Xanthines

- Found in about ~60 plant species, many of which contain a combination of xanthines
- Mild stimulants affecting body & brain
  - caffeine (strongest CNS action; most widespread use)
  - theophylline (strongest PNS action)
  - theobromine (~1/10th as potent as caffeine)
  - FYI - aminophylline, a theophylline derivative, is widely used medically

Ripening Coffee Beans

Picking Tea

- Camellia sinensis
- Leaves contain theophylline + caffeine as well as other nutritionally beneficial compounds:
  - Antioxidant polyphenols (anti-cancer & cardiovascular problems)
  - Bone-beneficial fluoride & phytoestrogens
- Teas vary but average 50 mg caffeine, green tea 35 mg

Cacao Tree & Cacao Beans

- Theobroma cacao (theobromine + caffeine)
  - Did you see the movie "Chocolat"?

Yerba Mate’ or Paraguayan Tea

Incredible Variety of Coffee/Caffeine Drinks

- Also incredible range of caffeine doses
- "average" coffee 100 mg per cup, more for "gourmet" coffees
- Jolt Espresso 120 mg “Cocaine” energy drink – 280 mg caffeine
- Some Starbucks large drinks:
  - 400 – 500 mg
Chocolates

- 30 mg in this dark chocolate; 10 mg in 1 oz of most milk chocolates

Caffeine Containing Candy

- Generally ~15-45 mg per piece

OTC Medicines per tablet

- Caffedrine 200 mg.
- NoDoz 100 mg.
- Vivarin 200 mg.
- Anacin 64 mg.
- Cope 32 mg.
- Excedrin 65 mg.
- Midol 32 mg.
- Aquabon 100 mg.
- Permathene 100 mg.
- Coryban D 30 mg.
- Vanquish 33 mg.
- Dristan 30 mg.
- Triaminicin 30 mg.
- In many prescription meds too

Soft Drinks ~35-70mg /12 oz)

- Mr. Pibb, Diet 57 mg./12 oz.
- Mountain Dew 54 mg./12 oz.
- Coca Cola, Diet Coke 46 mg./12 oz.
- Mr. Pibb 41 mg./12 oz.
- Dr. Pepper, Sunkist Orange 41 mg./12 oz.
- Pepsi Cola 38 mg./12 oz.
- Pepsi Light, Diet 36 mg./12 oz.
- Surge 51 mg./12 oz.
- Jolt 72 mg./12 oz.
- Of course size matters – “Big Gulp” = 190 mg.

“Energy” Drinks ???

- Bawls – guarana bev. 80 mg caffeine
- XTC Tea – unknown dose guarana, kola nut, caffeine, tea, kava kava, mate & ma huang
- http://www.cspinet.org/new/cafe.html

Energy Drinks

- http://www.youtube.com/watch?v=ZfSJ1ik-2gA
- 240 mg caff in 24 oz can
- Unknown dose caffeine+ guarana
- 80 mg in this can. 116 mg in 12 oz. + taurine and glucuronolactone
Caffeinated Water

Per 16.9 oz bottle
Water Joe 60-70mg
Aqua Java 50-60 mg
Aqua Blast 90 mg
Krank 20  100mg
Java Water  125mg

Caffeinated Alcoholic Beverages

• [http://www.fda.gov/ForConsumers/ConsumerUpdates/ucm233987.htm](http://www.fda.gov/ForConsumers/ConsumerUpdates/ucm233987.htm)
• Inhale your caffeine:
  • [http://www.youtube.com/watch?v=tkEUxxUXm_Q](http://www.youtube.com/watch?v=tkEUxxUXm_Q)

Others

• Ben & Jerry’s Coffee Frozen Yogurt 85/cup
• Starbucks Ice Cream 40-60/cup
• Dannon Coffee Yogurt 45/cup
• Cracker Jack’s: “sport” jellybeans
• Chips, seeds, jerky & cereal!
• Chewing tobacco
• Caffeinated soap!!!
• Caffeinated pantyhose!!

Caffeine’s Action

• Absorption takes 30-60 min.; CNS effects peak at 2 hrs. ED50 = 100-125 mg. in non-tolerant
• Half-life is ~3-7 hours in most adults, but significant genetic variability in metabolism (up to 12 hrs) (40-230 in newborn!)
• Longer half-life in infants, elderly & pregnant & those on birth control pills or SSRIs, especially Luvox, fluoxetine
• Half-life shorter (~1.5-3.5 hrs) in smokers and then rebounds to longer half life and increased sensitivity when quitting smoking, so that caffeine aggravates withdrawal

How Xanthines Work

• **Block receptors** for a natural calming/sleep-promoting neurotransmitter adenosine.
• Normally adenosine helps dilate blood vessels, slows heart, makes us sleepy, decreases body temp, constrict bronchioles
• Blocking adenosine causes the opposite effects

Dose Dependent Body Effects

• Increased HR & BP; release of adrenaline
• Increased salivation & GI secretions
• Bronchodilation & increased respiration
• Increased metabolism & increases temp.
• Increased urination (diuretic effect)
• Constricts brain blood vessels; dilates other vessels including coronary arteries
CNS Effects

- Increased wakefulness, decreased fatigue
- Increased attention, decreased boredom
- Mild mood elevation
- Increased motor activity
- Increased response to sensory stimuli
- Shortens reaction time

Caffeinism (too much)

- restless, anxious, irritable, agitated, panic attack in some
- insomnia
- muscle tension & tremors
- rapid, sometimes irregular HR
- flushed, hot and sweaty
- nausea; increased urination
- sensory disturbances (visual, tinnitus, increased awareness of body sensations)
- Usually occurs at dose > 600 mg but depends on individual's sensitivity

Withdrawal

- Regular use does produce moderate tolerance and dependence
- Beginning about 12-18 hrs after your last dose:
  - throbbing headache, worsens with exercise
  - fatigue, no energy, yawning
  - difficulty concentrating, slowed performance
  - glum, irritable, mild depression
- For a regular user withdrawal symptoms may last a week
  - http://www.youtube.com/watch?v=4L8XW2g3ytI

Health Risks?

- Primary risks to those with pre-existing conditions, e.g.:
  - may increase BP in those prone to hypertension
  - may aggravate ulcers or heartburn due to gastric reflux
  - may trigger or increase panic attacks in some, worsen generalized anxiety disorder symptoms
  - Caffeinism can be mistaken for anxiety disorders
  - High doses may increase risk of miscarriage, stillbirth or decreased growth of fetus (6-10 cups/day or the equivalent). Also present in breast milk.
  - May increase calcium loss if consumed without dairy & increase risk of osteoporosis
  - May cause sleep problems
  - Caffeine withdrawal is the cause of some headaches
- But all in all - low toxicity – LD50 ~ 5-10 g (50-100 Nodose tablets).

Health Benefits

- Headache relief for normal and migraine headaches
- Moderate use – mild mood elevator & stimulant
- Used therapeutically in a variety of ways (cardiac stimulant, respiratory stimulant, anti-asthma, additive in some sedating medications)
- May reduce risk of kidney stones, gallstones
- May help protect against Parkinson’s disease and cognitive decline in aging
- Anti-oxidant actions may be beneficial
- Topically - prevention of skin cancer?