Special Acknowledgement

• Thanks to Michelle Ruha and other previous presenters for their efforts on this topic.
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
Toxin:

Chinaberry

Melia azedarach

Toxin: melatoxins
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
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
leaves offset at stem
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
Commercial tobacco

Nicotiana tabaccum

Tree tobacco

Nicotiana glauca

Photos: wikipedia.com
A woman ate stems and roots from this plant. An hour later she developed vomiting and in the ED seized.
• 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

Latin: *Sophora secundiflora*

Contains:
Others with nicotinic alkaloids

- *Laburnum anagyroides*
  - Golden chain tree
- *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
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

**The toxin:**

![Chemical structure of mescaline]
Sympathomimetic

• The leaves of this plant are chewed in East Africa for stimulant effects

• Plant: Catha edulis

• Toxin: cathinone – Structurally similar to amphetamines – Indirect sympathomimetic
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:**

A complex aliphatic alcohol

\[
\text{HOCH}_2\text{(CH}_2\text{)}_2\text{-}{(\text{C}≡\text{C})}_2\text{-}{(\text{CH}=\text{CH})}_3\text{-CHCH}_2\text{CH}_2\text{CH}_3
\]

**Cicuta maculata**

Water Hemlock
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
This plant toxin antagonizes the glycine receptor, resulting in hyperreflexia and muscle spasms.

Treatment is benzos, barbs, paralysis, intubation.

*Strychnos nux vomica*

*Strychnine*
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
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
- 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

wikipedia
• Grayanotoxins
  – *Rhododendron*
  – *Azaleas*
  – *Mountain Laurels*

• Veratrum Alkaloids
  – *Zigadenus spp*
  – *Veratrum spp*

• Aconitine 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
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:
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?

– Amygdalin
– A cyanogenic glycoside
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 \textit{linamarin}.
- Normally soak the roots to remove toxin.
- During droughts roots not soaked.

\textit{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
Jequirity Bean – Abrus precatorius

Toxin: Abrin

AKA rosary pea
Other toxalbumin-containing plants

- **Jatropha spp**
  - Physic Nut
  - Contains: curcin
- **Phordendron 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
Blighia sapida

Which is toxic?

Endocrine

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

Unripe fruit contains: Hypoglycin A

Endocrine
‘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

Glycyrrhiza spp
Licorice Root

Glycyrrhizic acid 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
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*
Mechanical and Chemical

- Common call to PCC when children chew on leaves and develop local pain

- Toxin: Calcium oxalate
• 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*
Irritant contact dermatitis caused by needle-like calcium oxalate crystals, raphides, in Agave tequilana among workers in tequila distilleries and agave plantations.

Salinas ML, Ogura T, Soffichi L.

Departamento de Química, Universidad Autonoma de Guadalajara, Jal, Mexico.

It was found that needle-like calcium oxalate crystals, raphides, are found abundantly in all tissues of Agave tequilana plants; thus, 1 droplet (0.03 ml) of juice pressed from leaves contains 100-150 crystals, 30-500 microm in length, sharpened at both ends. In tequila distilleries, 5/6 of the workers who handle the agave stems have experienced the characteristic irritation. In contrast, only 1/3 of workers in agave plantations who harvest agave plants, complain of the irritation. It is confirmed that all the irritation suffered in both distilleries and plantations takes place at bodily locations where the plants come in contact with the worker's skin in the course of their work.

PMID: 11205412 [PubMed - indexed for MEDLINE]
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