Tuesday Lecture – Psychoactive and Poisonous Plants

Reading: Textbook, Chapter 12

Test II – Thursday 3/30

First Project Presentations: Next Tuesday

Please bring presentation file (e.g. powerpoint) to me, either on digital media or sent by e-mail, one lecture prior to your presentation

Presentation should be 5-10 minutes.

Practice your presentation!

Major Psychoactive Drugs from Plants used in U.S.A.

Marijuana (*Cannabis sativa*)

Heroin (*Papaver somniferum*)

Cocaine (*Erythroxylum coca*)

Tobacco (*Nicotiana tabacum*)

Chemistry and Pharmacology of Psychoactive Drugs

Mode of activity

1. Absorption into bloodstream
2. Circulation (→ "rush")
3. Activity

-- affect neurotransmitters:

Can mimic actions = agonists

Can inhibit actions = antagonists

Neurotransmitters

5 major types

1. Acetylcholine → stimulates muscle contractions; slows heart
   antagonists: atropine, scopolamine
   agonists: nicotine; stimulants
2. Norepinephrine → stimulates neurons; reused
   antagonist: cocaine agonist: mescaline
3. Serotonin → stimulates cells regulating sensory perceptions
   alteration of neurons: LSD-type compounds → illusions etc.

Neurotransmitters, cont.

4. Dopamine → influences areas that control pleasure responses
5. Peptides → act as painkillers, etc. (endorphin, etc.)
   - active in minute amounts; affect very specific receptors
   agonists: opiates, tetrahydrocannabinol

History of Drug Use

Use of mind-altering drugs is ancient

-- present in many indigenous cultures

Difference:

-- indigenous cultures – drugs used by certain people in the society (shamans), in specific rituals

-- U.S. 21st century culture – dissociation of drug use from formal cultural or religious customs

Fig. 12.4, p. 292

Marijuana – *Cannabis sativa*

Cannabis sativa – multi-use plant:

- fibers → ropes, fishnets, clothing
- seeds → food, oil (non-food uses)
- glands → psychoactive drug

Cannabaceae

- Includes only *Cannabis* and *Humulus* (hops)
- Related to Moraceae, Celtidaceae, Ulmaceae
- herbaceous, laticifers, dioecious

Fig. 12.5, p. 293

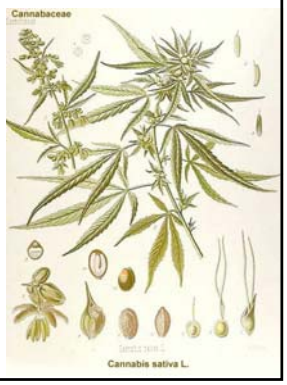


Fig. 12.5, p. 293

Cannabis flowers

Pistillate – 2 stigmas/flower

Staminate – several stamens/flower

Cannabis Biology

Major Drug Component – delta-trans-tetrahydrocannabinol (THC)

- binds to specific receptors in brain

THC- produced in glands on leaves and flowers

-- female plants produce more glands

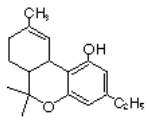
-- gland production stimulated by heat, sunlight, drought

-- sinsemilla (sin = without semilla = seeds) – particularly strong

Hashish – product - relatively pure resin

Glands

THC



Marijuana – History of Use

Cannabis – native to central Asia

Chinese – first to use, employed for fabric, medicines

India – country where first used for hallucinogenic properties

Africa – introduced through Arab traders; used as medicine

Europe – became popular in 1800s

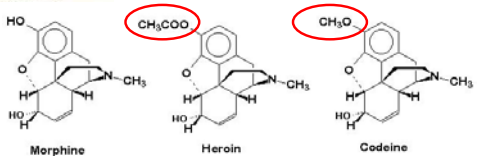
U.S.A. – 1900s -- use proscribed, outlawed

End of 20th century – contentious debate regarding merits of legalization

Fig. 12.7, p. 295

Papaver Alkaloids- Opiates

Fig. 11.6, p. 279



Morphine Heroin Codeine

Opiates – History and Politics

3000 BC – first records of use; 2500 BC – Sumerian "joy plant"

Romans/Greeks – familiar with opium

Europe – 1525, rediscovery of solution of opium in alcohol = laudanum (Paracelsus)

Chinese – first introduced in 7th century AD by Arab traders

→ Banned by government

British trade policies → forced Chinese to trade for opium

1803 – morphine purified → able to deliver it in defined doses

Potent painkiller, but problem – addictive

Heroin – synthetic derivative of morphine -- addictive

Opium Production - Geography

Problems:

Area of production – poor countries, important cash crop

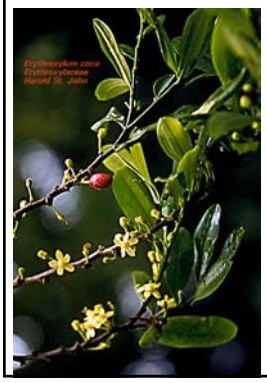
Area of consumption – wealthy countries, deleterious social effects

Transport – through remote areas, effects on biodiversity

Opium Production – 2002 Update

Poppy field in Afghanistan – lifeline for subsistence farmers?

Cocaine



Erythroxylum – shrubby species of Andean highlands

- used by Incas as mild stimulant (must be mixed with basic solution to aid in extraction/absorption of alkaloids)

Cocaine – History of use

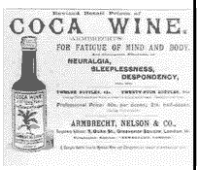
3000+ yrs – used by indigenous peoples in South American highlands as mild stimulant

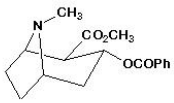
1860 – cocaine isolated in pure form

1884 – S. Freud "Uber Coca" – recommended use

1800s – used in various products, including Coca-cola

1904 – use banned from food products





Cocaine

Andean User – 0.2 mg/day (chewing 57 g leaves)

Heavy User (U.S.) – 2-3 g (2000-3000 times dose of Andean user)

Heart Failure, as low as 20 mg (100 times dose from chewing leaves)

Cocaine – History of Abuse

1914 – Drug declared illegal in U.S.A.

Coke = hydrochloride salt of cocaine, water soluble so it moves across membranes (sniffing or snorting → powder taken into nostrils)

Crack = altered form by treating coke with boiling water and baking soda (freebase, involves use of ether in process → more dangerous)

Both crack and freebase can be injected or smoked

Addictive, debilitating drug

1998 – 1.5 million Americans chronic cocaine/crack users

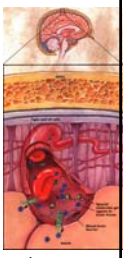
*** Can be lethal at first use ***

Cocaine – special problems

Mode of action: interferes with re-uptake of dopamine, brain neurotransmitter → prolongs feeling of well-being

Physiological effects → addiction + withdrawal

"Crack" Babies – from mothers addicted to crack cocaine



Red=active

Blue-inactive

Destruction of mid-altitude forests in Andes to produce crop, in Peru, Colombia

Association with rebellions – e.g. Shining Path (*Sendero Luminoso* - Peru)

Tobacco

Solanaceae (alkaloid-containing family)

Nicotiana – N. tabacum; N. rustica, N. suaveolens

Native to New World

Tobacco – History of Use

Native Americans – smoking, eating, snuffing

-- medicinal uses

-- considered sacred by many tribes

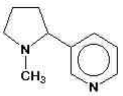
1492 - Columbus – took tobacco to Old World

1556 – Thevet took seeds to France, started cultivation in Europe

1604 - King James I: Counterblaste to Tobacco

1600s – British-American colonies, important cash crop

Tobacco - Chemistry



Nicotine (2)

Nicotine – major alkaloid

- extremely addictive, passes into brain faster then heroin or caffeine
- release of dopamine through action on acetylcholine receptors
- stimulates release of adrenaline

1880 – change in curing process → acid tobacco smoke

- must be inhaled to produce effect (reaction on surface of lungs)
- effect is exhilarating, likely to produce dependence/addiction
- byproduct – constituents in smoke carried to lung surface

Tobacco and Health - History

1602 – first report to link tobacco smoking to possible ill health

1795 – report of lip cancers associated with smoking

1920s – medical reports linking lung cancer to smoking

1966 - health warnings on cigarette packages

1993 – EPA report classifying Environmental Tobacco Smoke (ETS) as a carcinogen

1994 – list of additives (600) released by tobacco industry

1998 – tobacco settlements, states and tobacco industry ($206 billion)

Recently recognized: effects on non-users:

1. Second-hand smoke
2. Unborn and children

Tuesday Lecture – Plant Beverages with Caffeine

Reading: Textbook, Chapter 13