemorrhage
 - 1. *Melilotus officinalis*, *M. alba* (sweetclover)
 - 2. **Molds** metabolize coumarin glycosides in clovers that are improperly cured for hay or silage
 - 3. **Form toxic DICOUMAROL-interferes w/ clotting, vit. K**
 - 4. **Cattle**
 - 5. **Rx w/ vit K-1**
- d. Methhemoglobinemia
 - 1. **NITRATE TOXICITY**—See notes above in “Top Ten”
 - Amaranthus*, *Avena sativa* (oats), *Beta vulgaris* (beets)
 - Chenopodium album* (lambs quarter), *Sorghum*, *Zea mays* (corn)
 - a) Dark **chocolate-brown** blood
 - b) RX: **Methylene blue**, charcoal lavage

- e. **Cyanide**—See notes above in “Top Ten”
- Pitted fruits *Prunus* (cherries, peaches, almonds, apricots)
 - Pomes (apples, pears)
 - Grasses (Johnson grass, Sorghums, corn)
 - Elderberry *Sambucus*
 - Birdsfoot trefoil, white clover, vetch *Eucalyptus* sp.

1. BRIGHT CHERRY-RED BLOOD

2. Rx w Na-nitrite and thiosulfate

3. “Bitter almond” smell in rumen

8. Skin/ Photosensitization (See hepatic #3)

- a. *Fagopyrum* (buckwheat) and *Hypericum* (St John’s wort)

9. Reproduction

- a. Abortion

1. *Astragalus* - + “contracted tendon”
2. *Pinus ponderosa* (ponderosa pine) *P. taeda* (Loblolly pine)

- b. Estrogenism *Trifolium repens* (subterranean clover)

- c. Agalactia: *Festuca* (Fescue) infected with *Claviceps* (ergot) fungus d. Teratogens

1. *Veratrum* (false hellebore) Cyclops
2. *Nicotiana tabacum* (tobacco) Arhrogryphosis, twisted limbs
3. *Lupinus* (Lupine) “crooked calf”
4. *Conium maculatum* (poison hemlock) Arhrogryphosis
5. *Astragalus* (locoweed) Arhrogryphosi, “contracted tendon

9. OTHER TOXICOSES

- a. Cantharidan (blister beetles in forage)
- b. Chocolate (Toxin=theobromine) highest in unsweetened baker’s choc
- c. Coal Tar poisoning (clay pigeons, creosote etc) Toxin= phenols

- d. Gossypol pigment in cottonseed meal (hi protein) (green yolks!)
- e. **PCBs, DIOXINS** halogenated cyclic hydrocarbons- transformers
 - i. **BIOACCUMULATE** in fats- takes YEARS to excrete
 - ii. **Many bac effects-teratogens, carcinogens imm supp**
- f. Volatile petroleum prod- gas, kerosene, diesel- Aspiration danger if vom
- g. ANNUAL “Ryegrass staggers” bacteria-infected nematode in galls in grass
- h. Perennial Ryegrass staggers - moldy summer ryegrass
- i. **BONUS Toad poisoning** Toxin= Bufagins digitalis effects,
 - i. *Rhinella marina* (formerly *Bufo marinus*, “giant” or “marine” toad)
 - ii. In Australia, Brazil, called a “Cane toad”
 - iii. Toxic partly because it is so big
 - iv. An introduced species of toad now in Florida, Hawaii, Texas
 - v. 20-100% mortality in untreated dogs
 - vi. Also toxic: Colorado River toad, *Incillius* (formerly *Bufo*) *alvarius*,
 - vii. SW USA & northern Mexico-big enough to be potentially lethal



The large size of this *Rhinella marina* marine toad contributes to its' toxic potential

Image courtesy, [Bernard Dupont](#)

“The clever men at Oxford,
Know all that there is to be knowed.
But they none of them know one half as much as intelligent Mr Toad.”

-Kenneth Grahame (author, The Wind in the Willows”)