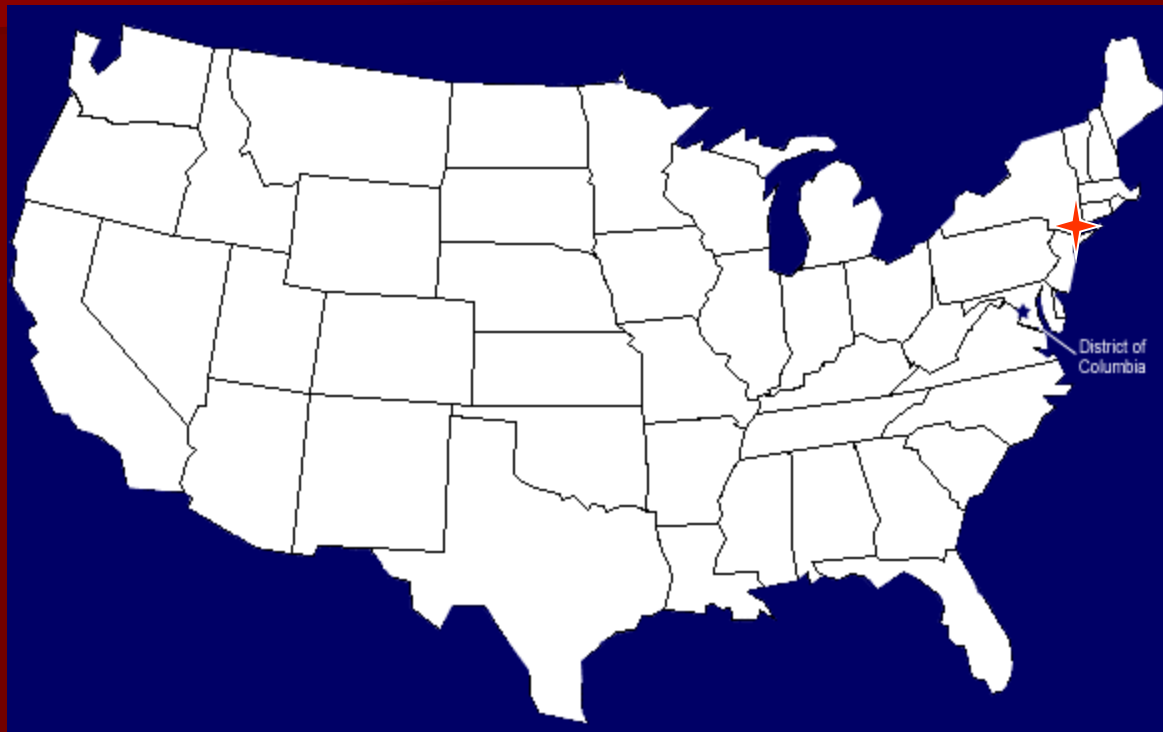


A grey donkey is harnessed to a black metal cart with two large spoked wheels. The donkey is standing in a grassy field with a line of trees in the background. The cart has a blue seat and a black frame. The text is overlaid on the image in a bold, orange, outlined font.

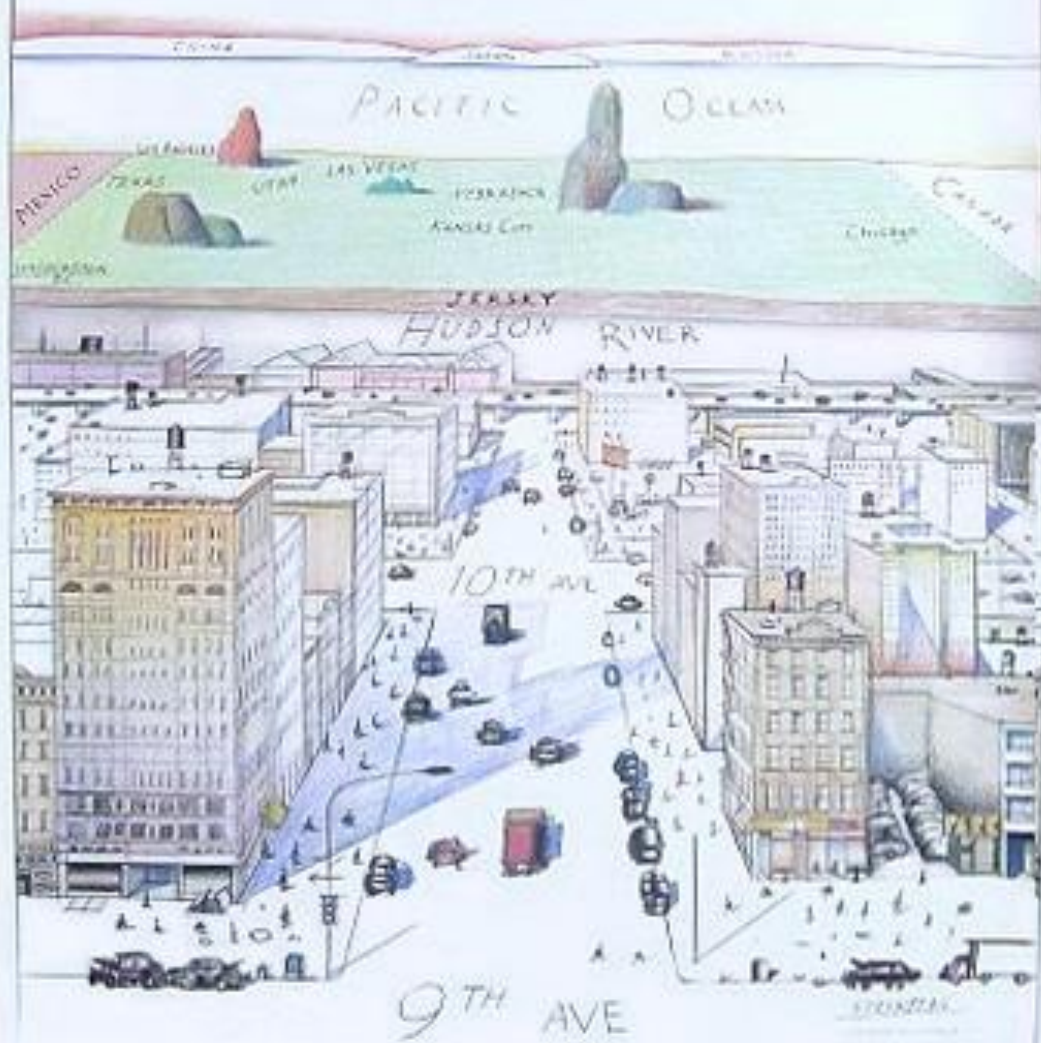
***Old MacDonald Bought The Farm:
Missouri Toxicology***

***S. Eliza Dunn (Halcomb), MD FACMT
Medical Affairs Lead
Bayer Crop Sciences***



District of
Columbia

THE NEW YORKER





Agriculture

- Farming consistently ranks in top 10 most dangerous jobs.
- 2020 – 368 fatalities in agricultural workers.
- Most fatalities related to trauma.
- Several important toxicologic causes of morbidity and mortality.

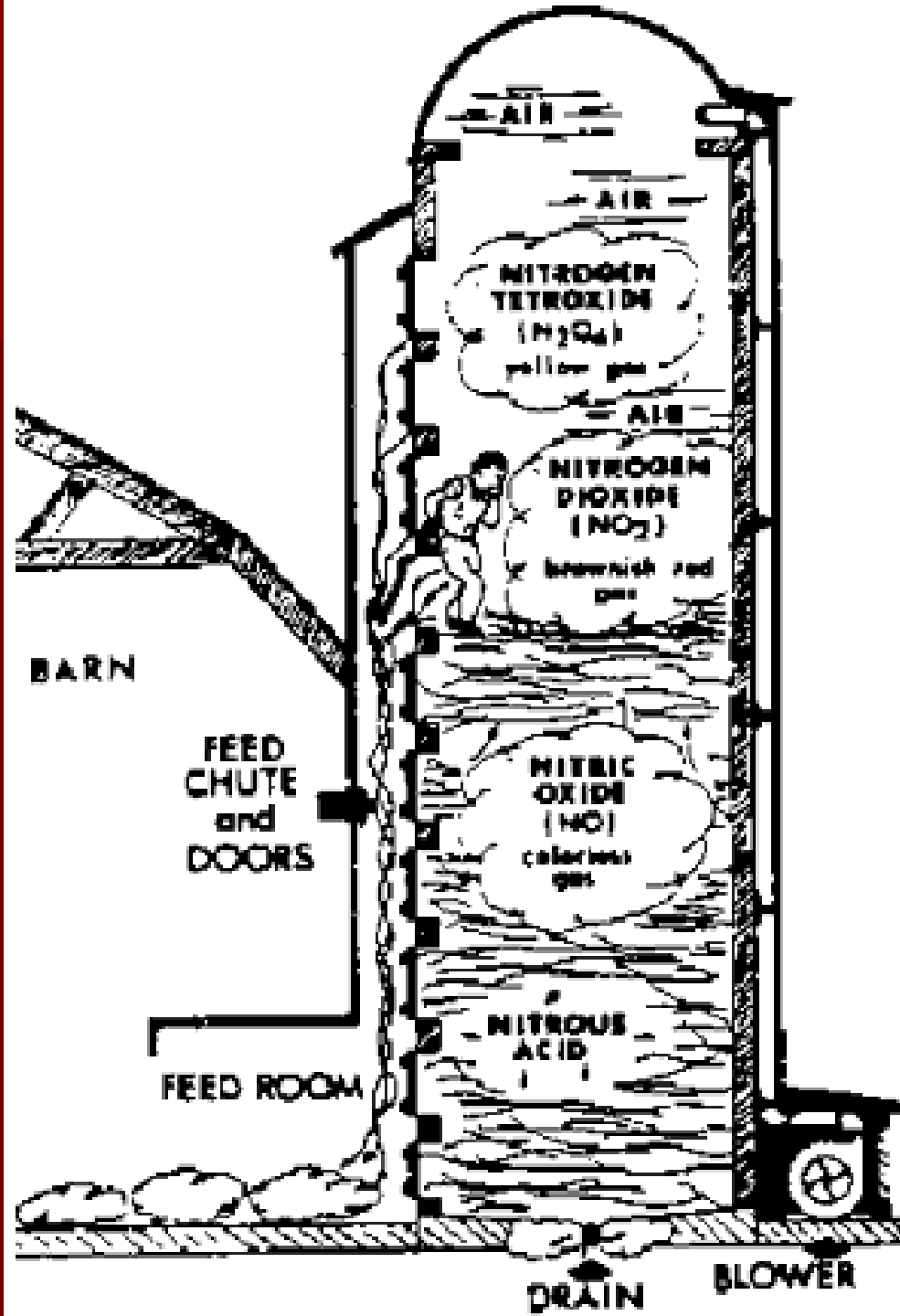
Agriculture

- 357 work related deaths from exposure to harmful substances between 1992-1996.
- Inhalational injuries accounted for 8.4% of these deaths.
- Exposure to caustic, noxious substances in a confined or restricted space were responsible for 30 fatalities.



Silo Filler's Disease

- During the 1st 24-48 hours of fermentation, the ambient atmosphere becomes depleted of O_2 .
- Nitrates in silage are converted by bacteria to NO_2 , N_2O_4 .







Silo Filler's Disease

- Concentrations over 25 ppm can be hazardous.
- Inhalation of 50 to 75 ppm for 30 to 60 minutes can cause bronchitis.
- 50 to 100 ppm causes chemical pneumonitis.
- 150 to 200 ppm, causes acute lung injury.

Silo Filler's Disease

- 300 to 400 ppm - fatal in 2 to 10 days.
- Over 500 ppm, acute pulmonary edema, fatal in less than 48 hours.
- Sudden deaths have been reported.

www.cdc.gov/nasd/docs - Animal handling safety considerations last accessed 1/20/06.
Hayhurst ER, Scott E. Four cases of sudden death in a silo. JAMA 1914;63:1570.
Douglas WW, Hepper NGG, Colby TV. Silo filler's disease. Mayo Clin Proc 1989;64:291-304.

Pathophysiology

- Inhaled NO_2 generates nitric acid and nitric oxide when it comes in contact with moisture in the respiratory tract.
- NO_2 , N_2O_4 also may directly oxidize pulmonary epithelium.
- Generate reactive nitrogen species such as peroxyntirite.
- Massive exposure can lead to death by simple asphyxiation.

Clinical Effects

- Cough, wheezing, mild ocular irritation
- Dyspnea, tachypnea
- Diaphoresis
- Chest discomfort
- Lightheadedness, syncope
- Occasional cyanosis
- Pulmonary edema
- Hypotension



Tests

■ CXR

- May be normal in mild cases
- May show small opacities in subacute cases
- May show diffuse alveolar infiltrates in severe cases.

■ Labs

- ABG may show hypoxemia
- Methemoglobinemia
- Leukocytosis

Phases

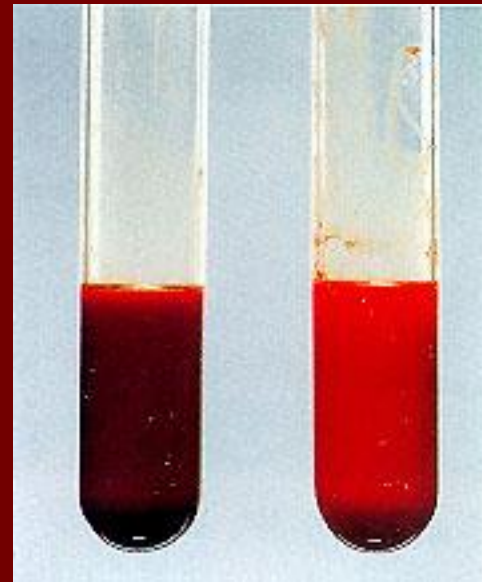
- Exposure is often mild and self-limiting.
- In severe cases the patient becomes acutely dyspneic.
- In less significant exposures symptoms may take up to 24 hours to develop.
- Patients will often make an apparent complete recovery and then 1-2 weeks later have a relapse of symptoms culminating in bronchiolitis obliterans.

Management

- ABCs – Patients with significant respiratory distress require intubation and ventilation.
 - Often need low tidal volumes, high FiO_2 and PEEP to maintain adequate blood oxygen saturation.
 - Hypotension is usually responsive to fluid, pressors may be necessary.
- Corticosteroids should be given to decrease inflammatory response.

Management

- As patient improves, baseline PFTs should be run.
- When patient is well enough to be discharged home a steroid taper should be given.
 - Generally start with 60 mg QD in adults x 3 weeks followed by a 7 week steroid taper.



© 2002 GSM

Take Home Points

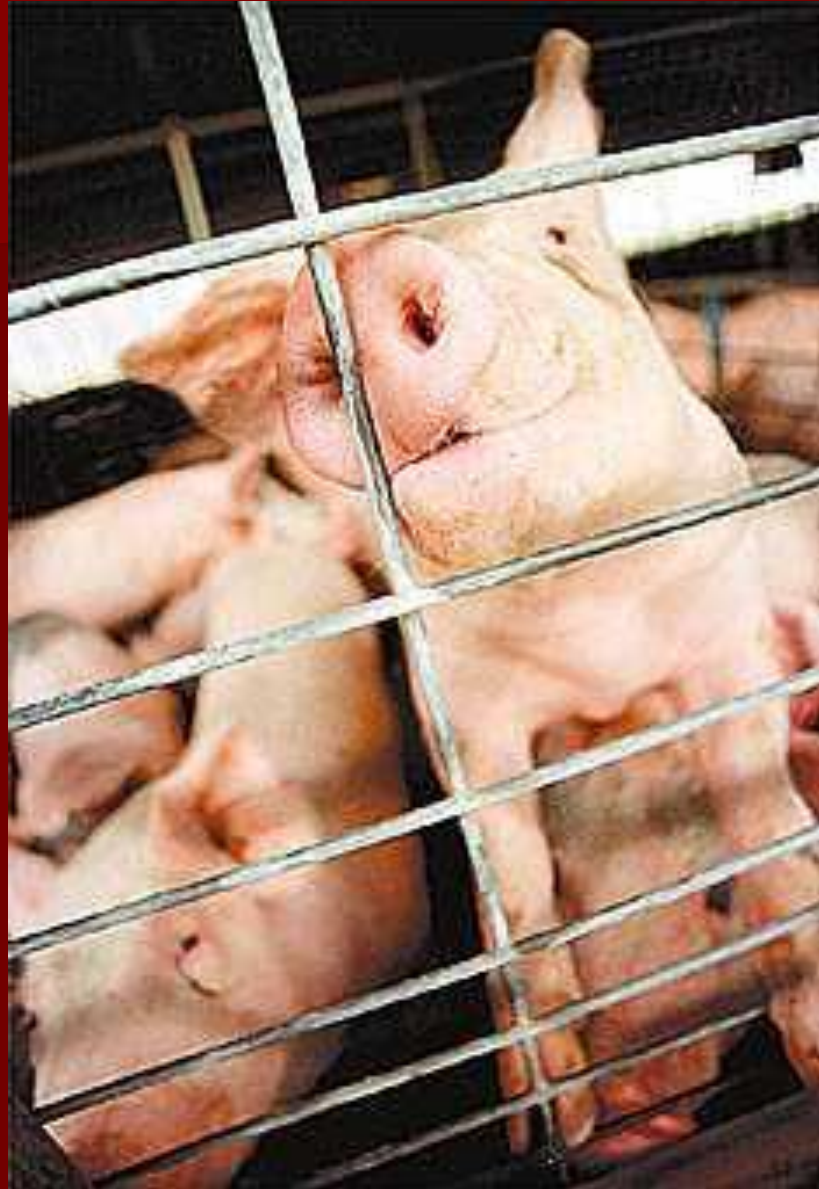
- Most exposures self limiting.
- All patients should be admitted for 24 hours .
- Cyanosis may be related to hypoxemia or methemoglobinemia.
- Complications include bronchiolitis obliterans and fibrosing alveolitis.



So where does all of this feed go?

PHOTO: FARM SANCTUARY









Manure Pits

- Four gases of major concern
 - Methane
 - Explosion Hazard
 - Ammonia
 - Heavier than air, irritant effects
 - Carbon Dioxide
 - Heavier than air, asphyxiant
 - Hydrogen Sulfide

Hydrogen Sulfide

“Death may come on like a stroke
of lightening...”

Hamilton A. Industrial Poisons in the United States. New York: MacMillan Company;
1925:324.

Hydrogen Sulfide

- Between 1984-1994 there were 70 fatalities related to H₂S poisoning in the USA.
- 36 related injuries in workers trying to rescue other workers without proper equipment.

Fuller DC, Suruda AJ. Occupationally related hydrogen sulfide deaths in the United States from 1984-1994. JOEM 2000;42;939-942.



Hydrogen Sulfide

- Produced by the bacterial decomposition of proteins.
- Decay of sulfur containing products.
 - Fish, sewage, manure
- Natural sources volcanoes, sulfur springs, underground deposits of natural gas.
- More dense than air.
- Odor of rotten eggs.

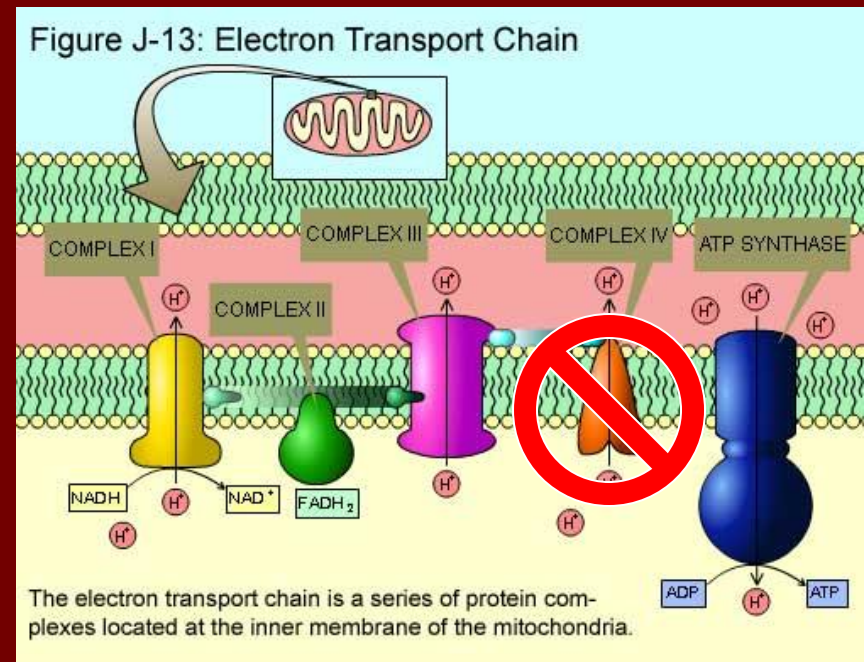
Hydrogen Sulfide

- 20-30 ppm – intense odor.
- 50-100 ppm – mild mucous membrane irritation.
- 100-150 ppm – olfactory fatigue.
- 200-300 ppm – irritation of respiratory tract and pulmonary edema.
- 500-700 ppm – severe systemic effects and death.

Kerns W, Isom G, Kirk MA. Cyanide and hydrogen sulfide. In: Goldfrank's Toxicologic Emergencies 7th ed. McGraw-Hill, New York 2002:1504-1507.

Pathophysiology

- Upon inhalation H_2S is rapidly distributed to the tissues.
- Enters mitochondria and binds to cytochrome oxidase with a greater affinity than does cyanide.
- Inhibition of oxidative phosphorylation leads to anaerobic metabolism and lactic acidosis.



Kerns W, Isom G, Kirk MA. Cyanide and hydrogen sulfide. In: Goldfrank's Toxicologic Emergencies 7th ed. McGraw-Hill, New York 2002:1504-1507

Pathophysiology

- Causes K⁺ mediated hyperpolarization of neurons.
- Enhances neuronal inhibitory mechanisms.
- Possibly causes respiratory depression by selective uptake of H₂S in white matter of brainstem.

Kerns W, Isom G, Kirk MA. Cyanide and hydrogen sulfide. In: Goldfrank's Toxicologic Emergencies 7th ed. McGraw-Hill, New York 2002:1504-1507.

Clinical Effects

- Ocular and mucous membrane irritation.
- Dyspnea, tachypnea, wheeze, hemoptysis.
- Pulmonary edema.
- Headache, weakness, coma, convulsions.
- Sudden loss of consciousness – “knock down” effect, death quickly ensues.

Tests

- Bedside
 - Smell is suggestive of exposure
 - Copper and silver coins in pockets are blackened
- ABG – Metabolic acidosis with a high lactate, normal O₂ saturation unless pulmonary edema present.
- Elevated mixed venous oxygen.

Tests

- MRI or CT brain may show subcortical white matter demyelination and globus pallidus degeneration.
- CXR may show diffuse bilateral infiltrates if pulmonary edema is present.

Treatment

- Rescuers should not enter area unless equipped with SCBA.
- Remove victim from source of exposure.
- ABCs – High flow O₂, possible role for HBO since useful in CN poisoning.
- Consider nitrite component of CN kit.
 - H₂S has higher affinity for metHb than cytochrome oxidase

Missouri Quiz





St Joseph

Macon

Hannibal

Kansas City

Jefferson City

St Louis

Joplin

Willow Springs

Springfield

Sikeston



SPECIAL DOUBLE ISSUE

People

weekly

THE
SEXIEST
MAN
ALIVE
2000

BRAD PITT



MATT DAMON

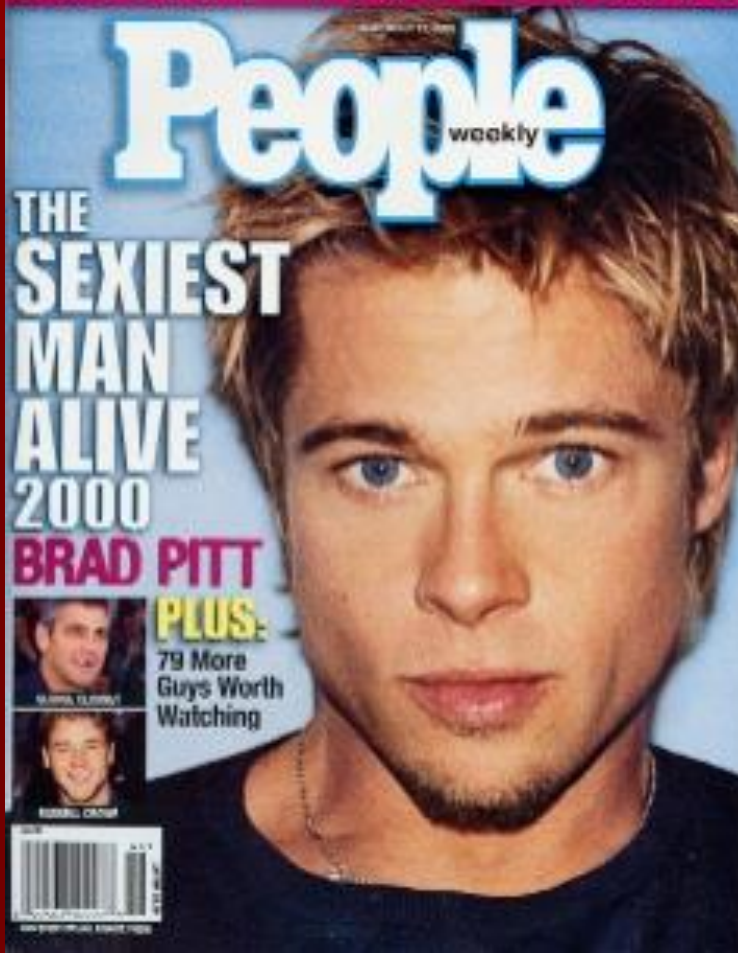


ROBERT DOWNEY JR.

PLUS:
79 More
Guys Worth
Watching



www.people.com





Insecticides

Cholinesterase Inhibitors

- Earliest use of cholinesterase inhibitors recorded in West Africa.
- “Ordeal bean”. – the Calabar bean.
- Named for the Calabar river in the Gulf of Guinea.
- *Physostigma venenosum*

Daniell FW. On the Natives of Old Calabar. Edinb. New Philos. Journ., 1846, p. 316.



Cholinesterase Inhibitors

- Two classes of agents
 - Organophosphates
 - Malathion, Parathion
 - Pesticides
 - Sarin, Tabun, Soman, GF, VX
 - Nerve agents
 - Carbamates
 - Aldicarb, carbaryl, propoxur, carbofuran
 - Pesticides
 - Physostigmine, pyridostigmine
 - Medicinal uses



whiteflies, West



Dilutable Concentrate
Malathion 50
Insect Spray

Controls insects in and around the garden

See directions inside booklet

Distributed by Chemagro, Division of United Industries Corporation, P.O. Box 15842, St. Louis, MO 63114-0842

EPA Reg. No. 46515-19-9688
EPA Est. Nos. 9688-MO-1, 769-GA-1-03, 46515-MI-1-00 Superscript used is first letter of lot number. Form 73744G1

Satisfaction Guaranteed

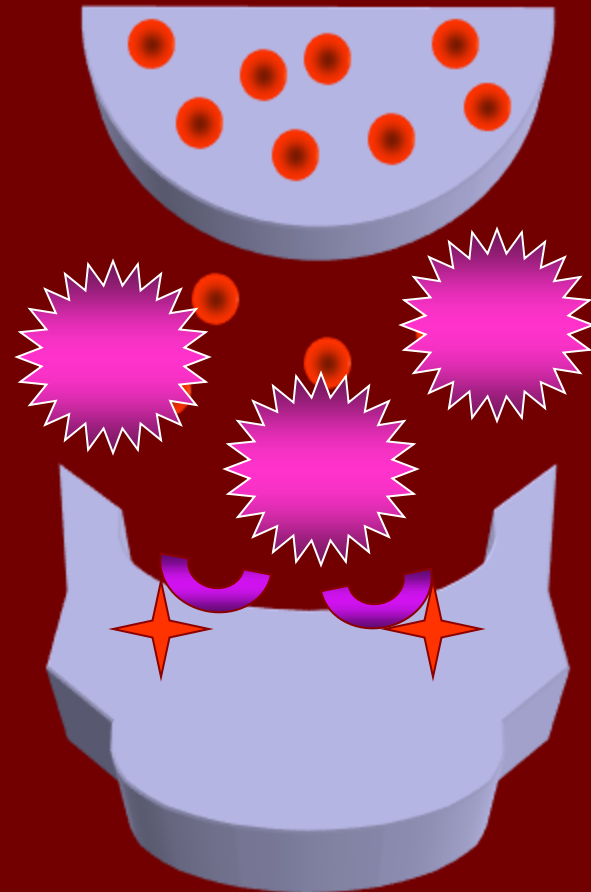
"If this Ace product fails to give complete satisfaction, return to the Ace Hardware Store where purchased for free replacement."



0 82901 73744 5

Normal Physiology

- ACh is released from the presynaptic terminal and binds to receptors on the postsynaptic terminal.
- Remaining ACh in synaptic cleft is broken down by AChE



Pathophysiology

- CIs bind to AChE and prevent breakdown of ACh.
- Postsynaptic receptor repeatedly stimulated by excess ACh.



Organophosphates vs Carbamates

- Organophosphates bind to AChE and undergo “aging” at which point they become irreversibly bound to AChE.
- Carbamates bind to AChE, however they spontaneously hydrolyze resulting in reactivation of the enzyme.

Muscarinic Effects

- Salivation
- Lacrimation
- Urination
- Diarrhea
- GI distress
- Emesis

KILLER Bs

- Bradycardia
- Bronchorrhea
- Bronchospasm



Nicotinic Effects

- Autonomic Ganglia
 - Diaphoresis
 - Mydriasis
 - Tachycardia
 - Hypertension
- NMJ
 - Fasciculations
 - Paralysis



CNS Effects

- Confusion
- Coma
- Seizures



Tests

- RBC and Plasma Cholinesterase.
 - RBC
 - **Need whole unclotted blood**
 - **Large range of normal values**
 - **Regenerates at 1% per day**
 - Plasma
 - **Wide range of normal**
 - **Acute phase reactant**
 - **Declines faster acutely, regenerates faster**
- ABG – monitor oxygenation status.
- CXR – may show pulmonary edema.

Management

- In patients who have ingested insecticides, decontamination is critical.
- Clothing should be removed and discarded.
- Ocular exposures require thorough irrigation.
- Dermal exposures may be aided by the use of a dilute hypochlorite solution.

Management

- ABCs – Often the patient is in severe respiratory distress and needs to be intubated.
 - Avoid using succinylcholine
- Once IV access is obtained consider OG lavage.
 - Remember that lavage fluid is a potential hazard

Management

- Atropine
 - Competitive inhibition of ACh at muscarinic receptors.
 - No effects on nicotinic receptors.



Management

- Pralidoxime (2-PAM)
 - Forms a complex with OP bound AChE.
 - OP – 2PAM complex released from enzyme
 - Useful for OP poisoning prior to aging.

Medicis JJ, Stork CM, Howland MA , et al. Pharmacokinetics following a loading plus continuous infusion of pralidoxime compared with the traditional short infusion regimen in human volunteers. Clin Toxicol 1996; 34; 289-295



Delayed OP Toxicity

- Intermediate Syndrome
 - 1-4 days after resolution of cholinergic symptoms patients develop cranial nerve palsies and neck flexor weakness.
 - EMG – NMJ dysfunction
 - Recovery over 1-3 weeks

Senanayake N, Karalliede L. Neurotoxic effects of organophosphate insecticides: An intermediate syndrome. N Engl J Med 1987 ; 316; 761-763

Delayed OP Toxicity

- Peripheral Neuropathy
 - Associated with TOCP adulterated cooking oil and alcohol
 - Distal polyneuritis resulting in paralysis of lower extremities.
 - Thought to be due to inhibition of NTE

Morgan JP. The Jamaica Ginger Paralysis. JAMA 1982; 248:1864-1867.

PLANTATION
ESSENCE JAMAICA
GINGER

ALCOHOL 93%



For Dyspepsia, Cholera Mor-
bus, Flatulent Colic, Nausea
and General Debility.



Unaka Brand

A High Grade
FLUID EXTRACT

GINGER

S. P. X.
Alcohol by vol. 83 p. c.

For COLDS
Des. 15 Drops

Children a. age

Product of
HILL BROS.
New York

USE BROWN'S
JAMAICA
GINGER



All Aboard For Convention Of Jakeleg Victims

The following communication has been received at the newspaper offices, unsigned and from an unknown source. It speaks for itself.

"Arrangements are being made to hold a Jakeleg Convention at an

I can't eat, I can't talk
Been drinkin' mean jake, Lord now can't walk

Missouri Fact









JOY

OF COOKING

OPOSSUM

If possible, trap 'possum and feed it on milk and cereals for 10 days before killing. Clean, but do not skin. Treat as for pig by immersing the unskinned animal in water just below the boiling point. Test frequently by plucking at the hair. When it slips out readily, remove the possum from the water and scrape. While scraping repeatedly, pour cool water over the surface of the animal. Remove small red glands in small of back and under each foreleg between the shoulder and rib. Parboil, page 132, 1 hour. Roast as for pork, page 407. Serve with:

Turnip greens

BEAR

Remove all fat from bear meat at once, as it turns rancid very quickly.

If marinated at least 24 hours in an oil-based marinade, all bear, except black bear, is edible. Cook, after marination, as for any recipe for Beef Pot Roast or Stew, pages 412-420. Bear cub will need about 2½ hours cooking; for an older animal, allow 3½ to 4 hours. Bear, like pork, can carry trichinosis, so be sure the meat is always well cooked through.

RACCOON

Skin, clean and soak overnight:

1 raccoon

in:

Salt water

Scrape off all fat inside and out. Blanch, page 132, for 45 minutes. Add:

2 tablespoons baking soda

and continue to cook uncovered for 5 minutes. Drain and wash in warm water. Put in cold water and bring to a boil. ♦ Reduce heat and simmer 15 minutes.

Preheat oven to 350°.

Stuff the raccoon with:

Bread Dressing, page 456

Bake covered, about 45 minutes ♦ uncover and bake 15 minutes longer before serving.

MUSKRAT

2 Servings

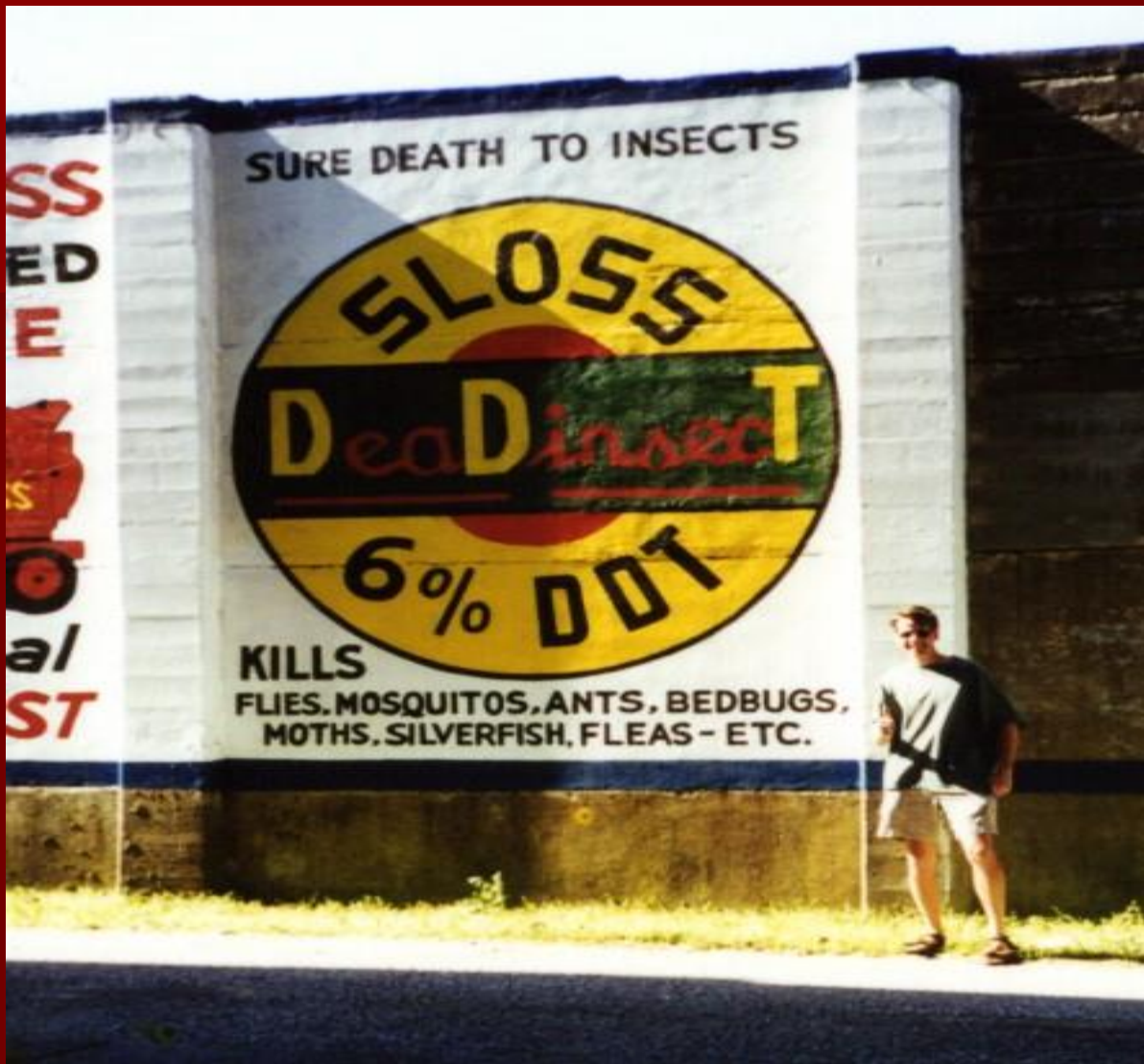
Skin and remove all fat from hams of:

6 muskrats

"DDT is good for me-e-e!"







SURE DEATH TO INSECTS



KILLS
FLIES, MOSQUITOS, ANTS, BEDBUGS,
MOTHS, SILVERFISH, FLEAS - ETC.



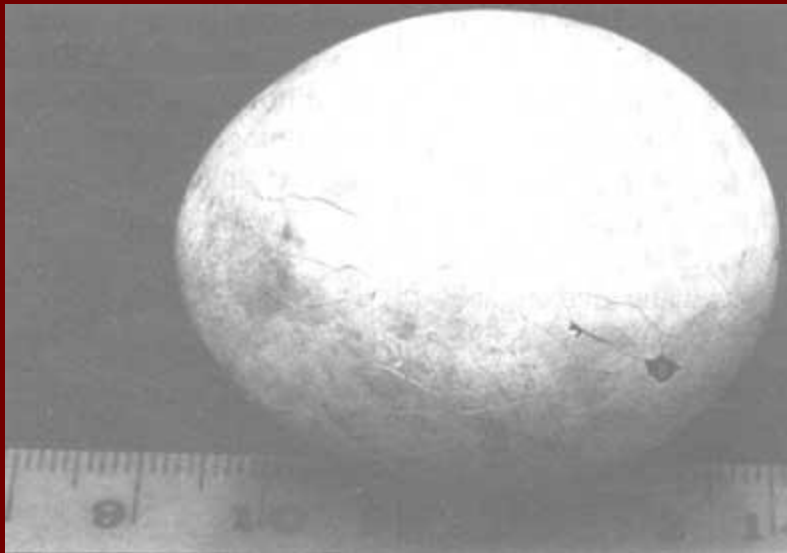
"The cornerstone of the new environmentalism . . .
well crafted, fearless, and succinct." — Peter Matthiessen

SILENT SPRING

40TH ANNIVERSARY EDITION

RACHEL
CARSON

With essays by Terry Tempest Williams and Linda Lear



Pathophysiology

■ Acute Toxicity

- Causes voltage dependent Na⁺ channels to remain open.
- Some organochlorines inhibit the GABA receptor

■ Chronic Toxicity

- Estrogenic effects?

Holland MG Insecticides: Organochlorines, pyrethrins, and DEET. In: Goldfrank's Toxicologic Emergencies 7th ed. McGraw-Hill, New York 2002:1366-1378.

Clinical Effects

■ Acute

- Nausea and vomiting
- High doses of DDT can cause seizures
 - Other organochlorines (lindane) can cause seizures at lower doses

■ Chronic

- “Kepone Shakes”

Holland MG Insecticides: Organochlorines, pyrethrins, and DEET. In: Goldfrank's Toxicologic Emergencies 7th ed. McGraw-Hill, New York 2002:1366-1378.

So now, whenever
I get the urge for
a cigarette, I
reach for a piece
of fruit!...

SMOKE-STOPPERS

How do
I tell
him?

MARGULIES
EPA CONFIRMS
CANCER LINK
TO PESTICIDE
ON PRODUCE

MARGULIES
BY THE RECORD
NEW JERSEY



Management

- ABCs
- Patients should be decontaminated.
- Cholestyramine may be useful.
 - 2.25 g/kg
- Control seizures with benzodiazepines.
- Supportive care.

Holland MG Insecticides: Organochlorines, pyrethrins, and DEET. In: Goldfrank's Toxicologic Emergencies 7th ed. McGraw-Hill, New York 2002:1366-1378.

Missouri Quiz





Missouri Quiz



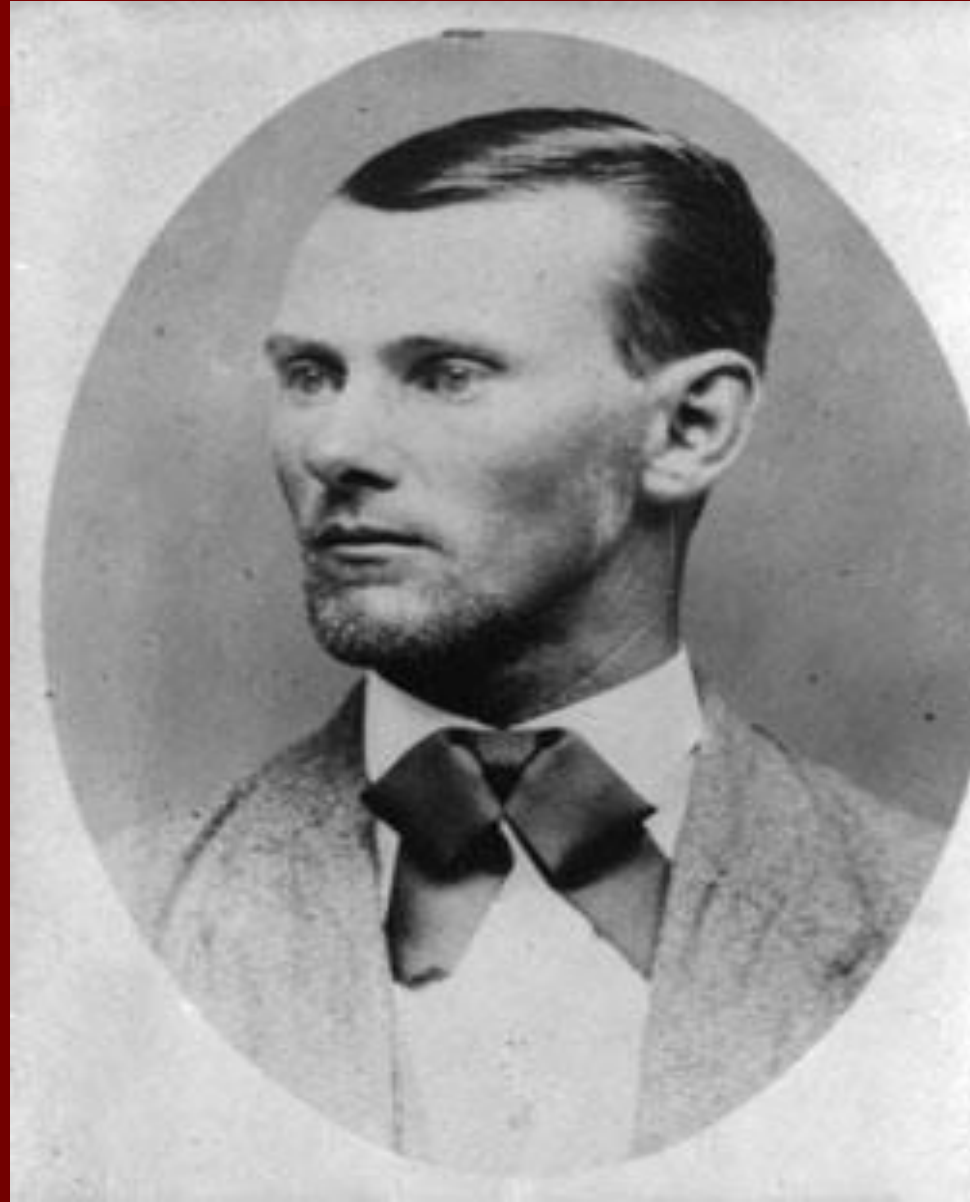
Other Agricultural Toxins

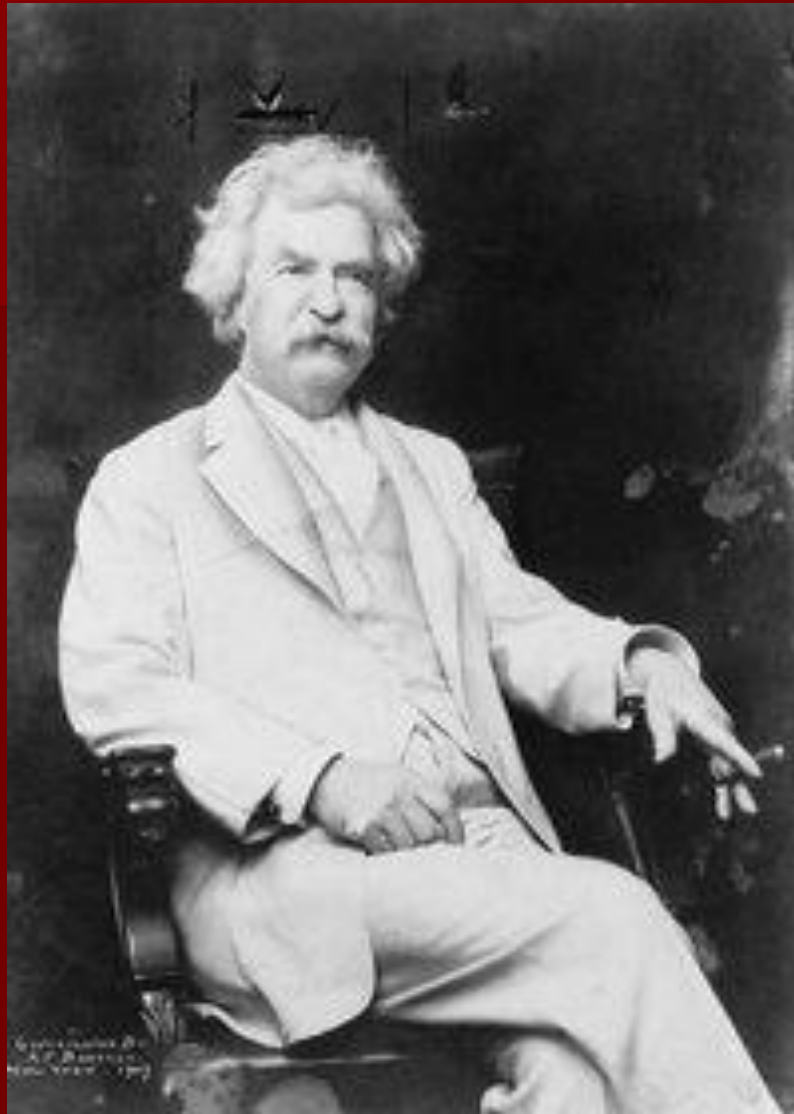
- Wild Plants
- Crops
- Snakes
- Tetanus



Other Famous Missourians

- Harry S. Truman
- Ulysses S. Grant
- Tennessee Williams
- T.S. Eliot
- Vincent Price
- Nelly
- Tina Turner
- Jesse James





"The New York papers have long known that no large question is ever really settled until I have been consulted."