Psychoactive Plants: Opium Poppy, Marijuana, and Cocaine

Psychoactive Drugs

Psychoactive drugs affect the central nervous system mainly by influencing the release of neurotransmitters or mimicking their actions.

On the basis of their effects, they can be classified as stimulants, hallucinogens, or depressants.

Stimulants excite and enhance mental alertness and physical activity; they reduce fatigue and suppress hunger.

Hallucinogens produce changes in perception, thought, and mood, often inducing a dreamlike state.

Depressants dull mental awareness, reduce physical performance, and often induce sleep or a trancelike state.

By strict definition, a narcotic drug is one that induces central nervous system depression resulting in numbness, lethargy, and sleep.

In contemporary use, the term narcotic applies to any psychoactive compound that is dangerously addictive (under this definition, cocaine, a stimulant, would be a narcotic drug).

Addictive compounds generally elicit one or more of the following: psychological dependence, physiological dependence, and tolerance.

The Opium Poppy

The ancient curse

The opium poppy, *Papaver somniferum*, belongs to the poppy family, Papaveraceae.

The ovary matures into a capsule, and if the capsule is sliced when it is still green, it exudes a milky latex rich in potent alkaloids (see fig. 20.1).

The dried latex turns brown and can be peeled from the capsule; this is crude opium.

Opium has been eaten, drunk, and smoked for centuries; the usual method of preparation was to dissolve the crude opium in wine.

Later, Hippocrates and other early physicians advocated poppy wine as a medicine for many complaints.

During the Middle Ages, a common method of preparing opium was to dissolve it in alcohol; this tincture, later known as laudanum, became a popular medication for centuries.
The Opium Wars

The Chinese used opium for centuries mainly for medicinal purposes.

After the introduction of tobacco smoking to China (ca 1600 A.D.), tobacco was mixed with opium; gradually the amount of tobacco decreased until opium was smoked alone leading to addiction among many Chinese.

The British were trading with the Chinese for silk, tea, and porcelain, but the Chinese demanded payment in silver.

To alleviate the drain of silver from Great Britain, the British decided to exploit the Chinese addiction to opium.

The British (via the British East India Company) had access to large amounts of opium, mainly from India, and a large illegal trade with opium rather than silver used as payment for Chinese goods developed through the port of Canton (the U.S. and other countries were also involved).

In 1839, in an attempt to stop the opium trade, the Chinese government confiscated and destroyed all the opium in Canton harbor.

The British retaliated by sending warships, and the first Opium War lasted from 1839 to 1842.

The British won and received major concessions including the right to trade in opium, the opening of more ports in China for foreign trade, and establishment of Hong Kong as a British colony.

The second Opium War was fought 10 years later; Britain, other European countries, and the U.S. were granted additional concessions.

The opium trade ended in 1913, but by this time opium was being cultivated in China and some 25% of the population was addicted.

Opium alkaloids

More than 20 alkaloids have been identified in opium, with morphine and codeine probably the most significant.

Morphine was isolated in 1806 and was soon recognized for its analgesic value.

Endorphins are chemicals produced naturally in the brain that modify mood by reducing sensations of pain and enhancing pleasurable feelings; endorphins bind to receptors in the brain, spinal cord, and intestines.
Morphine depresses areas of the brain involved in the perception of pain and reduces anxiety that accompanies pain, apparently by binding to endorphin receptor sites.

Morphine is a general central nervous system depressant and, like opium, is strongly addictive.

The use of morphine declined dramatically after it was realized just how addictive the drug could be, but it is still the drug of choice today for intense pain (e.g., from severe burns, visceral pain during recovery from surgery, pain associated with some cancers, pain from kidney stones).

Medically, codeine is one of the most commonly used opiates; it has value as an oral analgesic but is only one-fifth as strong as morphine; it is usually used in combination with nonopiate analgesics such as aspirin and acetaminophen.

Codeine is superior to morphine in suppressing the cough reflex in the central nervous system; therefore, it is often used in prescription cough syrups.

Heroin

Heroin, a semisynthetic derivative of morphine, was introduced as a nonaddictive opiate with analgesic properties superior to morphine and cough-suppressant properties superior to codeine; it was used in many over-the-counter medicines for about two decades (see fig. 20.2).

We now know that heroin is six times more addictive than morphine; it is not used medicinally in the U.S. nor is it manufactured here legally.

Withdrawal

Addictive substances, including opium and opium derivatives, trigger a withdrawal response when the drug is no longer taken.

Common symptoms include increased respiration, perspiration, runny nose, goose bumps, muscle twitches, insomnia, vomiting, and diarrhea.

Marijuana

The marijuana plant is Cannabis sativa, but some taxonomists recognize two additional species and several varieties.

Marijuana plants are dioecious, meaning that staminate (male) flowers and pistillate (female) flowers are on different plants (see fig. 20.3).

The plants are known for their resin production by glandular trichomes, with the maximum amount of resin coating the unfertilized pistillate flowers and adjacent leaves.
Potency of the resin, which contains the hallucinogenically active compounds, varies greatly depending on genetic strains and growing conditions.

It is believed to have originated in central Asia; it is widely cultivated today and many names have been given to the plants and to products made from the plants or resin (e.g., marijuana, hemp, grass, pot, hash, hashish, bhang, charas, ganja, ma, kif, dagga).

Early history in China and India

Use of Cannabis can be traced back about 5000 years to ancient China where the hemp plant was valued for its fibers (for cloth, paper, and rope) and medicinal properties.

Earliest documented records of marijuana’s use as a hallucinogen can be traced to the Scythians, ancient nomadic Slav horsemen from central Asia, about 500 B.C.

Marijuana use spread from central Asia to Asia Minor, northern Africa, India, and elsewhere.

The first written mention in India is found in the Sanskrit Zend-Avesta around 600 B.C.

Marijuana use in India was associated largely with religious ceremonies and achieving a contemplative state.

Three grades of Cannabis have been recognized in India:

- Bhang, the least potent, consists of dried, cut tops that are ground with spices to prepare a drink or candy.

- Ganja is prepared from resin-rich pistillate flowers and tops of specially bred high-yielding strains; it is usually smoked.

- Charas, the most potent, consists of pure resin (also known as hashish) from these special strains and is also smoked.

The use of Cannabis spread throughout the Muslim world, into the Middle East and Africa where hookahs (water pipes – see fig. 20.4) were commonly used for smoking hashish.

Legend has it that Hashishins, 12th-century religious fanatics who swore to kill all of their enemies, were worked into a murderous frenzy by smoking Cannabis; the words “assassin” and “hashish” both derive from the name Hashishin.

Spread to the West

Marijuana was probably introduced into the U.S. around the turn of the 20th century, possibly from Mexico or the Caribbean Islands.
Its use became popularized in the U.S. in the 1920s, but in the 1930s concerns about
marijuana led to the establishment of laws prohibiting its use

A dramatic increase in marijuana use came about during the social revolution of the
1960s; marijuana became the recreational drug of choice among members of the so-
called counterculture of this time

Today, marijuana use is still popular, but it competes with a host of other readily
available drugs

THC and its psychoactive effects

_Cannabis_ contains a large number of phenolic compounds known as cannabinoids, but
the main psychoactive component is delta-9-tetrahydrocannabinol (THC)

The concentration of THC in the plant varies considerably, depending on genetic strain,
sex of the plant, climate, and growing conditions

The effects of _Cannabis_ include a sense of euphoria and calmness

According to studies, even moderate use of marijuana impairs learning, short-term
memory, and reaction time

Because THC is fat soluble, it accumulates in body tissues, and measurable amounts
may remain in the body for days after inhalation

Effects of marijuana on males include a decrease in sperm production and decreased
testosterone levels; in pregnant women, THC can cross the placenta and possibly
damage the fetus

Marijuana and hashish are usually inhaled in smoke, which can damage lung tissue

The effects of marijuana relate to the interaction of THC with cannabinoid cell surface
receptors in many regions of the brain

Medical use

Over the centuries in various cultures, marijuana has been used to treat numerous ailments

In contemporary medicine, marijuana is used mainly to treat glaucoma and as an aid to
chemotherapy

Glaucoma is a group of eye diseases characterized by increased pressure within the eye
that can damage the optic nerve and cause blindness
Smoking marijuana and ingesting preparation with THC significantly decrease ocular pressure in patients with glaucoma.

Patients undergoing chemotherapy for cancer often experience side effects of nausea, vomiting, and loss of appetite; these side effects can be reduced by using marijuana or marinol, a synthetic form of THC.

Marijuana has also been used to counteract weight loss associated with the AIDS wasting syndrome, and to reduce spasmodic movements in patients with multiple sclerosis and Parkinson’s disease.

Since 1996, eight states (Alaska, California, Colorado, Hawaii, Maine, Nevada, Oregon, and Washington) have enacted laws or passed referenda that effectively allow patients to use medical marijuana.

Several studies are underway to determine the medical efficacy of marijuana, and some physicians have called for a reclassification of marijuana from a Schedule I drug (defined as a drug with no accepted medical use and a high potential for abuse) to a Schedule II drug (a drug that can be prescribed for appropriate medical applications).

Cocaine

Cocaine is the major alkaloid of the coca plant; it occurs in the leaves, which can be harvested two or three times a year.

Cocaine belongs to a group of compounds known as tropane alkaloids, many of which occur in the nightshade family.

South American origins

The coca plant is native to the Andes where the leaves have been chewed for centuries; figurines depicting coca chewing date back 3500 years (see fig. 20.5).

When chewed, coca leaves reduce appetite and thirst, and increase energy levels and endurance.

According to myth, a god created the coca plant to alleviate hunger and thirst among the people.

By the end of the 15th century, use of coca was widespread among the Incas, but casual chewing was considered a sacrilege.

After the Spanish conquest, enslaved natives working in mines were given coca leaves to chew.
Freud, Holmes, and Coca-Cola

Cocaine was isolated from coca leaves in the late 1850s; its anesthetic qualities were quickly recognized, but it was the stimulating qualities that popularized it.

Sigmund Freud was an enthusiastic advocate of the drug as a stimulant and as a means of combating morphine addiction.

At the same time, cocaine was gaining in popularity in the U.S. and could be found in over-the-counter medicines, tonics, elixirs, and beverages.

As a preparation for colds, asthma, and hay fever, its effectiveness was related to the shrinking of mucus membranes and draining of sinuses.

It was promoted as a panacea for ailments from headaches to hysteria, and coca-wine became one of the most popular beverages of the late 19th century.

Another cocaine-containing beverage was Coca-Cola, created in 1886 and marketed as a “brain tonic”; by the end of the century, negative effects of cocaine were recognized and it was eliminated from the Coca-Cola recipe in 1903.

Widespread use of cocaine in the late 19th century is also evident from its appearance in literature of the day; the fictional detective Sherlock Holmes was a cocaine user.

Cocaine was included under the Harrison Act of 1914, the first federal antinarcotic law that regulated the use of cocaine, opium, morphine, and heroin.

Coke and crack

By the mid 1970s, cocaine use dramatically increased, and it was the favorite drug of the middle and upper class by 1980.

It was believed that cocaine was not addictive and was relatively harmless (damage to the nose and mucus membranes was considered the major drawback).

Today, it is generally recognized that cocaine is a seriously dangerous drug.

Cocaine makes its way into the U.S. from plantations in South America, mainly Colombia, Ecuador, Peru, and Bolivia; these plantations produce approximately 400 tons annually.

The leaves are extracted to produce cocaine base, which is refined into cocaine hydrochloride, a white powder that is generally cut with various adulterants so that the percentage of cocaine hydrochloride in the street drug is reduced to about 12%.

In this form, the powder can be snorted and the alkaloid absorbed through the mucus membranes of the nose.
Freebasing involves boiling the powder in an ether solution to produce pure cocaine (the freebase), which is smoked to produce an intense high.

Crack is a form of freebase prepared by heating a cocaine hydrochloride solution with baking soda to produce solid chunks that can be broken into tiny “rocks”, which are smoked to produce a quick, intense high.

Crack is an especially addictive form of cocaine.

Medical use

Cocaine acts as a local anesthetic, temporarily blocking the transmission of nerve impulses at the site of application.

Novacain and Xylocaine, commonly used synthetic local anesthetics, are structurally similar to cocaine.

Another valuable property of cocaine is its ability to constrict blood vessels when applied locally; this quality has made cocaine the anesthetic of choice for ear, nose, and throat surgery (it was formerly used for eye surgery as well).

A deadly drug

Cocaine is a powerful stimulant to the central nervous system that produces a short-lived euphoric high.

The high is accompanied by a burst of energy and alertness similar to that produced by an intense adrenalin rush.

Many users experience depression and lethargy following the high.

Physiological effects of cocaine include increased heart rate, respiration, blood pressure, and body temperature, and dilation of the pupils.

Cocaine abuse has resulted in death due to heart attack, cerebral hemorrhage, respiratory failure, and convulsions.

Chronic cocaine use can cause a psychosis similar to schizophrenia with accompanying paranoia and hallucinations.

Heavy users develop insomnia and appetite loss; if they are snorters, there is often considerable damage to mucus membranes and nasal cartilage.

Cocaine is generally recognized as being both psychologically and physically addictive; withdrawal symptoms include depression, irritability, and drug craving.
Main Points from A Closer Look 20.1 – The Tropane Alkaloids and Witchcraft

Tropane alkaloids occur mainly in the nightshade family; they include atropine, hyoscyamine, and scopolamine.

These alkaloids have a variety of effects on the body: they relax smooth muscles, dilate the pupils of the eye, dilate blood vessels, increase heart rate and body temperature, induce sleep and lessen pain, stimulate and then depress the central nervous system, and some can cause hallucinations.

All three of these tropane alkaloids occur in belladonna, henbane, mandrake, and jimsonweed.

Belladonna has a long history of use as a medicinal, psychoactive, and poisonous plant.

Mediterranean women would apply juice from the plant to their eyes, the result being dilation of the pupils and origin of the name “bella donna” or beautiful lady.

Atropine is the alkaloid that causes dilation of the pupils; it is used medically today by ophthalmologists.

Atropine also is used as an antispasmodic for treating Parkinson’s disease, epilepsy, and stomach cramps; as a bronchodilator for treating asthma; as a heart stimulant following cardiac arrest, and as an antidote for various poisons and overdoses.

Atropine itself is toxic and has a history of use as a poison.

Belladonna, henbane, mandrake, and jimsonweed were also used by witches and sorcerers of the Middle Ages to prepare magic potions.

Images of witches flying through the air on broomsticks and transforming themselves into animals originated from hallucinations induced by decoctions produced from these plants.

Henbane was used medicinally in Europe as a sedative and pain reliever, especially for toothache.

Mandrake, because of its root shaped somewhat like the human body, was used to treat male and female sexual complains.

_Datura_ (jimsonweed), because of its cosmopolitan distribution, has been used by many peoples for both medical and hallucinogenic purposes.

The major active compound, scopolamine, can cause hallucinations of floating or flying; it is used today for motion sickness and for its sedative qualities.

This lecture outline was prepared mainly from _Plants and Society_, by Levetin and McMahon, 2003 (3rd edition), and may contain phrases or entire sentences taken verbatim from that source.