Psychoactive drugs are grouped in several ways:

- chemical nature of the compound
- effects
- plant source

The definition of narcotic varies:

- any habit-forming drug
- any drug used illicitly
- specifically, drugs obtained from opium poppy
Table 15.2 organizes psychoactive drugs according to their primary effects.

<table>
<thead>
<tr>
<th>KIND OF PSYCHOLOGICAL EFFECT</th>
<th>PLANT-DERIVED COMPOUNDS</th>
<th>PHYSIOLOGICAL ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavior stimulants and convulsants</td>
<td>Cocaine</td>
<td>Block reuptake of norepinephrine</td>
</tr>
<tr>
<td></td>
<td>Caffeine</td>
<td>Activate intracellular metabolism</td>
</tr>
<tr>
<td></td>
<td>Nicotine</td>
<td>Stimulate acetylcholine receptors</td>
</tr>
<tr>
<td></td>
<td>Strychnine</td>
<td>Block inhibitory synapses</td>
</tr>
<tr>
<td>Narcotic analgesics (opiates)</td>
<td>Opium, morphine, codeine</td>
<td>Mimic endogenous neurotransmitters that relieve pain</td>
</tr>
<tr>
<td>Psychedelics</td>
<td>Tetrahydrocannabinol</td>
<td>Mimic an endogenous neurotransmitter</td>
</tr>
<tr>
<td></td>
<td>Mescaline, myristicine, elemicin</td>
<td>Mimic norepinephrine</td>
</tr>
<tr>
<td></td>
<td>Atropine, scopalamine, ololiqui, harmine</td>
<td>Block acetylcholine action; mimic serotonin</td>
</tr>
<tr>
<td>Antipsychotic agents</td>
<td>Reserpine</td>
<td>Deplete norepinephrine</td>
</tr>
</tbody>
</table>

The Chemistry and Pharmacology of Psychoactive Drugs

Most chemicals with psychoactive properties contain nitrogen and belong to one of the classes of alkaloids.

The most notable exception is delta *trans* tetrahydrocannabinol (THC) (alcohol), the active compound of marijuana.

![Delta-trans-tetrahydrocannabinol](image1)

**FIGURE 15.3**

THC, or delta-*trans*-tetrahydrocannabinol (top), a complex alcohol responsible for marijuana’s intoxicating effects, is now known to bind to specific receptors in the brain. One compound that would ordinarily bind to the receptors appears to be an anandamide (bottom).
The active compounds in psychoactive drugs enter the bloodstream and are transported to all parts of the body.
The History of Psychoactive Drug Use

The use of mind-altering drugs is very ancient.

Ancient people sought substances that would transport them to another world where communication with gods, demons, and the dead was possible.

In most cultures, only specific individuals were allowed to ingest psychedelic substances.

Anthropologists and botanist have found that New World peoples used more species of plants for their psychoactive properties than people in the Old World.

Forty species vs. six species
The History of Psychoactive Drug Use

Important Psychoactive Plants

Marijuana or hemp:

- durable fibers
- seeds are nutritious
- oil is used in lamps, paints, varnishes and cosmetics

Ten-thousand year old potsherds imprinted with twisted hemp fiber suggest that Cannabis is among the oldest cultivated plant. Cannabis is native to Central Asia.

The Chinese were the first to use Cannabis.
Important Psychoactive Plants-Marijuana

The legendary Chinese Emperor Shen Nung observed that female plants contained higher proportions of the creative (yin) principle than the male (yang).

He recommended female plants for correcting spiritual imbalances.

The ancient Vedas, sacred Hindu writings, describe Siva, the Lord of Bhang, bringing Cannabis from the Himalayas for the enjoyment of the Indian people.

India was the country in which hallucinogenic properties of Cannabis were first exploited.

The Bengalis developed a cultivation strategy that maximized production of psychoactive compounds.

The Indians realized that marijuana is dioecious.

Figure 15.5

Female plants are more potent than males.

The resins exuded on the upper leaves and bracts of the female inflorescences are rich in psychoactive substances.

If plants are exposed to heat and sun, then resins are produced in great abundance.
Important Psychoactive Plants—Marijuana

Indians classify *Cannabis* products:

- ganja (potent flowers and upper leaves)
- hashish (charas) (pure resin)

The most common way of ingesting *Cannabis* in India is bhang, a milk-based beverage made with ground *Cannabis* leaves, sugar and spices.

Marijuana reached Europe during the first part of the 13th century.

Marco Polo brought back the legend of “The Old Man of the Mountain” story.

A group of artists and intellectuals in Paris revived this story in the middle of the 19th century.

A French psychiatrist, Dr. Jacques-Joseph Moreau de Tours knew that marijuana changed a person’s perception. He administered it to sane individuals to reproduce symptoms of psychosis.

“Club des Hachichins”

Not surprisingly, some of the art and literature of this period was influenced by marijuana.

Although, Moreau concluded in *On Hashish and Mental Alienation* (1845) that hashish use has deleterious effects on mental health, the use of the drug continued to spread.

In the 15th and 16th centuries, Arab traders introduced marijuana to Africa (dagga).

The drug was commonly given to calm women in childbirth and fed to babies when they were weaned.

Smoking became popular after the Dutch colonized the continent.

The Spaniards introduced *Cannabis* to the New World through hemp cultivation in Chile in 1545.

The British brought hemp to Jamaica around 1800 for fiber production.

Although these commercial attempts failed, *Cannabis* escaped cultivation and spread around the island.

When African slaves were brought to Jamaica in the middle of the 19th century to harvest the sugarcane, they found *Cannabis* growing wild.

In the American colonies, hemp was grown for fiber use.

The introduction of hemp’s psychoactive effects followed the pattern previously established in France and Britain.
In 1876, the Centennial Exposition had a Turkish Bazaar that featured hasish smoking as a special attraction.

In the 1920’s, Harry Anslinger from the Federal Bureau of Narcotics revived the “Old Man of the Mountain” story in an anti-marijuana campaign.

He publicized stories around the horrors of marijuana “addiction.”

States banned the use of marijuana in the 1920’s and 1930’s.

In 1937, the use of Cannabis came under federal jurisdiction with the passage of the Marijuana Tax Law, which made possession or transfer of Cannabis illegal with the exception of medical or industrial purpose (heavily taxed).

In the 1960’s, medical researchers isolated and identified THC.

Over the last 40 years, research has shown that the compound is effective as:

- pain reliever
- combats hypertension
- reduces pressure in the eyes for glaucoma patients
- reduces nausea
- dilates bronchial vessels so provides relief for asthma sufferers
Important Psychoactive Plants-Marijuana

Many studies have been unable to find evidence of the physical dependence and withdrawal symptoms that are the hallmarks of addiction.

However, heavy marijuana use is correlated with:

- diminished sex drive
- lower sperm count
- reduced motor coordination
- impairment of short term memory

Important Psychoactive Plants-Opiates

The capsules of *Papaver somniferum* (Papaveraceae) are rich in alkaloid-containing latex.

Codeine and morphine are the most abundant opium alkaloids.

Sumerian tablets from 2500 B.C. refer to opium as the "joy plant."

Its name comes from the Greek opion for poppy juice.

The early Greeks realized that drinking wine with opium latex led to a trance-like state.

They associated poppies with divination such as Hypnos, the god of sleep, Morpheus, the god of dreams and Thanatos, the god of death.

In the 17th century, the Dutch introduced tobacco smoking to Taiwan and began to mix tobacco with opium in their pipes to treat malaria.

The practice of smoking opium spread to the mainland where it was rapidly adopted throughout the country.
Soon tobacco disappeared from the mixture, and smokers inhaled vapors from heated balls of latex that were dropped in the bowl of the pipe.

Opium smoking became very popular in China and Chinese officials tried to ban the drug.

By 1800, Britain gained a monopoly of the trade rights with China.

The English felt compelled to continue the practice of opium dealing because it was one of the few commodities that China would exchange for silk and spice.

The importation of opium was illegal in England, but they needed to maintain international trade.

In 1839, the Chinese confiscated and destroyed British opium supplies in Canton.

England retaliated by invading China and touched off the first Opium War which ended with a treaty that ceded Hong Kong to Britain.

Opium trading and use in China was strictly forbidden after the establishment of the People’s Republic of China in 1949.

Opium was not common in Europe until 1525 when Paracelsus dissolved opium in alcohol (laudanum).
Important Psychoactive Plants-Opiates

In 1803, morphine was isolated from opium which produced a purified alkaloid that could be given in measured doses.

Morphine is 10 times as strong as opium.

The hypodermic syringe was developed in 1853.

Doctors had a rapid method of introducing morphine into the bloodstream.

The dangers of morphine were recognized after 45,000 soldiers returned home from the Civil War addicted to the pain killer.

In an attempt to develop a non-addicting analgesic, scientists discovered in 1874 that morphine could be chemically altered with 2 acetyl groups.

Heroin was even more powerful than morphine, but originally described as “lacking addicting qualities.”

In 1905, it soon became clear that heroin was more dangerous than morphine.

Heroin crosses cell membranes more rapidly than morphine.

Because of this fast absorption:

- heroin is more addictive than morphine
- must be administered more often than other opiates
- produces pronounced withdrawal symptoms
Important Psychoactive Plants-Cocaine and Crack Cocaine

*Erythroxylum coca* and *E. truxillense* (*Erythroxylaceae*) are native to the eastern slopes of the north-central Andes.

Discoveries of bags of coco leaves in 3000 year old Andean burial sites indicate that inhabitants of this region used long before Europeans discovered South America.

By the time Pizarro conquered Peru, coco was an integral part of the Inca life and considered a sacred plant.

The indigenous preparation of cocaine involved:

- collecting leaves
- drying leaves
- allowing leaves to “sweat” (lightly ferment)

Indians dipped leaves into lime (calcium oxide).

Lime raises the pH of the quid and aids in extraction and absorption of alkaloids.

The leaves are chewed and either expelled or swallowed.

Chewing produces:

- a feeling of well-being
- lessens sensations of hunger and fatigue

Important Psychoactive Plants-Cocaine and Crack Cocaine

The Spanish took coca back to Europe, but it did not receive much attention in leaf form.

In 1860, cocaine was isolated and became very popular.

Sigmund Freud published *Über Coca* (1884) and recommended it as a treatment:

- alcoholism
- morphine addiction
- local anesthetic
- use for depression
Important Psychoactive Plants-Cocaine and Crack Cocaine

Coca wine beverage in the 1860's

Coca-Cola which included caffeine-rich extracts of *Cola nitida* and coca was marketed in 1886 as a headache remedy and tonic.

Since 1904, federal law has prohibited the inclusion of cocaine in any beverage.

As more and more reports of cocaine-induced violence were reported at the turn of the 19th century, the government took steps to reduce the use.

In 1914, the Harrison Narcotics Act formally declared the drug illegal.

Cocaine is a 3-ringed alkaloid, but it is most commonly taken as a hydrochloride “salt” known as coke.

Coke is usually diluted with other substances:

- sugar
- caffeine
- lidocaine
Important Psychoactive Plants-Cocaine and Crack Cocaine

The salt form is water-soluble and moves easily across mucous membranes of the nose.

Crack is produced by treating with boiling water and baking soda.

If either is used in the extraction, then freebase is produced.

Both can be injected or smoked.

They are highly fat-soluble and pass quickly across cell membranes.

In the United States, pure cocaine has become extremely addictive.

1.5 million and 4.5 million chronic cocaine and crack users

Cocaine acts primarily by interfering with the reuptake of dopamine.

Dopamine produces feelings of well-being.

Dopamine is normally pumped back into the original neuron.

Cocaine prevents the reuptake of dopamine and prolongs the feelings of well-being.

It also blocks the uptake of other neurotransmitters.

The sustained use of cocaine produces physiological changes in the brain that leads to addiction and withdrawal.

Unlike drugs such as morphine, the direct effects of cocaine are primarily psychological.

Chronic cocaine abuse leads to scabbing of the mucous membranes and deterioration of the nasal septum.

Continual use leads to the depletion of neuroreceptors.

Prolonged cocaine use can result in:

- seizures
- aggressive, paranoid, and anxious behavior
- lack of sleep
- loss of appetite
- eventual heart damage
- increased risk of heart attacks
Next to alcohol and caffeine, nicotine is the most widely used psychoactive drug in the world today.

The Centers for Disease Control and Prevention (CDC) estimate about 40 million Americans (18 and older) smoke tobacco and about 480,000 deaths per year can be attributed to smoking.

Tobacco comes from *Nicotiana* (Solanaceae), which is primarily a New World genus. *Nicotiana tabacum* is native to Central America and South America, and its relative *N. rustica* is native to eastern North America.

Tobacco was smoked, eaten and snuffed by native people throughout the New World at least 1000 years before Columbus landed in the West Indies.

Among Native Americans tobacco was used medicinally to ease pain of childbirth and stave off hunger on long hunts.

Dried leaves were valuable and incorporated into symbolic practices like smoking a peace pipe.

Maya priests thought that smoke rising from their pipes carried messages to the gods.
Important Psychoactive Plants-Tobacco

Columbus was presented with tobacco leaves on his voyages.

Rodrigo de Jerez was the first European to smoke tobacco.

Claims of tobacco’s medicinal virtues:

- female problems
- snake bite antidote
- lung strengthener
- ulcer remedy
- cure for the plague
- potent aphrodisiac

Commercial production of tobacco began in Brazil in 1600 and Virginia in 1612.

The British promoted tobacco cultivation in their colonies to ensure a national supply.

An acre planted in tobacco yields 4 times the revenue of an acre planted in corn.

For many years, tobacco was the most important item of trade between England and North America.

Smoking was enjoyed before 1880, but its popularity greatly increased because of a change in the tobacco curing process.

Farmers began to use hot air piped to drying rooms via flues.

The indirect drying produced a milder form of tobacco which was perfect for cigarettes.

However, these tobaccos produced an acid smoke when burned.

Acid tobacco smoke must be inhaled to produce any physiological effect.

The inhaled smoke is neutralized on the surface of the lungs and the nicotine carried in the smoke is readily absorbed through the lungs.
Important Psychoactive Plants - Tobacco

Nicotine, the major alkaloid in tobacco, is extremely addictive.

It passes across the protective barrier of the brain faster than heroin or caffeine.

Other Psychoactive Plants

From Egyptian dynastic times through the Middle Ages, one of the major sources of hallucinogenic compounds (and poisons) in Europe was a group of herbs that belong to the deadly nightshade family (Solanaceae).

Historically, the most important were:

- **Atropa belladonna** (Europe)
- **Datura** (warm areas of North America)
- **Mandragora officinarum** (Europe)

The active compounds in these species are tropane alkaloids that slow smooth muscle action.

They act by inhibiting acetylcholine receptors in both the central and peripheral nervous system.

Carefully measured amounts are useful in treating heart irregularities.

In larger but sublethal doses, these same alkaloids produce hallucinations.

In Europe, belladonna, henbane and mandrake assumed great importance during the Middle Ages in witchcraft and folk medicine.

Atropine can be absorbed through the skin.

During the Middle Ages, while under the influence of atropine, witches were transported to rendezvous with spirits or demons.
Other Psychoactive Plants

The portrayal of witches flying on brooms may come from the “broom pole” representing the stick used to apply atropine-containing ointment to vaginal membranes.

Caapi (Banisteriopsis caapi; Malpighiaceae) is one of the most important groups of plants used by South American Amazonian tribes as a source of hallucinogenic compounds.

Infusions of mashed bark or stems are chewed to release the active alkaloid.

People using caapi describe feelings of having experienced death or a separation of spirit and body.

Sometimes hallucinations produce terrifying apparitions of jaguars or snakes.

These compounds, like LSD, have structures similar to the brain neurotransmitter serotonin.
Other Psychoactive Plants

Ololiuqui (o-low-lee-oo-key) seeds are ingested, usually only by experienced individuals during rituals.

*Turbina corymbosa* and *Ipomoea tricolor* are in the morning glory family (Convolvulaceae).

Both plants are used for altering perceptions and the seeds contain lysergic acid diethylamine, the same compound present in LSD.

Before its discovery in *Turbina* and *Ipomoea*, lysergic acid alkaloids were thought to be restricted in nature to fungi.

Several species of the cactus family are used as sources of hallucinogenic compounds.

Best known is peyote, *Lophophora williamsii*, a small gray-green cactus native to the Rio Grande valley of Texas and northern New Mexico.

Sixteenth century reports by European explorers describe its use by Aztecs as a divinatory plant.

The Spanish referred to peyote as a “diabolic root.”

After the fall of the Aztec empire, a few Mexican Indian tribes used peyote.

In the United States, the Plains Indians began to use them as late as the 1880’s.

Indians harvest peyote by cutting off the top of the stem.

They ate stem tips, or buttons, fresh or dried.

The initial reaction is nausea, but 1 or 2 hours later the nausea is replaced by kaleidoscopic illusions of vivid colors and distorted perceptions of time.

The faithful report hearing voices of their ancestors who help diagnose or solve problems.
Other Psychoactive Plants

Thirty to 40 different alkaloids and numerous chemicals are ingested when peyote is consumed.

The most active compound is mescaline, which binds to serotonin receptors and excited neurons in the frontal cortex of the brain.

FIGURE 15.33
The chemical structure of mescaline, the dominant psychoactive alkaloid in peyote and related alkaloids that mimic the action of norepinephrine. Myristicine and elemicin are compounds with similar effects found in the spices mace and nutmeg (Chapter 13, Fig. 15.25).
Ch 15-Psychoactive Drugs and Poisons from Plants

How are psychoactive drugs grouped?

What are the different ways to define narcotic?

Name the psychological effects of:
cocaine
caffeine
nicotine

What is the physiological action for each drug?

Name the psychological effects of:
opium
morphine
codeine

What is the physiological action for these drugs?

Name the psychological effects of:
tetrahydrocannabinol (THC)
mescaline
atropine
ololiuqui

What is the physiological action for each drug?

Know history of psychoactive drug use.

Marijuana
Scientific name:
Family:
Place of origin:

Early history (China and India)
Name products from marijuana and hemp.

History of Marijuana
Marco Polo /The Old Man of the Mountain (13th century)
Introduction of marijuana in Africa (15th-16th century)
Introduction of marijuana to the New World (16th century)
Cultivation of marijuana in the New World (hemp cultivation)
Cultivation of marijuana in Jamaica (early 19th century)
History of marijuana in Europe (mid-19th century)-(Paris)
Centennial Exposition-Turkish Bazaar (1876)
History of marijuana in the United States (20th century)

Over the last 40 years, research has shown that THC is an effective compound for which medical conditions?

Heavy marijuana use is connected with which side-effects?

Narcotic analgesics (opiates)
What are the most abundant opium alkaloids?
Know origin/history of opiates
Scientific name:
Family:
Place of origin:

Opium
Early history
17th century-(Dutch)-smoking opium
China (Opium War (Anglo-Chinese War))

Morphine
Early history of morphine
What was morphine used for?
History connected to American Civil War
When was morphine isolated?
**Ch 15-Psychoactive Drugs and Poisons from Plants**

**Narcotic analgesics (opiates)**

**Heroin**

- How is morphine altered to produce heroin?
- When was heroin first synthesized?
- Why was heroin developed?
- What common over the counter medicine contained heroin?
- Why is heroin more addictive and dangerous than morphine?
- What are the most serious problems with heroin?

**Cocaine**

Know origin and history of coco

- Scientific name:
- Family:
- Place of origin:
- Early history of cocaine
- Importance in Incan culture
- How were coco leaves prepared?
- Coco leaves were chewed by indigenous people.
- What effects are produced by chewing the leaves?
- Coco leaves were brought to Europe by the Spanish.
- When was cocaine first isolated?
- Sigmund Freud recommended coco leaves as a treatment for which medical conditions?
- How was coco used in medicinal beverages and tonics?
- Coke is what chemical form of cocaine?
- Coke is typically diluted with other substances such as?
- Why are coke and crack cocaine extremely addictive?
- What is the physiological action of cocaine?
- Prolonged cocaine use can cause what type of symptoms?

**Nicotine**

Know origin/history of nicotine

- Scientific name:
- Family:
- Place of origin:

According to the Center for Disease Control and Prevention (CDC), how many Americans (18 and older) smoke tobacco?

- How many deaths per year are attributed to smoking in the U.S.?
- What are the two species of *Nicotiana* (Solanaceae)?

**Early history of tobacco**

- Indigenous people in New World
- How was tobacco used by indigenous people?
- History of tobacco in Europe.
- Cultivation of tobacco in the New World.
- What were the early “medical virtues” of tobacco?
- Commercial production of tobacco began in ________________ in __________ and __________ in ________________.
- History of tobacco production in the early American Colonies.
- History of tobacco production and smoking in the U.S.
- How did the tobacco curing process greatly increase the popularity of smoking?

**Definitions**

- narcotic
- marijuana
- hemp
- dioecious
- ganja
- hasish
- The Old Man in the Mountain
- Dr. Jacques-Joseph Moreau de Tours
- Club des Hachichins
- dagga
- Marijuana Tax Law
- THC
- opiates
- opium den
- Opium War (Anglo-Chinese War)
- laudanum
- morphine
- heroin
- cocaine
- coco
- Harrison Narcotics Act
- coke
- crack cocaine
- dopamine
- nicotine
- tobacco
- nightshade family
- datura
- belladona
- atropine
- tropane alkaloids
- caapi
- serotonin
- ololiuqui
- morning glory
- lysergic acid
- (LSD-Lucy in the Sky with Diamonds)
- St. Anthony’s Fire
- ergotism
- peyote
- mescaline
Throughout history, which plant family was one of the major sources of hallucinogenic compounds (and poisons) in Europe?

Historically, what are the most important members of the nightshade family?

Where did each plant originate?

What is the active compound in these hallucinogenic compounds?

What is the physiological effect of these compounds?

How were belladona, henbane and mandrake important in witchcraft and folk medicine in the Middle Ages?

**Caapi**
Scientific name:
Family:
Place of origin:
How was the drug taken?
Physiological effects?
Caapi is similar to which brain neurotransmitter?

**Ololiuqui (O-low-lee-oo-key) & Morning Glory**
Scientific name:
Family:
Place of origin:
What part of the plant is ingested?
Hallucinogenic compound:
Physiological effects?

**Peyote**
Scientific name:
Family:
Place of origin:
What part of the plant is taken?
Hallucinogenic compound:
Physiological effects?
General history of peyote in North America?