

# Toxicology Part One

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# Introduction

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A drug can be defined as a natural or synthetic substance that is used to produce physiological or psychological effects in humans or other higher order animals

# Introduction

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The nature of the drug experience can be approached from two distinctly different aspects of human behavior:

- Psychological dependence
- Physical dependence

# Psychological Dependence

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The common denominator that characterizes all types of repeated drug use is the creation of psychological dependence for continued use of the drug.

# Psychological Dependence

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Emotional factors that play a part in drug dependence include the personal characteristics of the user, his or her expectations about the drug experience, society's attitudes and possible responses and the settings in which the drug is used.

# Psychological Dependence

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The intensity of the psychological experience with drug is difficult to define.

Some drugs e.g., alcohol, heroin, and cocaine with continued use lead to a high degree of involvement.

# Psychological Dependence

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Others such as marijuana and codeine have a lower potential for abuse.

Our general knowledge of alcohol consumption should warn us of the dangerous of generalizing when it come to drug abuse

# Physical Dependence

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Physical dependence is defined as the physiological need for a drug that has been brought about by its regular use. The desire to avoid withdrawal sickness, or abstinence syndrome, ultimately causes physical dependence or addiction.

- Marijuana and cocaine are common drugs of abuse whose regular use does not lead to physical dependence.



# Common Classification of Drugs of Abuse

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Narcotics

Depressants

Stimulants

Hallucinogens

Anabolic Steroids

# Narcotics

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Narcotic drugs are analgesics, meaning they relieve pain by a depressing action on the central nervous system. Their depressant effects impact on blood pressure, pulse rate and breathing rate.

# Narcotics

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The regular use of a narcotic drug will invariably lead to physical dependence.

The most common source for these narcotic drugs is opium, extracted from poppies.

# Narcotics

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Morphine is readily extracted from opium and is used to synthesize heroin.

Addicts frequently dissolve heroin in water by heating it in a spoon, and then inject in the skin.

# Narcotics

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Heroin produces a “high” that is accompanied by drowsiness and a sense of well-being that generally last for three to four hours.

Codeine is also present in opium, but it is usually prepared synthetically from morphine.

# Synthetic Opiates Not Derived From Opium

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OxyContin, with the active ingredient oxycodone, is not derived from opium or morphine, but does have the same physiological effects on the body as do opium narcotics.

OxyContin is prescribed to a million patients for treatment of chronic pain.

# Synthetic Opiates Not Derived From Opium

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Methadone is another well-known synthetic opiate.

Methadone, which is pharmacologically related to heroin, appears to eliminate the addict's desire for heroin while producing minimal side effects.

# Common Narcotics and Overdose Characteristics

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Drug	Characteristics of Drug Overdose
Opium	Difficulty breathing, low blood pressure, weakness, dizziness, confusion, loss of consciousness, coma, cold clammy skin, small pupils
Heroin Codeine Morphine	Difficulty breathing, low blood pressure, coma, spasms of the stomach or intestines, constipation, nausea, vomiting, sleepiness, blue fingernails and lips, death
Methadone	Difficulty breathing, drowsiness, coma, low blood pressure, muscle twitches, blue fingernails and lips
Oxycodone	Slow, difficult breathing, seizures, dizziness, weakness, loss of consciousness, coma, confusion, tiredness, cold clammy skin and small pupils



# Depressants

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Depressants are substances used to depress the functions of the central nervous system.

Depressants calm irritability and anxiety and may induce sleep.

# Depressants

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These include alcohol (ethanol), barbiturates, antianxiety drugs, and various substances that can be sniffed, such as airplane glue, model cement, or aerosol gas propellants such as freon.

# Depressants

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Alcohol (ethyl alcohol) enters the body's bloodstream and quickly travels to the brain, where it acts to suppress the brain's control of thought processes and muscle coordination.

Barbiturates, or "downers," are normally taken orally and create a feeling of well-being, relax the body, and produce sleep.

# Depressants

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Antianxiety drugs unlike barbiturates, produce a relaxing tranquility without impairment of high-thinking faculties or inducing sleep; e.g., Valium, Xanax.

Sniffing has immediate effects such as exhilaration, but impairs judgment and may cause liver, heart, and brain damage, or even death.

# Stimulants

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The drug classification of stimulants includes amphetamines, sometimes known as “uppers” or “speed,” and cocaine, which in its free-base form is known as *crack*.

Stimulants are substances taken to increase alertness or activity, followed by a decrease in fatigue and a loss of appetite.

# Stimulants

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Amphetamine and methamphetamine, often injected intravenously, cause an initial “rush,” followed by an intense feeling of pleasure.

This is followed by a period of exhaustion and a prolonged period of depression.

# Stimulants

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Cocaine, extracted from the leaves of ***Erythroxylon coca***, causes increased alertness and vigor, accompanied by the suppression of hunger, fatigue, and boredom.

# Stimulants

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***Crack*** is cocaine mixed with baking soda and water, then heated.

- Crack is often smoked in glass pipes, and like cocaine, stimulates the brain's pleasure center.



# Stimulants and Overdose Characteristics

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<b>Drug</b>	<b>Characteristics of Drug Overdose</b>
Amphetamines (speed)	High blood pressure, rapid heart rate, agitation, irregular heartbeats, stroke, seizures, coma, death
Cocaine/ crack cocaine	Dangerous rise in body temperature, sweating, tremors, seizures, irregular heartbeats, stroke, confusion, heart attack, bleeding in the brain, death
Methamphetamines	Dangerous rise in body temperature, profuse sweating, confusion, rapid breathing, increased heart rate, dilated pupils, high blood pressure, kidney failure, bleeding in the brain, death

# Hallucinogens

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Another class of drugs is hallucinogens; marijuana is the most widely used illicit drug.

Hallucinogens cause marked changes in normal thought processes, perceptions, and moods.

# Hallucinogens

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Marijuana is the most controversial drug in this class because its long-term effects on health are still largely unknown.

- The Cannabis plant contains a chemical known as tetrahydrocannabinol, THC, which produces the psychoactive effects experienced by users. Its concentration varies in the Cannabis plant.

# Marijuana

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**Marijuana** refers to a preparation derived from the plant *Cannabis*.

The chemical substance largely responsible for the hallucinogenic properties of marijuana is known as *tetrahydrocannabinol*, or **THC**.

# Marijuana

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The THC content of *Cannabis* varies in different parts of the plant, generally decreasing in the following sequence: resin, flowers, leaves, with little THC in the stem, roots or seeds.

# Marijuana

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The THC-rich resin is known as ***hashish***.

Marijuana does not cause physical dependency, but the risk of harm is in heavy, long-term use.

# Medical Marijuana

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Many states are beginning to pass laws to allow for medicinal uses of marijuana

- Commonly prescribed to deal with pain and nausea
- 8 medical reasons allowed for cannabis use
- Most medicinal cannabis is low in THC but high in cannabidiol, CBD, which does not cause psychoactivity
- Most is taken as an oil extract not smoked

# Other Hallucinogens

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Other hallucinogens include LSD, mescaline, PCP, psilocybin, and MDMA (Ecstasy).

LSD is synthesized from lysergic acid, and can cause hallucinations that can last for 12 hours.

Phencyclidine, or PCP, is often synthesized in clandestine laboratories and is often smoked, ingested, sniffed.



# Other Hallucinogens

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Phencyclidine is often mixed with other drugs, such as LSD, or amphetamine, and is sold as a powder ("angel dust"), capsule, or tablet.

Oral intake of PCP first leads to feelings of strength and invulnerability, which may turn to depression, tendencies toward violence, and suicide.

# Hallucinogens and Overdose Characteristics

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Drug	Characteristics of Drug Overdose
MDMA (ecstasy)	Increased heart rate and blood pressure, muscle cramps, panic attacks, seizures, loss of consciousness, stroke, kidney failure, death
Mescaline	Hallucinations, euphoria, dizziness, vomiting, increased heart rate, dilated pupils, diarrhea, headaches, anxiety, irrationality of thoughts
LSD	Dilated pupils, loss of appetite, sleeplessness, increase in body temperature, increased heart rate and blood pressure, sweating, dry mouth, tremors, confusion, distortion of reality, and hallucinations
PCP	Increased heart rate and blood pressure, convulsions, sweating, dizziness, numbness, and possibly death from heart failure. Drowsiness, which can lead to accidents. Users sometimes exhibit psychosis (completely losing touch with reality (that can last for weeks.)

# Anabolic Steroids

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- A chemical structure similar to testosterone
- Promote cell and tissue growth increasing bone mass and body muscle.
- Popular with weightlifters, bodybuilders, and other athletes

# Bacterial Toxins

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## **Tetanus** (also called *Lockjaw*)

- Produced by the *Clostridium tetani* bacteria
- Causes violent muscle spasms

## **Botulism**

- Produced by *Clostridium botulinum*—botulism
- Paralyzes muscles
- Causes irreversible damage to nerve endings
- Extremely deadly in very small amounts
- Most poisonous biological substance

# Pesticides and Heavy Metals

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Drug	Characteristics of Drug Overdose
Pesticides (e.g., DDT, aldrin, dieldrin)	Interferes with the movement of nerve impulses and muscular contractions; anxiety, seizures, twitching, rapid heart beat, muscle weakness, sweating salivation, diarrhea, tearing, coma, and death
Lead	Nausea, abdominal pain, insomnia, headache, weight loss, constipation, anemia, kidney problem, vomiting, blue discoloration along the gum line, seizure, coma, and death
Mercury	Acute poisoning from inhalation causes flu-like symptoms, muscle aches, and stomach upset; chronic poisoning causes irritability, personality changes, headache, memory and balance problems, abdominal pain, nausea and vomiting, damage to the gums, mouth, and teeth. Long-term exposure can cause death.

# Pesticides and Heavy Metals

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Drug	Characteristics of Drug Overdose
Arsenic	Within 30 minutes of ingestion produces abdominal pain, severe nausea, vomiting, diarrhea, muscle cramps, convulsions, kidney failure, delirium, and death. Chronic exposure produces skin lesions, headache, personality changes, nausea, vomiting, diarrhea, convulsions, and coma.
Cyanide	Overdose can be fatal 6-8 minutes after ingestion. Rapidly causes weakness, confusion, coma, and pink skin from high blood oxygen saturation. Produces an almond-like odor.
Strychnine	Enters the body by inhalation or absorption through eyes or mouth. Produces, within minutes, body spasms, temperature rises, violent convulsions, and death.

# Bioterrorism Agents

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## **Ricin**

A poisonous protein in the castor bean

Lethal in extremely small amounts

Enters the body in various ways:

- inhaled as a mist or a powder
- ingested as food or drink
- injected into the body

Causes death within a few hours

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# Anthrax

Bacillus anthracis, which forms endospores

Spreads to humans from infected animals

Enters the human body through:

- Inhalation; causing breathing problems that usually result in death
- Ingestion; becoming fatal in 25% to 60% of cases
- Absorption via the skin; leading to death in about 20% of untreated cases



# Drug-Control Laws

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The U.S. federal law known as the Controlled Substances Act will serve to illustrate a legal drug-classification system created to prevent and control drug abuse.

# Drug-Control Laws

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This federal law establishes five schedules of classification for controlled dangerous substances on the basis of a drug's:

- potential for abuse
- potential for physical and psychological dependence
- medical value

# Schedules of Classification

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Schedule I drugs have a high potential for abuse and have no currently accepted medical use such as heroin, marijuana, methaqualone, and LSD.

Schedule II drugs have a high potential for abuse and have medical use with severe restrictions such as cocaine, PCP, and most amphetamine and barbiturate prescriptions.

# Schedules of Classification

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Schedule III drugs have less potential for abuse and a currently accepted medical use such as all barbiturate prescriptions not covered under Schedule II, such as codeine and anabolic steroids.

# Schedules of Classification

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Schedule IV drugs have a low potential for abuse and have a current medical use such as darvon, phenobarbital, and some tranquilizers such as diazepam (valium) and chlordiazepoxide (librium).

# Schedules of Classification

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Schedule V drugs must show low abuse potential and have medical use such as opiate drug mixtures that contain nonnarcotic medicinal ingredients (Tylenol 3).