Chapter 6, 7, 8
DRUGS
Introduction

• 19th century: active compounds in poppies and coca plants extracted and purified
  – Processing resulted in morphine and cocaine
  – Narcotics were unregulated and widely available from physicians, from drugstores, and through the mail

• Early 1900s: an estimated 250,000 drug addicts in the United States
• **Narcotic**: analgesic or pain-killing substance that depresses vital body functions such as blood pressure, pulse rate, and breathing rate. The regular administration of narcotics will produce physical dependence

• **Analgesic**: a drug or substance that lessens or eliminates pain

• **Hallucinogen**: a substance that induces changes in mood, attitude, thought, or perception
• **Depressant:** a substance used to depress the functions of the central nervous system. Depressants claim irritability and anxiety and may induce sleep

• **Stimulant:** a substance taken to increase alertness or activity

• **Anabolic steroids:** steroids that promote muscle growth

• **Screening test:** a test that is nonspecific and preliminary in nature
• **Confirmation:** a single test that specifically identifies a substance

• **Microcrystalline tests:** tests to identify specific substances by the color and morphology of the crystals formed when the substance is mixed with specific reagents
• Narcotics: Opium, Heroin, Darvon
• Hallucinogens: Marijuana, LSD, STP, DMT, Mescaline, PCP
• Depressants: Alcohol, Barbiturates, Tranquilizers (Librium and Valium), glue sniffing
• Stimulants: Amphetamines, Cocaine, Crack
Preliminary Analysis

Faced with the prospect that the unknown substance may be any one of a thousand or more commonly encountered drugs, the analyst must employ screening tests to reduce these possibilities to a small and manageable number. This objective is often accomplished by subjecting the material to a series of color tests that will produce characteristic colors for the more commonly encountered illicit drugs. Microcrystalline tests can also be used to identify specific drug substances by studying the size and shape of crystals formed when the drug is mixed with specific reagents.
Confirmational Determination

- Once this preliminary analysis is completed, a confirmational determination is pursued.
- Forensic chemists will employ a specific test to identify a drug substance to the exclusion of all other known chemical substances.
- Typically infrared spectrophotometry or mass spectrometry is used to specifically identify a drug substance.
Collection and Preservation

- The field investigator has the responsibility of ensuring that the evidence is properly packaged and labeled for the laboratory.
- Generally common sense is the best guide, keeping in mind that the package must prevent the loss of the contents and/or cross-contamination.
- Often the original container in which the drug was seized will suffice.
- All packages must be marked with information that is sufficient to ensure identification by the officer in the future and establish the chain of custody.
Controlled Substances Act

• CSA, Title II of the Comprehensive Drug Abuse Prevention & Control Act of 1970
  – legal foundation of the Government’s fight against abuse of drugs & other substances
  – a consolidation of numerous laws regulating the manufacture & distribution of narcotics, stimulants, depressants & hallucinogens
Controlled Substances Act

- CSA places all substances into 5 groupings (schedules) based on the substance’s
  - medical use
  - potential abuse
  - safety or dependence liability
Schedule I

- Substance has a high potential for abuse
- Substance has no currently accepted medical use in treatment in the United States
- There is a lack of accepted safety for use of the substance under medical supervision
- heroin, LSD, Marijuana, methaqualone
Schedule II

- Substance has a high potential for abuse
- Substance has a currently accepted medical use in treatment in the U.S. or a currently accepted medical uses with severe restrictions
- Abuse of the substance may lead to severe psychological or physical dependence
- morphine, PCP, cocaine, methadone, methamphetamine
Schedule III

- Substance has a potential for abuse less than those in Schedules I and II
- Has a currently accepted medical use in treatment in the U.S.
- Abuse may lead to moderate or low physical dependence or high psychological dependence
- anabolic steroids, codeine & hydrocodone with aspirin or Tylenol, some barbiturates
Schedule IV

- The substance has a low potential for abuse relative to those in Schedule III
- Has a currently accepted medical use in treatment in the U.S.
- Abuse may lead to limited physical dependence or psychological dependence relative to those in Schedule III
- Darvon, Valium, Xanax
Schedule V

- The substance has low potential for abuse relative to those in Schedule IV
- Has a currently accepted medical use in treatment in the U.S.
- Abuse may lead to limited physical or psychological dependence relative to those substances in Schedule IV
- Over-the-counter cough medicines with codeine
Controlled Substance Analogues

- New class of substances created by the Anti-Drug Abuse Act of 1986
- Controlled substance analogues
  - substances not controlled but found in illicit traffic
  - structurally or pharmacologically similar to Schedule I or II controlled substances
  - no legitimate medical use
- Treated as a Schedule I substance
Emergency or Temporary Scheduling

• Added by the Comprehensive Crime Control Act of 1984

• Allows a substance not currently controlled, but being abused, temporarily into Schedule I
  – only applies to substances with no accepted medical use
  – temp. scheduling order good for 1 yr with a possible extension of up to 6 months
Controlled Substances

• Drugs with no accepted medical use in U.S. are placed in Schedule I
  – are available only for scientific research
• Drugs that have been approved for medical use are placed in Schedules II-V
  – the fact that a drug has been approved for medical uses does not change when it becomes a controlled substance
  • often require written prescriptions with limited refills
Regulation

• The CSA creates a closed system of distribution for those authorized to handle controlled substances

• All entities authorized by DEA to handle controlled substances must be registered
  – complete & accurate records must be kept of all quantities of controlled substances manufactured, purchased and sold
The Drug Scheduling Process

• DEA collects data
• Administrator of DEA requests a scientific & medical evaluation from the Department of Health & Human Services
  – recommendation as to whether a substance should be controlled or removed from control
  – HSS solicits info from the commissioner of FDA, National Institute on Drug Abuse (NIDA) and from the scientific & medical community
The Drug Scheduling Process

• DEA evaluates all available data & determines into which schedule the substance will be placed

• Main issue is the potential for abuse
  – if a drug has not potential for abuse, it cannot be controlled
Controlled Substances

Classification
Classification of Controlled Substances

- Federal & most state codes classify by schedule
- Classification by origin
  - based on whether a substance is naturally occurring, semisynthetic (prepared chemically from a naturally occurring substance) or synthetic
    - no distinction made between a substance obtained from nature & that same substance prepared in a lab
## Classification of Controlled Substances by Origin

<table>
<thead>
<tr>
<th>Naturally Occurring</th>
<th>Synthetic</th>
<th>Semisynthetic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marijuana</td>
<td>Phencyclidine</td>
<td>Heroin</td>
</tr>
<tr>
<td>Cocaine</td>
<td>Amphetamines</td>
<td>LSD</td>
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<tr>
<td>Morphine</td>
<td>Barbiturates</td>
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<tr>
<td>Mescaline</td>
<td>Meperidine</td>
<td></td>
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<tr>
<td>Psilocybin/psilocin</td>
<td>Methadone</td>
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</tbody>
</table>
Classification of Controlled Substances

- Classification by form
  - based on the form in which the substance is most often found when submitted as evidence to the lab
- There are three major forms in which substances are found
  - the plant
  - “marked” tablets, capsules, elixers
  - general unknowns
The Plant

• Forms
  – whole or parts
  – mature or immature
  – extracts that contain appreciable amounts of plant material

• Substances may require some botanical examination as well as chemical analysis

• Examples
  – marijuana, peyote, & psilocybin mushrooms
“Marked” Tablets, Capsules, Elixers

- Legitimately manufactured substances which usually bear logos, numbers, initials, etc
  - gives a clue what the substance might be
  - identity must be corroborated with lab testing
General Unknowns

• Often white or colored powders
• Sometimes “homemade tablets
• Members of this group are usually adulterated (“cut”)
  – never have external marking that help identify them
• Examples
  – cocaine, heroin, some forms of amphetamines & barbituates, PCP
Drug Analysis

Planning an Analytical Scheme
Identifying Compounds in Evidence Samples

• Principles of drug analysis
  – Criminal penalties depend on actual substance present in sample and amount of substance present

• Drug analysis process
  – Step 1: Chemist performs a screening test
  – Step 2: Chemist performs a quantitative analysis to confirm the sample’s identity and determine its mass
General Principles

★ First test should be a visual examination
  – naked eye
  – low-power microscope
    • especially important with plant materials & powders that do not appear to be uniform
    • determine weight or volume of sample

⏰ Examinations should proceed from general to the specific
  – each test should help narrow the number of possible substances that the sample could be
When ever possible, at least one test should be specific for the drug in question. Confirmatory test should be of a different type than those procedures used in the presumptive & separation phases of the examination.

- **Confirmatory tests**
  - IR, GC-MS
- **Presumptive or screening tests**
  - “Spot” tests, TLC
General Principles

- Try to conserve the drugs present as evidence
  - would allow for reanalysis
- If the sample is too small to do a complete analysis
  - perform non-destructive tests before destructive tests
Scheme of Analysis

- Preliminary visual examination of all samples
- Weigh all samples
- Select representative samples (if appropriate)
- Screening tests (usually spot)
- Separation tests
- Confirmatory tests
Scheme of Analysis

1. Quantitative analysis if appropriate
2. Other tests if appropriate
Preliminary Examination

- If there are a large number of samples with similar packaging segregate the samples into groups
- Determine if the mixture is homogeneous
- See if crystals of a drug have been coated onto plant material (microscope)
  - PCP is often coated onto marijuana or parsley
- Hygroscopic materials such as cocaine tend to aggregate & become discolored
Microscopic Tests

• Two Types
  – morphology tests
  – microcrystal tests

• Morphology
  – most commonly used with plant matter such as marijuana
    • look for botanical features
Microcrystalline Tests

• Involves dissolving the sample in a suitable solvent, filtering, and adding a precipitating agent to promote crystallization

• The size & shape of the crystals are highly characteristic of the drug
Identifying Compounds in Evidence Samples

• Presumptive tests: color tests
  – Some controlled substances produce vivid colors when they contact certain reagents
  – Color change is used as a screening test in the field

• Color test reagents
  – Dillie-Koppanyl
  – Duquenois-Levine
  – Marquis Reagent
  – Scott Test
  – Van Urk
Screening Tests

• Primary function to eliminate some drugs from consideration & indicate the identity of a drug

• Categories
  – spot tests
  – microscopic tests
  – spectroscopic tests
Spot Tests (Color Tests)

- Often done on a spot plate or sometimes in a test tube
- Normally destroy the sample
- No spot test is specific for a particular drug
  - negative test is a good indicator for the absence of the controlled substances that respond positively to it
- Diluents may interfere with some spot tests
  - especially concentrated sulfuric acid
Spot Tests

• Marquis
  – 2% formaldehyde in sulfuric acid
    • turns purple in the presence of most opium derivatives
    • becomes orange-brown with amphetamines & methamphetamines
Spot Tests

• Dillie-Koppanyi
  – 1% cobalt acetate in methanol followed by 5% isopropylamine in methanol
    • turns violet-blue in the presence of most barbiturates
Spot Tests

- Duquenois-Levine
  - Reagent A: 2% vanillin & 1% acetaldehyde in ethanol
  - Reagent B: concentrated hydrochloric acid
  - Reagent C: chloroform
    - solutions are added sequentially to vegetation
      - purple color appears in the chloroform layer for marijuana
Spot Tests

• Van Urk
  – 1% solution of p-dimethlaminobenzaldehyde in 10% concentrated hydrochloric acid and ethanol
    • turns purple in the presence of LSD

• Difficult to conduct in field
  – LSD is present in very small amounts in illicit preparations
Spot Tests

• Scott Test (cocaine)
  – solution A: 2% cobalt thiocyanate dissolve in water and glycerin (1:1)
  – solution B: concentrated hydrochloric acid
  – solution C: chloroform
    • powdered cocaine turns solution A blue
    • color turns pink on adding solution B
    • blue color appears in the chloroform layer on adding solution C
Identifying Compounds in Evidence Samples

• Presumptive tests: thin-layer chromatography
  – Separation technique takes advantage of the solubility and physical properties of the controlled substance to separate and distinguish compounds in a mixture
  – Multiple samples and standards can be spotted on the same TLC plate and the results of the separation compared
Confirmatory Tests

• A test that has the capability of identifying a drug after it has been presumptively identified by other techniques
  – individualization
  – generally spectroscopic
    • IR (method of choice in most forensic labs)
      – IR is unique for each compound (“fingerprint”)
      – substance should be as pure as possible
    • Mass Spectrometry
Identifying Compounds in Evidence Samples

• Confirmatory tests: gas chromatography–mass spectrometry
  – GC separates diluents and adulterants from the controlled substance
  – MS records the sample’s mass spectrum
  – MS produces a series of small mass peaks (fragments) that are unique to organic compounds
  – GC-MS identification is the most reliable confirmation test
Identifying Compounds in Evidence Samples

• Confirmatory tests: infrared spectrophotometry
  – Unknown sample must be purified to removed unwanted materials
  – Selected absorption of infrared radiation by organic molecules is a valuable technique for identifying the molecules
Controlled Substances

Some Common Examples
Narcotics

• Bring relief from pain and produce sleep
• Analgesics
  – relieve pain by depressing the central nervous system (CNS)
• Most common source is opium
  – a gummy, milky juice exuded through a cut made in the unripe pod of the poppy
    • Papaver somniferium
Papaver somniferum
Opium Pods
Opiates & Opioids

Opiates
(natural or semisynthetic)

Heroin
Morphine (MS Cotin)
Codeine (Tylenol w/codeine)
Oxycodone (Percodan)

Opiods
(synthetic)

Meperidine (Demerol)
Methadone (Dolophine)
Propoxyphene (Darvon)
Fentanyl (Sublimaze)
Opium

- Crude opium contains ~1/4 by weight of alkaloids
- Two groups
  - benzylisoquinolines
  - phenanthrenes
    - morphine & codeine
- ~10% of total alkaloid content is morphine

The sap is extracted by slitting the pod vertically in parallel strokes with a special curved knife.
The Phenanthrenes

Codeine

Morphine
Narcotics

• Morphine
  – The most concentrated alkaloid (10%)
  – Potent analgesic and cough suppressant

• Codeine
  – One of the most potent cough suppressants known
Heroin

- A semisynthetic derivative of morphine
- Street heroin is usually no more than 35% heroin
  - common diluents
    - quinine
    - starch
    - lactose
    - procaine
    - cocoa (Mexican heroin)

A street user deal of heroin which may vary from 125-250mg and cost approximately $25
Narcotics

• Heroin
  – Similar physiological action to morphine
  – Easy to prepare for intravenous injection
  – Rarely sold in pure form—usually diluted
  – Wide variability in purity on the streets
  – Often causes overdoses and death

• Methadone
  – Synthetic narcotic used to treat heroin addiction
  – Available for free at clinics
Heroin: Brown, Gear, H, Heaven, Horse, Junk, Skag, Smack.
Synthesis of Heroin

• An acetylation reaction
  – reflux purified morphine with either acetic anhydride (preferred) or acetic acid at 90°C for 5 hours
  – solution cooled & neutralized with sodium carbonate
  – precipitated by addition of conc, HCl
Heroin

Mexican brown heroin and Southeast Asian heroin.
Where Does it Come From?

Over 60 percent of the heroin that is sold in the United States originates in the poppy fields of Southeast Asia.

In another method of smuggling heroin, couriers swallow heroin-filled latex balloons before boarding commercial airlines.
Narcotics

- **OxyContin**
  - Synthetic narcotic containing oxycodone
  - Similar to heroin and morphine
  - Approved in 1995 for sale as a treatment for chronic and severe pain
  - Often obtained illegally through forged prescriptions, theft, or prescriptions from corrupt physicians
Pharmacology

• Morphine & heroin act on the central nervous system

• The molecule fits into & blocks a specific receptor site (mu site) on a nerve cell
  – action of the receptor site is eliminated

• Heroin is more fat soluble than morphine & crosses the blood-brain barrier more easily
  – hydrolyzed to morphine in the body
Methods of Analysis

• Color Tests
  – Marquis (purple); Froehde’s reagent (purple changing to olive green on standing) Mecke’s (yellow, turning to green on standing)

• Microcrystalline Tests
  – platinum chloride, sodium acetate, mercuric chloride
Narcotics

• Why opiates work: the lock-and-key model
  – Drug molecule fits into a receptor site in the body and initiates a particular event
  – Molecular attraction is easily broken, making the effect of the drug temporary
  – Chemists can design molecules for an optimal fit in a receptor site
Methods of Analysis

• Separation
  – easily separated from cutting agents by TLC
  – separated from quinine procaine, etc by a number of mobile phase systems
    • acetic acid:ethanol:water (30:60:10)
Hallucinogens

• Cause marked alterations in normal thought processes, perceptions & moods

• Common Hallucinogens
  – marijuana
  – LSD
  – Psilocybin
  – Peyote
  – PCP
Other Hallucinogens

- 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, or sniffed.
- Phencyclidine is often mixed with other drugs, such as LSD, or amphetamine, and is sold as a powder (“angle 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.
Marijuana

• The most widely used drug in U.S.
• A preparation from the plant Cannabis
  – consists of crushed leaves mixed with flower, stem & seed
  – plant secretes a sticky resin known as hashish
Cannabis: Blow, Dope, Draw, Ganga, Gear, Grass, Hash, Marijuana, Pot, Skunk, Weed.
A Marijuana Garden
Marijuana

- Active ingredient is tetrahydrocannabinol (THC)
- The THC content varies in different parts of the plants
  - resin > flowers > leaves
  - stem, roots & seeds have low THC content
Cannabis Resin

Pakastani & Afghan resin comes in hard brittle blocks ~3.5% THC

Cannabis oil concentrated liquid resin form which looks like motor oil 20-65% THC
THC

- Greatest concentration of THC is found in the flowering tops of the female cannabis plant.
  - Sinsemilla
    - 3.5-4% THC content
Street Marijuana

- The amount sold as a street deal varies quite considerably but typical quantities are shown together with the various current forms of packaging.
Pharmacology

- THC binds to an unknown receptor in the brain
- Inhibits the enzyme adenylate cyclase
  - enzyme stimulates the synthesis of adenosine monophosphate
    - involved in the amplification of signal within the brain’s neurons
Pharmacology

• Marijuana receptors are many times more numerous than opiate receptors
  – receptors are not found in the brain stem (portion of brain controlling basic body functions)
  • non-lethal drug
LSD

• A semisynthetic drug synthesized from lysergic acid
  – a substance that comes from *Clavica purpurea*,
    • a fungus which grows on rye plants

• Colorless, odorless, tasteless liquid
Common Forms

• An immensely potent drug
• A “dose” is between 0.05 & 0.25 mg
  – too small to be handled safely without dilution
• “Blotter acid”
  – aq. solution poured onto absorbant paper
    • paper is injestad

Design depicts ‘Conan the Barbarian.’ Sheet measures 24 x 15 cm & contains ~1,000 doses of LSD
Common Forms

• LSD has appeared in many forms including tablets, capsules, gelatin squares and microdots.
  – 0.05-0.1 mg LSD
LSD: Acid, Rips, Tabs, Trips.
LSD Synthesis

Lysergic acid

Lysergic acid diethylamide (LSD)
Methods of Analysis

• Difficult to analyze because of the small dose size
  – a typical table or paper may contain less than 0.1 mg
• Common spot test is Erlich’s test (p-dimethylaminobenzaldehyde) turns purple
• TLC can be used when there is not enough sample for a confirmatory test followed by spectrofluorimetry (fluoresces ~ 320 nm)
Pharmacology

• Acts on multiple sites of the CNS
• Believed to prevent the inhibition or displacement of the neurotransmitter serotonin
• Results in some sensory neurons going “unchecked” increasing their electrical firing causing perceptual & thought distortions
“Magic” Mushrooms

- Contain psilocybin & psilocin
- Drug can be extracted, but usually mushrooms are eaten
- Concentration of psilocybin is low
  - may take 30 mushrooms for effect
“Magic” Mushrooms

• Primary psychogenic alkaloid is Psilocybin
• Psilocin appears to be the primary metabolite
• Psilocybin responds to several spot tests – Marquis (yellow)
• Chemist often must identify the plant or extract the drug
Pharmacology

- Believed to prevent the inhibition or displacement of serotonin
- Permits certain sensory neurons to go ‘unchecked’ increasing their electrical firing
- Less potent than LSD – wears off within 6 hrs
Stimulants

- Relieve fatigue, reduce need to sleep, increase energy
- Bring about psychological & physical exhilaration
- Common stimulants
  - amphetamine
  - methamphetamine
  - cocaine
Amphetamines

- Legal preparations are white, odorless, crystalline powders with a bitter taste.
- Illegal preparations include fine to coarse powders, crystals and 'chunks'.
  - Most common colors are off-white, yellow and pink.
Street Amphetamine

- Illegally produced amphetamines often have a strong, unpleasant smell which may be 'fishy' or ammonia-like
- Can be adulterated with sugar, caffeine or other stimulants

Often sold in gram wraps which would cost $20-$30. Often double-wrapped with cling film (users to hide it under their tongue to prevent detection)
**Speed**: Billy Whiz, Crystal, Glass, Ice, Sulfate, Uppers.
Methamphetamine

- More potent than amphetamine
- Ice is made from methylamphetamines hydrochloride

Largest crystal in the center is the size of a nickel
The structures of these substances is similar to that of Dopamine
Synthesis of Amphetamines

Phenylacetone (P2P) 1. CH$_3$NH$_2$ 2. Al/Hg  
Amphetamine (R=H)  Methamphetamine (R=CH$_3$)  

P2P, common precursor to amphetamines controlled in Schedule II
Analysis

• Spot tests
  – Marquis (orange)

• Confirmation
  – IR spectroscopy on free bases (liquids) or hydrochloride or sulfate salts
  • salts give better spectra
Pharmacology

- Amphetamines interfere with the reuptake of dopamine and norepinephrine.
- Also displaces these neurotransmitters from their presynaptic nerve terminals
  - causes an increased amount of these compounds to be released
  - results in massive stimulation of the nervous system
Cocaine

- A naturally occurring alkaloid found in the coca plant
  - *Erythroxylon coca*
- Grows in high elevations in the Andes
Where Does it Come From?

The Upper Huallaga Valley of Peru is the primary source of the coca leaf.

After being picked the leaves are dried
Street Cocaine

- paper wrap shows about 0.5g
  - cost between $60 & $100.
- 'rocks' of crack
  - each packet would cost between $50 and $60
Cocaine: Charge, Charlie, Chaz, Coke, Draw, Snow, Toot.
Crack: Base, Freebase, Pebbles, Rocks, Scud, wash
Isolation of Cocaine

• Isolation from macerated leaves achieved by
  – treating with sodium bicarbonate
  – extracting with an organic solvent
  – alkaloids purified and
Isolation of Cocaine

- Alkaloids are hydrolyzed
- treated with $\text{BCl}_3$ followed by benzoyl chloride to give the cocaine
Cocaine for Smoking

• Freebase (user)
  – prepared by neutralizing cocaine hydrochloride with ammonium hydroxide

• Crack (supplier)
  – neutralizing with baking soda (heating in microwave)
  – cooling precipitates cocaine
  – drying precipitate forms a cake which is broken into rocks
Analysis

• Presumptive Tests
  – Spot Tests
    • Scott Test (blue; pink; blue)
  – TLC
    – Microcrystalline (gold chloride or lead iodide)
• Quantitative analysis can be done by GC
• Confirmatory Test
  – IR
Pharmacology

• Cocaine interferes with the normal reuptake of the neurotransmitters norepinephrine, serotonin & dopamine in the nucleus accumbens
  – region of the brain that mediates pleasure response

• Excess neurotransmitters hyperstimulate nucleus accumbens
Depressants

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

• Depressants calm irritability and anxiety and may induce sleep.
• These include alcohol (ethanol), barbiturates, tranquilizers, and various substances that can be sniffed, such as airplane glue, model cement, or aerosol gas propellants such as freon.
Depressants

- 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.
- Tranquilizers, unlike barbiturates, produce a relaxing tranquility without impairment of high-thinking faculties or inducing sleep.
- Sniffing has immediate effects such as exhilaration, but impairs judgment and may cause liver, heart, and brain damage or even death.
Inhalants

• Are popular among children and youth
• Are easy to obtain, inexpensive, not subject to criminal penalties
• Produce effects similar to drinking alcohol
• Can be inhaled by leaning over open container or by sniffing a rag soaked in the substance
Club Drugs

The term *club drugs* refers to synthetic drugs that are used at nightclubs, bars, and raves (all-night dance parties).

Substances that are often used as club drugs include, but are not limited to, MDMA (Ecstasy), GHB (gamma hydroxybutyrate), Rohypnol ("Roofies"), ketamine, and methamphetamine. GHB and Rohypnol are central nervous system depressants that are often connected with drug-facilitated sexual assault, rape, and robbery.
Club Drugs

Methylenedioxymethamphetamine, also known as MDMA or Ecstasy, is a synthetic mind-altering drug that exhibits many hallucinogenic and amphetamine-like effects.

Ecstasy enhances self-awareness and decreases inhibitions; however, seizures, muscle breakdown, stroke, kidney failure, and cardiovascular system failure often accompany chronic abuse.

Ketamine is primarily used as a veterinary animal anesthetic that in humans causes euphoria and hallucinations.

Ketamine can also cause impaired motor functions, high blood pressure, amnesia, and mild respiratory depression.
Club Drugs

• Are tasteless, odorless, and colorless
• Are difficult to detect in toxicology or blood tests
• Render the victim unconscious but responsive with little or no memory of what happened
• Are often used in drug-facilitated sexual assaults (e.g., GHB, Rohypnol, Ketamine)
  – Rohypnol: once a legal prescription in the United States, but outlawed in 2000
  – Ketamine: used as a veterinary sedative or hospital-grade anesthetic
Anabolic Steroids

Yet another category of drugs is the anabolic steroids.

These are synthetic compounds that are chemically related to the male sex hormone testosterone.

Anabolic steroids are often abused by individuals who are interested in accelerating muscle growth.

Side effects include unpredictable effects on mood and personality, depression, diminished sex drive, halting bone growth, and liver cancer.
Anabolic Steroids

• Definition: androgenic performance-enhancing drugs that are synthetic derivatives of testosterone
  – Average dose for medical use: 1–5 mg
  – For body building: hundreds of milligrams

• Most popular sources: illegal imports and drugs made in clandestine U.S. laboratories
Drug Dependence (1 of 2)

• Factors affecting the risk of dependence:
  – Dose
  – Route of administration
  – Frequency of administration
  – Metabolism
Drug Dependence (2 of 2)

• Physical dependence: withdrawal sickness occurs when administration of the drug stops

• Psychological dependence: drug creates feelings of satisfaction and a desire to repeat the experience
Tracking Drug Distribution: CISPA

- Chromatographic impurity signature profile analysis (CISPA) allows chemists to link individual bags of drugs to a specific shipment.
- CISPA uses gas chromatography to separate and identify the impurities created when the drug is manufactured.
- Impurities in cocaine create a unique pattern of GC peaks that can be recorded.
Personal Testing for Drugs of Abuse

- Objective of workplace testing is to eliminate erratic behavior, prevent injuries, and avoid hiring persons who abuse drugs.
- Screening uses TLC and immunoassay testing; GC-MS is used as a confirmatory test if needed.
- Immunoassays take only 10 minutes to perform and can simultaneously screen for 10 drugs in the urine.