Poisonous Plants

ACMT Board Review Course
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Plants

• Natural Products: 5% of tox boards
  – Includes food and marine poisonings, herbals, plants, fungi, toxic envenomations
• ~5% of exposures reported to PCC each year, most in children < 6 years
  – Often a few deaths per year, but most reported exposures minor
Plant Poisoning by Organ System

- GI toxins
- CNS toxins
- Cardiovascular toxins
- Multiorgan-system toxins
- Hepatotoxins
- Nephrotoxins
- Endocrine toxins
- Dermal and mucous membrane irritants

Lots of calls / Little threat

- *Euphorbia pulcherrima* – Poinsettia
- *Ilex spp* – Holly
- *Phoradendron spp* – Mistletoe
- *Lantana spp*
- *Spathiphyllum spp* – Peace lily

- Ingestion of this plant may produce severe vomiting and diarrhea. Purple stains on fingers and a foamy quality to the diarrhea may provide a clue to the species of plant.

  Pokeweed
  AKA
  *Phytolacca americana*
**Phytolacca americana**

- Edible if parboiled
- Root is the most toxic part, mature berries least toxic
- Contains pokeweed mitogen
  - May see plasmacytosis
- Supportive care

**Solanum spp**

- 1700 species; nightshade, potato
- Poisoning usually from ingestion of immature fruit
- Solanine glycoalkaloids
  - Usually produce GI irritant effects
  - Hallucinations and coma
Chinaberry

- Tree grows to 50 feet
- Native to Asia, grows in US
- Fruit are green berries that turn yellow and remain after leaves shed
- Fruit and bark poisonous
- Vomiting and diarrhea
- Care supportive

CNS Toxins

- Anticholinergic plants
- Nicotinic alkaloid - containing plants
- Hallucinogenic
- Sympathomimetic
- Epileptogenic

2 adolescent males eat these seeds

2 hours later, they are found stumbling, incoherent and their pupils look “blown”

In ED they are combative and hallucinating, have >8mm pupils, and are tachycardic in the 130s.
Datura spp

- Along roadsides, pastures, waste areas
- Leaves are long and lobed, with large white funnel-shaped flowers, entire plant toxic
- Seed pods = spiny capsules with 50-100 seeds
- Toxin = atropine, scopolamine, hyoscyamine
- Symptoms begin 30-60 minutes after ingestion and continue 24-48 hours
What is this plant?

Angel’s Trumpet

*Brugmansia* spp

Other anticholinergic plants to know...

- *Atropa belladonna*: Deadly Nightshade
- *Mandragora officinarum*: Mandrake
- *Hyocyamus niger*: Henbane
- Anticholinergic plants
  - Contain tropane (belladonna) alkaloids
    - atropine, hyoscyamine, scopolamine
  - Inhibit postsynaptic muscarinic receptors
    - Produce anticholinergic syndrome
    - Physostigmine will reverse
• After ingesting a tea made of the leaves of this plant a patient developed tachycardia, vomiting and diarrhea, salivation, agitation, and convulsions

Tobacco Plants
• Small plants, shrubs, or trees
• Broad green leaves, tubular flowers
• Pyridine-piperidine alkaloids
• Ingestion, dermal absorption, inhalation
  – nicotinic syndrome (blockade of nicotinic acetylcholine receptors)
• Harvesting wet leaves: green tobacco sickness
• 1 cigarette or 3 butts toxic in a child

Plant / Toxin
• *N* *tabacum* (commercial tobacco)
  – Nicotine
• *N* *glauca* (wild tree tobacco)
  – Anabasine
• *N* *trigonophylla* (desert tobacco)
  – Nicotine and anabasine
• *Lobelia inflata* (Indian tobacco)
  – Lobeline

Urinary metabolite of nicotine: cotinine
Plants

**Commercial tobacco** *Nicotiana tabaccum*

**Tree tobacco** *Nicotiana glauca*

Photos: wikipedia.com

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**Plant:** Conium maculatum  
**Toxin:** coniine

- A woman ate stems and roots from this plant. An hour later she developed vomiting and in the ED seized.

*purple spots*

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- Family Umbelliferae  
- Along roads and ditches and in wooded areas  
- Mistaken for wild carrots  
- Stems and leaves may be purple-spotted  
- Root most toxic part of plant
Betel Nut -

- 'Quid' chewed in Far East, Asia, India, South Pacific
  - Areca nut, betel leaf, lime paste, leaf tobacco
- Toxin:
  - Nicotinic, muscarinic
- Users have red-stained oral mucosa and saliva, dark-stained teeth

Mescal Bean Bush, AKA Texas Mountain Laurel

Shrub with purple flowers, woody pods with bright red seeds

Contains:
Others with nicotinic alkaloids

- Laburnum anagyroides  
  - Golden chain tree
  - cytisine

- Caulophyllum thalictroides  
  - Blue cohosh (herb)
  - N-methylcytisine in seeds, roots

Hallucinogenic Plants

Toxin: ergine
Lysergic acid amide
10% potency of LSD

Ipomoea violacea - Morning Glory

Hawaiian Baby Woodrose

Clinically, similar to LSD
- euphoria, distortions of perception, hallucinations, panic, nausea and vomiting
**Plants**

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**Myristica fragrans**

* Nutmeg

- This common household spice must be taken in large doses to produce hallucinations
- Toxin:
  - metabolized to amphetamine-like compounds
  - produce a variety of CNS effects (stimulation to depression)

**Claviceps purpurea**

- Fungus that infects rye, other grains
- The toxins are indole derivatives
- Ingestion may produce ergotism (gangrenous or CNS, with hallucinations)

**Peyote - Lophophora williamsii**

- This cactus will make you vomit before you hallucinate
- structurally similar to hallucinogen amphetamines
- pharmacologically similar to hallucinogenic indoles
- emetic, hallucinogen, stimulant
Sympathomimetic

- The leaves of this plant are chewed in East Africa for stimulant effects
- Plant: Khat; Catha edulis
- Toxin: cathinone
  - Structurally similar to amphetamines
  - Indirect sympathomimetic

Convulsant Plants

- Believing this to be a wild carrot, a man ingests a few bites from the root and within 30 min develops vomiting followed by seizures

Cicuta maculata

Toxin: HOCH₂(CH₂)₂(C≡C)₂(CH=CH)₃-CHCH₂CH₂CH₃

A complex aliphatic alcohol

Water Hemlock

Cicuta maculata
**Water Hemlock**

- Umbelliferae family
- Grows to 6 feet, compound leaves, small white flowers, chambered tuberous roots
- Roots have a parsnip or carrot-like odor, and highest concentration of toxin
- Rapid onset GI effects and seizures

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**This plant toxin antagonizes the glycine receptor, resulting in hyperreflexia and muscle spasms**

Treatment is benzos, barbs, paralysis, intubation

*Strychnos nux vomica*

*Strychnine*

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**Cardiovascular**

- Plant cardiac glycosides
  - Inhibit Na-K-ATPase
  - Clinically identical to digoxin toxicity
  - Cross react with digoxin assay but levels do not correlate with toxicity
  - Require higher doses dig Fab
- Sodium channel openers
- Sodium channel blockers
Plants

**Cardiac Glycosides**

- Foxglove – Digitalis lanata, D purpurea – Digitoxin
  - Purple, pink, white, yellow
  - Grows to about 3 feet
  - Whole plant toxic

**Cardiac Glycosides**

- Common oleander – Nerium oleander – Oleandrin

**Cardiac Glycosides**

- Lily of the valley – Convallaria majalis – convallotoxin, convallarin

**Cardiac Glycosides**

- Yellow oleander – Thevetia peruviana – Thevetin – AKA Lucky Nut
  - Common method of suicide in Sri Lanka
Cardiac Glycosides

- Red squill
  - Urginea maritima
  - Scillaren
- Rodenticide

Christmas rose
- Helleborus niger
- AKA Hellebore

Grayanotoxins
- Rhododendron
  - Azaleas
  - Mountain Laurels
- Zigadenus spp
- Veratrum spp

Veratrum Alkaloids
- Zigadenus spp
- Veratrum spp

Aconite alkaloids
- Monkshood, Wolfsbane
- Aconite

Rhododendron spp

- Rhododendrons and Azaleas
- Leaves toxic
- Poisoning has resulted from ingestion of grayanotoxin-contaminated honey
  - reported in Turkey
  - 'mad honey'
  - AKA andromedotoxin

Sodium Channel Openers
Veratrum Alkaloids

- **False hellebore**
  - Veratridine, germidine
- **Death camus**
  - Zygacine, zygadenine
- Mistaken for wild onions
- Toxicity has occurred from sneezing powders made from pulverized roots of Veratrum spp

Aconite

- Found in some herbals
- All plant parts contain aconitine
- All of the Na channel activators produce:
  - salivation, emesis, hypotension, bradycardia, arrhythmias, paresthesias, weakness
  - Effects 30 min to 6 hours following ingestion and persist several days
- Aconite also known for:

The Yew

- Flat, needle-like leaves with black seeds surrounded by a (nontoxic) red aril
- Effects: N/V/D, arrhythmias, wide QRS

What is the primary toxin?

How does this toxin act?
Multi-organ system toxins

- Cyanogenic glycosides
- Toxalbumins
- Mitotic Inhibitors

A woman ingested a bag of apricot kernals she purchased at a health food store. About 50 min later she was comatose and acidotic.

To what toxin was she exposed?

Cyanogenic Glycosides

- *Prunus spp*
  - cherries, peaches, plums, apricots
  - Laetrile
- *Malus spp*
  - apples
- Cassava
Cyanogenic Glycosides

- Amygdalin - found in kernals and seeds
- Hydrolyzed to hydrocyanic acid by beta-glucosidase (amygdalase)
- Cyanide toxicity results
  - Clinically similar to other CN poisoning except delayed onset due to metabolism of amygdalin
- Treated with cyanide antidote

Cassava

- Roots contain high concentration of the cyanogenic glycoside linamarin
- Normally soak the roots to remove toxin
- During droughts roots not soaked

*Manihot esculenta*

Chronic ingestion of Cassava may lead to...

Konzo
- Tropical Spastic Paraparesis
- Tropical Ataxic Neuropathy

- An upper motor neuron disease
- Paresthesias, sensory ataxia, optic atrophy, sensorineural hearing loss
Chickling pea

- *Lathyrus sativa*
  - AKA grass pea, sweet pea
- Contains: BOAA
  - Beta-N-oxalylamino-L-alanine
- Mechanism: AMPA glutamate receptor agonist, leads to degeneration of receptors
- Poisoning occurs when this is main diet
- Clinical: neurolathyrism, indistinguishable from cassava-induced spastic paraparesis

Toxalbumins

- These plants contain toxins that bind the 60s ribosomal subunit, inhibit RNA polymerase: Inhibit protein synthesis
- Mild symptoms: diarrhea
- Severe: vomiting, diarrhea, abdominal pain, hypovolemia, hypokalemia, hepatorenal dysfunction, hyperthermia, seizures

Castor Bean - *Ricinus communis*
**Castor Bean**

- Large leafy plant with brown capsules containing three shiny, hard-coated seeds
- Source of castor oil; toxin: ricin
- Whole swallowed seeds not toxic
- Toxic if chewed
- Pure ricin injected IV much more toxic than ingested ricin

**Toxin:**

AKA rosary pea

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**Other toxalbumin-containing plants**

- *Jatropha spp*
  - Physic Nut
  - Contains: curcin
- *Phoradendron spp*
  - American mistletoe
  - Contains: phoratoxin
- *Robinia spp*
  - Black locust
  - Contains: robin
Anti-mitotic toxins
inhibit microtubule assembly (metaphase arrest)
• Colchicine
  – *Colchicum spp*
    • Autumn crocus, meadow saffron
  – *Gloriosa superba*
    • Glory lily
• Clinically: severe GI sx and leukocytosis; then bone marrow suppression, alopecia, peripheral neuropathy

Anti-mitotics
• *Podophyllum spp*
  – Mayapple
    • Traditional Chinese herbal remedy
    • Podophyllotoxin
• Clinical: similar to colchicine, with GI effects followed by bone marrow suppression and peripheral neuropathy
  – Early CNS depression, no alopecia

Endocrine
Grows in West Africa, West Indies, Central America, Florida

Which is toxic?
‘Jamaican vomiting sickness’

- Cases have occurred from canned fruit
- Hypoglycin A
  - Inhibits beta-oxidation of fatty acids and gluconeogenesis
  - Metabolized to methylene-cyclopropyl acetic acid (MCPA), inhibits carnitine-acyl CoA transferase
- Microvesicular steatosis, hypoglycemia, vomiting, seizures, death

Excessive ingestion may produce a hypermineralocorticoid syndrome

- HTN, hypokalemia, edema, metabolic acidosis, weakness, muscle cramps

inhibits 11β-hydroxysteroid dehydrogenase; can’t convert cortisol to cortisone

Hepatotoxins

- Pyrrolizidine alkaloids
  - Crotalaria spp
  - Heliotropium spp
  - Symphytum spp (Comfrey)
  - Senecio spp
- Can cause hepatitis and hepatic venoocclusive disease
**Plants**

**Rhubarb**
- Edible leaf stalk but raw leaf blades are toxic
- Contain 1% soluble oxalates
  - Also anthraquinone glycosides that may cause GI distress
- Rare renal dysfunction may occur

**Dermal and Mucous Membrane Irritants**
- Mechanical
- Chemical
- Allergic
- Phototoxic

![Stinging nettles](Urtica_dioica.png)
- Toxin: Calcium oxalate

**Mechanical and Chemical**
- Common call to PCC when children chew on leaves and develop local pain
- Toxin:
Calcium oxalate crystals are packaged in raphides, arranged in bundles called idioblasts.

When bite on leaf, idioblasts fire, depositing proteolytic enzymes with the raphides.

Results in pain and swelling.

Potential for life-threatening airway obstruction.

Other calcium oxalate containing plants:

**Philodendron spp**

**Caladium spp**

**Spathiphyllum spp**
**Capsicum annum**  
Chili pepper  
- Capsaicin, in spices and pepper spray  
- Irritating to mucous membranes  
- May act through depletion of substance P from nerve terminals  
- Large oral exposure may cause gastroenteritis

**Toxicodendron spp**  
poison ivy, poison oak, poison sumac  
Clusters of three leaflets, green and waxy appearing  
Oily resin - toxicodendrol, contains urushiol  
Contact dermatitis in susceptible people  
Resin under fingernails can continue to produce dermatitis if not removed

**Allergic Plant Dermatitis**  
- Type IV hypersensitivity  
- Treatments: soap and water; steroids, antihistamines  
- Other plants  
  - Ginkgo, mango, pistachio, cashew
Photodermatitis

- Psoralen in celery
  - Grocery workers
- Photodermatitis
  - Allergen via dermal exposure or ingestion
    - Activated by light to produce rash

Major Summary Points

- Too many –
- Suggested reading