Stimulating plants
Today...

- Stimulating plants
- Caffeine effects
- Coffee
- Tea
- Cocoa or cacao
- Kola
- Tobacco
- Ephedra
Caffeine

- **Caffeine** is the active ingredient in the most popular stimulating beverages.

- Caffeine is an **alkaloid**, group of secondary compounds found in plants – made to discourage grazing.

- **Desirable effects:** Promotes alertness and endurance. It stimulates the central nervous system, faster heartbeat, constriction of blood vessels, increased respiration rate, suppression of appetite, diuresis.

- **Undesirable effects:** headaches on withdrawal, infertility, birth defects, insomnia, nervousness, irritability
Caffeine-containing drinks

- Coffee
- Tea
- Cocoa
- Kola

- Many soft drinks have added caffeine.
Coffee

- Coffee is made from the seeds of *Coffea arabica*
- Native of Ethiopia (Eastern Africa)
- The fruits and leaves were eaten for stimulation
- Grown in Yemen; domesticated there, roasting of beans invented in the 13th century
- Coffee brewing spread to Arabian world in 16th century, then to Europe in the 17th century
- Coffee houses were popular in Europe by the 1700’s – centers for intellectual discourse
Centers of coffee trade

- Mocha, Arabia, in the 17th century
- Dutch East Indies and Ceylon in the 18th century
- French Islands in the 18th century
- Brazil in the 1800’s, where it had a profound impact
- Now, most coffee produced in Brazil and Colombia (leading producers of coffee)
- Today, coffee is second to oil as the world’s most traded commodity
Growing coffee beans

- The plant is a small tree, grows in **cool subtropical mountain habitats**
- The small fruit is called a cherry
- It contains **two seeds called beans**
- Harvested by hand when the beans are ripe
Processing coffee

- The hull is first removed
- The seeds are fermented for 12-24 hours (but they’re non-alcoholic)
- Seeds are dried for 1 week
- Coffee beans are then roasted – which produces the flavor, and the dark brown color
Decaffeinated Coffee

- Coffee may be decaffeinated before roasting
- Invented by a German chemist, who was convinced his father had died of caffeine addition
- Basically, a solvent is used to soak green coffee beans – the solvent removes the caffeine

- Caffeine is sold for use in medicines, soft drinks:
  - Pepsi, Coca cola, Mountain Dew, Jolt Cola
  - Anacin, Excedrin
  - NoDoz, Vivarin, Midol
Specialty coffees

- **Espresso**: originated in Italy, a single cup of coffee is brewed at a time as hot water under pressure is forced through finely ground, dark roasted beans.

- **Latte**: is like espresso, but with steamed milk

- **Café mocha**: is a latte with less steamed milk, but with chocolate syrup added

- **Cappuccino**: also made with espresso, less steamed milk than latte, and large cap of foamed milk
Tea

- Tea is made from the dried tip leaves of the species *Camellia sinensis*, a small tree or shrub native to the area adjoining Tibet, India, China and Myanmar (formerly known as Burma).

- (Herbal teas: infusions made from plants other than *Camellia sinensis*)

- *Camellia sinensis* plants flourish in tropical or subtropical climates, with abundant rainfall and no danger of frost.
Tea

- Importance of tea: more people drink tea than any other stimulating beverage in the world.
- However, international trade of tea is less than for coffee
Origin and history of tea

- Tea originated in China about 2700 BC, according to legend… Emperor Sheng Nung
- In fact, the word China comes from chai, the Russian word for tea.
- Tea was introduced in Japan
- Portuguese and Dutch introduced tea to Europe in the late 1600’s, after coffee
- Tea came to American colonies; Boston Tea Party in 1773, to protest a tea tax.
Tea cultivation

- Tea is a small tree, which is pruned to be a bush.
- The top two youngest leaves and stem tips are harvested by hand or machine.
- Processing of tea:
  - **Black tea**: leaves are withered, rolled, fermented (non-alcoholic) and dried.
  - For **green tea**, the leaves are steamed, rolled to break cells to release aroma, dried (green tea is not fermented).
  - **Oolong teas** are semifermented – leaves are greenish brown.
Tea aroma and flavor

- The aroma and flavor of tea comes from essential oils
- Additional taste from tannins
- Stimulating effect from caffeine and theophylline
- Caffeine levels vary with the type of tea:
  - Black tea has the most caffeine
  - Oolong intermediate
  - Green tea has the least caffeine
- Caffeine levels also depend on the length of brewing
Health effects of tea

- Studies show that people who drink large amounts of green tea have lower rates of cancer.
- Animal studies show that green tea reduces breast and prostate cancers.
- Polyphenols in green tea interfere with an enzyme needed for cancer growth.
- Theophyllin in tea, although similar to caffeine, actually has medicinal properties: used for treatment of asthma.
Culture and Tea

- **Japanese Tea Ceremony**: ritual that symbolizes the Zen Buddhist concept that universal truths lie in simple tasks. Tea room is austere to focus attention on ceremony. Green tea: poured, whipped, served.

- **British High Tea**: late afternoon light meal (pastry) with tea, served with cream

- **Russians**: served in tall glasses with lemon

- **Hot summer of 1904**: iced tea was invented in St. Louis; tea bag also invented

- **Chai tea**: spicy tea drink (black tea, water, milk and spices) is a common drink for workers in India – chic in the U. S.
Cocoa or cacao

- The seed of the plant *Theobroma cacao* is the source of chocolate.
- Origin: native of South and Central America tropical forest
- “Chocolatl” consumed by the Aztecs, who made a drink of chocolate, vanilla and chili pepper; medicinal use; even as currency! *Theobroma* = food of the gods
- Introduced to Spain by Hernan Cortes in the 1520’s. The Spanish added sugar.
- Cocoa use spread to the rest of Europe
- The Swiss added milk
- In the 19th century: Cocoa butter processed with sugar to make chocolate; first chocolate bars.
Cocoa cultivation

- The fruits are the size and shape of a small football, borne on the trunk of the tree.
- The fruits are harvested by hand, cut open and the seeds, surrounded by a white pulp, are collected.
Cocoa processing

- Seeds are fermented (non-alcoholic) for 4-7 days, they develop the flavor and dark brown color.
- Seeds are then dried, polished, roasted, cracked and dehulled to release nibs (cotyledons).
- Nibs are ground to a paste – called chocolate liquor.
Chocolate processing

- Chocolate liquor can be molded directly for making baking chocolate.
- Cocoa butter can be removed, to make cocoa powder. The cocoa butter is the main ingredient for white chocolate.
- Cocoa butter is also used for suntan lotions, soaps and cosmetics.
Chocolate effects

- The stimulating effect of chocolate comes from caffeine and theobromine; chemically related to caffeine
- High energy food (57% carb.; 32% fat; 8% prot.)
- Cannabinoids in chocolate give a feeling of euphoria
- Cocoa contains phenylethylamine (PEA). The PEA in chocolate is the same endorphin that is naturally excreted into the bloodstream when a person experiences the sensation of "being in love".
- Stearic acid (fatty acid) raises HDL levels, "good" cholesterol; whereas flavonoids reduce LDL ‘bad’ cholesterol levels and stimulate immune function.
- Plus, it contains vitamin E, a great antioxidant!

![theobromine](![image](theobromine.png))

![caffeine](![image](caffeine.png))
Kola

- Cola drinks are derived from the kola tree (*Cola nitida*); native of West Africa
- Seeds of the kola tree are fermented (non-alcoholic), dried and grinded.
- Kola seeds contain high caffeine, and kolanin, a heart stimulant.
Cola drinks

- Coca-cola invented in 1886, in Atlanta, GA
- An extract of coca leaves and cola seeds
- Coca extract contained cocaine – used as medicine
- Cocaine was later removed, but Coca Cola still contains the coca extract
Other stimulating plants: Tobacco

- The plant *Nicotiana tabacum* contains *nicotine* – a powerful stimulant of norepinephrine release in the hippocampus. It is a highly addictive alkaloid.

- Origin: Americas. Natives grew and smoked tobacco before Columbus

- Introduced to France by Jean Nicot in the 1500’s (Linnaeus named the plant in his honor)

- U.S. colonies in Virginia, North and South Carolina, Maryland had large tobacco plantations
Tobacco effects

- Can improve memory and recall
- But has many more negative effects, including reduced blood circulation
- Tars and carbon monoxide can produce cancer.
- Cigarette smoking has been linked to lung cancer, heart disease, emphysema, oral cancer and premature birth.
- Smokers have 8.3 years shorter life expectancy
Ephedra

- *Ephedra* species; a gymnosperm native to China, used for medicinal purposes (decongestant against asthma, bronchitis)
- Active compound: ephedrine
- A CNS stimulant, bronchial dilator, increases blood pressure; an effect similar to adrenaline
PSYCHOACTIVE PLANTS
Today…

- Psychoactive drugs
- Opium poppy
- Marijuana
- Cocaine
- Peyote
- Kava
- Others
Psychoactive Drugs

- Psychoactive: plant compound that alters the mental state, rather than physical state

- Hallucinogen: Non-addictive substance that causes hallucinations – perceiving or sensing things that have no reality; seeing, hearing, smelling, feeling things that are not really there

- Hallucinations are usually temporary and produce changes in perception (of time, space)

- Changes in mood, in thought

- These compounds are also known as psychodelic
Psychoactive plants

- Possession, use, growth or distribution of psychoactive plants is illegal.
- Psychoactive plant use can be dangerous to one’s health.
- Same drug can be medicinal, psychoactive or toxic: depending on the dosage (quantity).
- A narcotic is a very addictive psychoactive compound: elicits psychological dependence, physiological dependence and tolerance.
Opium Poppy

- **Opium poppy** (*Papaver somniferum*), native to the Middle East, is a flower with colorful petals.
- After pollination, the ovary matures into a capsule. If capsule is sliced when green, it exudes a milky latex; when dried it turns brown (opium).
- Poppy seeds contain negligible amounts of opium – used for breads, muffins, cookies.
- Opium has been eaten, drunk or smoked by ancient societies for relieving pain.
Opium history

- Used by Egyptians, Babylonians, Greeks and Romans as an analgesic; valued for its sleep-inducing properties.
- Usually dissolved in wine or alcohol
- The Opium Wars: Britain smuggled opium into China in 1830’s, creating an addiction in the population
- Chinese government destroyed British opium and ships, and British retaliated
- British won, controlled Hong Kong and opium traffic
- Opium trade ended with the establishment of the People’s Republic of China
Opium use

- Laudanum: a mixture of opium and alcohol, popular drug in the 19th and early 20th centuries
- Opium contains 26 different alkaloids; of these, three are important: **Codeine, Papaverine and Morphine**
- **Codeine** is used as an oral analgesic, but it is one-fifth as strong as morphine
- **Papaverine** is rarely used treatment for diarrhea and cramps
Morphine

- Morphine was isolated in 1806 and is 10 times stronger than opium.
- Valued for its analgesic value – pain relief properties (still now, nothing deadens pain better than morphine!). It reduces perception of pain. It is still used today to control intense pain (burns, terminal cancer, after operations, etc.).
- Endorphins are the natural “feel good molecules” in the brain. Morphine binds to endorphin receptor sites and mimics its action.
- Morphine is strongly addictive – widespread addiction among those injured during the U. S. Civil War was called ‘soldier’s disease’.
Heroin

- Introduced in 1898 by Bayer Co. as a cough medication, at first it was thought to be non-addictive; “Heroic drug”…

- But heroin is six times more addictive than morphine – it is no longer used medicinally in the US (but it is in other countries)
Heroin

- Opium poppy is still grown illegally in South East Asia: Myanmar, Laos and Thailand (the **Golden Triangle**) and also in Central Asian countries such as Pakistan, Afghanistan and Iran (the **Golden Crescent**)

- Withdrawal symptoms (when drug is not taken) include: increased respiration, perspiration, runny nose, goose bumps (thus name “cold turkey”), muscle twitches, insomnia, vomiting, diarrhea.

- **Methadone** is a synthetic opiate used as gradual substitute for recovering patients; it is less addictive and has milder withdrawal symptoms than heroin
Marijuana

- *Cannabis sativa* is one of the oldest cultivated plants in the world
- Marijuana plants are dioecious annuals: they have male and female flowers on separate plants
- Distinctive palmately compound leaves with usually 5-7 toothed leaflets
- Plants produce a resin by glandular trichomes, especially in unfertilized pistillate (female) flowers and adjacent leaves
History of Marijuana

- Known in ancient China, valued for its fiber (for cloth, paper and rope) and for its medicinal value.
- 5,000 years ago, Emperor Shen Nung recommended its use to treat rheumatism, gout, malaria, absentmindedness.
- Spread to Central Asia, India, Northern Africa: hallucinogenic properties used for religious ceremonies.
- Spread throughout the Muslim world – Hashishins (where words hashish and assassin come from).
History of Marijuana

- Introduced into Europe after Napoleon invaded Egypt – hashish smoking clubs (intellectuals, writers, poets, artists claimed it enhanced creativity)

- Brought to the U.S. in 1611 in Jamestown; used as a cash crop until the end of the Civil War – fiber used to make rope and cordage (remember that US Constitution and Declaration of Independence are written on hemp paper)

- In the 1920’s, marihuana smoking introduced by Mexican immigrants, picked up soon by Jazz musicians
Marijuana prohibition

- The Fed. Bureau of Narcotics in the 1930’s launched an educational campaign – greatly distorted the problem and exaggerated the dangers.

- Federal prohibitions (Federal Marijuana Tax Act) passed in 1937 when marijuana cigarettes or “reefers” were widely sold (marijuana prohibition was supported and promoted by tobacco growers).

- Ban relaxed during WWII, supported by USDA
Marijuana use

- During the 1960’s and 70’s, a resurgence of marijuana use – drug of choice for “hippies” in the social revolution.

- Recent trends tend to be on stricter and harsher sentences for users and dealers.

- Most of Europe ignores marijuana use. In the Netherlands, marijuana use is tolerated, legal. England also has relaxed its marijuana laws, with reduced penalties for use or possession. Spain, Italy and Luxembourg have decriminalized most drug use.
Active compound

- Marijuana contains cannabinoids, and delta-9-tetrahydrocannabinol (THC) is the psychoactive component.

- **Hemp** (*Cannabis sativa* subspecies *sativa*) is a tall erect cultivar with long internodes and very little THC.

- **Marijuana** (*Cannabis sativa* subspecies *indica*) is a wild plant, short and bushy – high in THC.
Forms of *Cannabis*

- **Marijuana** – common form found in the streets: dried and crushed leaves, usually smoked.
- **Hashish** – resin from recently fertilized flowers. Usually smoked, eaten or drunk; rare in U. S.
Medical uses

- Used for centuries to treat several ailments.
- Now, used to treat glaucoma – eye disease, pressure within the eye. THC reduces ocular pressure.
- Also, as an aid to people undergoing chemotherapy – THC reduces side effects such as nausea, vomiting, loss of appetite.
- AIDS patients also use it to counteract weight loss.
- Multiple sclerosis patients – reduces spastic movements.
- Activists trying to legalize medical use.
Cocaine and the Coca Plant

- **Cocaine** is the major alkaloid of *Erythroxylum coca* – the coca plant
- A small tree or shrub, with shiny evergreen leaves
- Native to the Andes Mountains of South America
- Coca plant was sacred to ancient Incas – leaves were chewed for endurance and stamina
- After conquest, Spanish allowed natives to keep chewing coca leaves for greater productivity
- Still today, leaves chewed by indigenous people in Peru, Bolivia to alleviate hunger, pain and fatigue
Cocaine

- Cocaine was isolated from coca leaves in the 1850’s in Germany
- Stimulating properties were famous: Sigmund Freud described it as a “magical drug”
- In the US, it gained popularity in over-the-counter medicines, tonics and beverages – claims of curing colds, asthma, hay fever, headaches
- Coca-Cola was initially marketed as a “brain tonic” and it contained cocaine – later removed as negative effects were evident
- **Harrison Narcotic Act** of 1914, antinarcotic law that regulated the use of cocaine, opium and morphine
Cocaine use

- In the 1970’s and especially the 1980’s, cocaine use increased dramatically.
- Cocaine makes its way to U.S. from S. American plantations.
- Crack cocaine is made by heating freebase cocaine with baking soda – solid chunks of “rock” cocaine smoked in a pipe, gives a high in seconds. A highly addictive form of cocaine.
Medical uses

- In the beginning, it was valued for its anesthetic properties
- Now, a synthetic form of cocaine called Novocain (procaine) and Xylocaaine are used as local anesthetic, to num certain regions (dentists use these)
- Cocaine constricts blood vessels; reduces blood flow during surgery
Deadly effects of cocaine

- Cocaine stimulates the CNS, produces a short-term feeling of euphoria, burst of energy and alertness
- It can also increase heart rate, respiration, blood pressure and body temperature, and a dilation of the pupils
- Cocaine abuse can result in heart attacks, cerebral hemorrhage, respiratory failure, convulsions
- Cocaine is the most addictive of drugs
Peyote

- Peyote is the cactus *Lophophora williamsii*, native to Mexico and southwestern Texas.
- The dried, cut tops of this green-gray cactus are called buttons – either consumed directly or soaked in water.
- Mescaline is the alkaloid that gives hallucinations, visions, etc.
- Widely used by Aztecs, now used by Native Americans – a sacred plant used in religious rituals.
Kava

- Kava (*Piper methysticum*) is a small shrub related to black pepper plant
- Kava roots are used to prepare an intoxicant
- Widely used in the islands of the South Pacific, especially Hawaii, Fiji, Polynesia
- Lactones are the active ingredients in kava; they make people relaxed and friendly
- Primarily used as a tranquilizer
- However, it can cause liver and kidney damage
Other psychoactive plants

- *Ipomea violacea* – morning glory, contains a powerful hallucinogen. Used in Mexico by the Aztecs.

- Nutmeg, *Myristica fragrans*, is a cooking spice, but if consumed in large amounts, it has hallucinogenic properties. Has bad side effects like nausea, headache, dizziness, vomiting, irregular heartbeat, etc.

- Virola – made from bark of Amazon trees. A potent hallucinogen used by Amazon natives.

- Caapi – also from the bark of trees from the Amazon, the active compound is harmine, a powerful narcotic.
Conclusions

- Many of these psychoactive plants and the derived drugs originally had medicinal or religious uses.
- Caffeine and nicotine are also powerful alkaloids that are also addictive and affect the CNS.
- Psychoactive drugs play an important role in almost every aspect of today’s society.
- Dosage (quantity) can determine whether a drug like morphine and cocaine can be medicinal, hallucinogenic or toxic (deadly).