

## Top 20 Toxicology Review

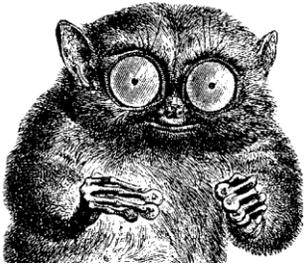
“I always keep a supply of stimulant handy in case I see a snake.....which I also keep handy. “ - WC Fields

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  
Zearalonone / 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 tetention*
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- molybdenul 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

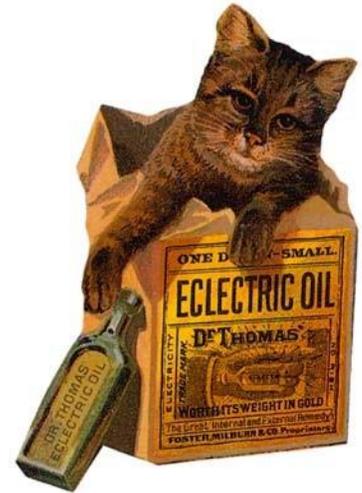
- i. Cattle-, sheep

**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 grass Sorghums, 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 (lamb's 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 flouresence 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 (pithomycotoxicosis)
  - 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'

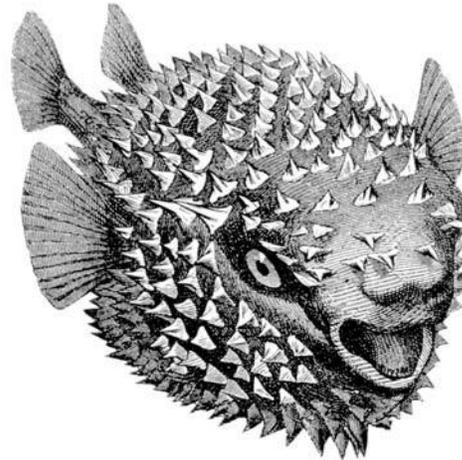
(urea, ammonia, etc)

- 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 NH<sub>3</sub> on sugars  
NOTE: blood **NH<sub>3</sub> 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, ( $\geq 7.5$ )** 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/ CuSO<sub>4</sub> or other algicides

## 20. Arsenic

- a. Inorganic
  - i. Pesticides, ant baits, wood preservative. Less use today
  - ii. GI tract, Cardiovasc effects
  - iii. Test stomach contents
  - iv. Rx with DSMA (Disodium methanearsenate) and DMPS
- b. Organic Arsenicals
  - i. Less tox than inorganics
  - ii. Aliphatics- old time stimulant, not comm. Now
  - iii. Aromatics- Thiacetarsemide- 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 supps, gasses, dust from nearby steel, aluminum manuf
- b. FL has High affinity for calcium & replaces hydroxyl grps 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=Trematrol 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/ CuSO<sub>4</sub> 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 flaviscens* (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), *Hemerocallus* (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 coenophialum***

b) Toxin=Fungus makes ergotine 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. Isopratenol 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. Methemoglobinemia
  - 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 bad 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, *Incillus* (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”)