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1. Learning Outcomes

After studying this module, you shall be able to know about-

- Hallucinogen Drugs and their Classification
- Some notable Hallucinogens and their signs and symptoms
- Forensic Analysis of Hallucinogen Drugs

2. Introduction to Hallucinogens

Hallucinogens (also called Psychedelics or Psychotomimetic Agents) are substances that induce changes in thought, perception, and mood, without causing major disturbances in the autonomic nervous system. Perceptual alterations can take the form of illusions, synaesthesias, or hallucinations. An illusion is the result of misinterpretation of an actual experience, while synaesthesias are sensory misperceptions (e.g. hearing colour or seeing sounds). Both require external stimuli for their institution. Hallucinations differ from them in this important respect, since they are perceptual alterations without any external stimulation whatsoever. Hallucinations may be visual, auditory, olfactory, gustatory, or tactile in nature. Most hallucinogens induce visual or auditory hallucinations; a few cause tactile or olfactory manifestations. While a number of therapeutic drugs can cause hallucinations in overdose, they are not classified as hallucinogens. A true hallucinogen is a drug that induces hallucinations in small doses (sometimes, as in the case of LSD, in microgram doses). Most genuine hallucinogens cause vivid visual hallucinations, while the other types of hallucinations are relatively uncommon.

Drugs with hallucinogenic properties have an obvious deleterious effect on driving. Inability to distinguish illusion from reality results in poor decision making and consequently poorer driving. Drugs such as psilocybe mushrooms, mescaline, lysergide (LSD), ketamine and PCP can produce fully formed hallucinations, seeing objects, shapes or individuals that are not present, and synaesthesias or blending of sensory information such as ‘seeing’ sounds, or ‘hearing’ colours. Ketamine and its psychomotor effects on driving have been evaluated. Many other drugs can produce milder hallucinations, including, as noted earlier, cannabis and stimulants. Methylenedioxy-substituted amphetamines, such as MDMA, methylenedioxyamphetamine (MDA) or methylenedioxyethamphetamine (MDEA) can also produce hallucinations, particularly tactile ones that enhance sensitivity to touch. However, the predominant impairing effects of that class of compounds appear more related to their excitatory and stimulant properties.

The popularity of hallucinogenic drugs has been fuelled by their glamorous representation in films and rock music. The 1960s saw an explosion of hallucinogen use almost in the form of an epidemic, and though it declined steeply in the 1970s and 1980s, there has been an alarming resurgence over the last decade.

3. Classification of Hallucinogens

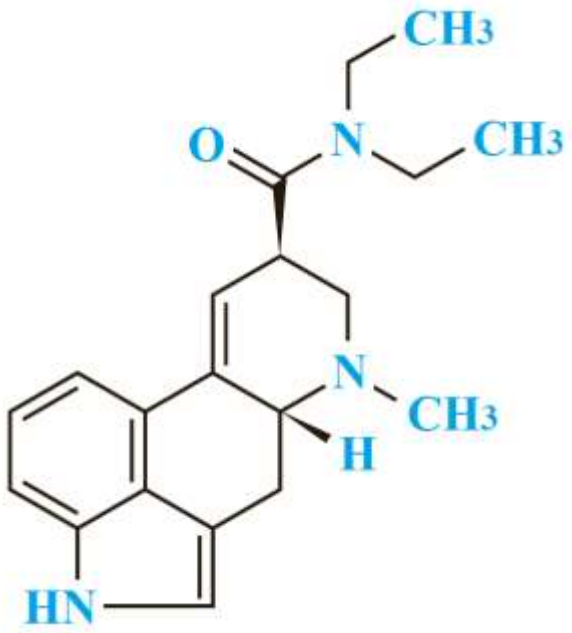
True Hallucinogens may be categorized according to their derivatives:

1) **Indole Alkaloid Derivatives**: They contain Indole Ring, which is simply a 6-membered benzene ring fused to a 5-membered ring containing nitrogen.in their molecular structure. E.g., LSD, Psilocin, psilocybin, Ibogaine, Harmine, DMT, DET, DPT, Bufotine
2) **Piperidine Derivatives:** The basic structure is a heterocyclic amine consisting of a six-membered ring containing five methylene bridges (-CH2-) and one amine bridge (-NH-). E.g., Datura, Cocaine, Phencyclidine, Ketamine
3) **Phenylethylamine Derivatives:** These compounds contain a Phenylethylamine structure within. E.g., Mescaline, Designer amphetamines.
4) **Cannabinoids:** Tetrahydrocannabinol

4. Notable Hallucinogens

❖ LYSERGIC ACID DIETHYLAMIDE (LSD)

It is also known by the names of Acid, microdot, purple haze, white lightning etc. LSD has derived its name from the German *'lyserge saure diethlyamid'.* It is the most powerful hallucinogen known to man. It is one of the indole alkaloid derivative; others being psilocybin and psilocin that is contained in the Mexican mushroom (Psilocybe mexicana). LSD was synthesized by Hofmann in 1938 who was working on the chemistry of ergot alkaloids and he experienced its hallucinogenic effects by himself. The properties of LSD were known in 1943.

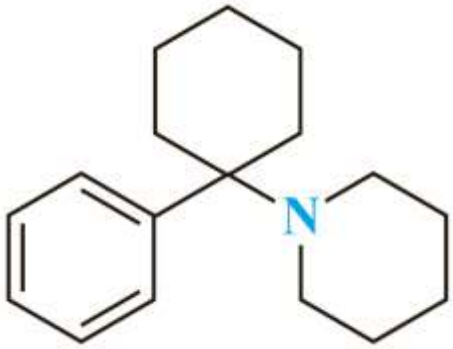


Lysergic Acid Diethylamide (LSD)

LSD is said to be the most powerful of all hallucinogens, and is active in doses of 50 to 100 mcg. It occurs as a water-soluble, colourless, tasteless, and odourless powder.

❖ **PHENCYCLIDINE**

Phencyclidine is also known by pseudonyms as Angel dust, Peace pill, Hog, Goon, Rocket fuel, Cadillac, Super Grass etc. Phencyclidine (PCP) was developed for use as an anaesthetic in the late 1970s but was abandoned quickly because of an unacceptably high incidence of postoperative psychotic reactions. PCP (1-phenylcyclohexyl piperidine) is easily synthesized and several variants exist. It is usually smoked in combination with tobacco and less frequently with marijuana but it may also be ingested or injected.

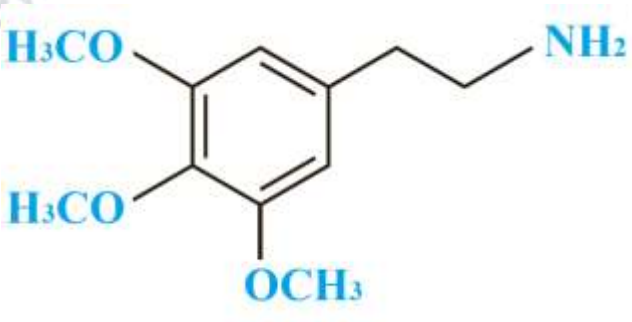


Phencyclidine (PCP)

Phencyclidine binds to inotropic n-methyl-d-aspartate (NMDA) receptors in the nervous system, blocking ion current through these channels. The most common street preparation, angel dust, is a white granular powder that contains 50-100% of the drug.

❖ **MESCALINE**

Mescaline is a phenylalkyl amine that was isolated in 1896 from Mexican 'Peyote cactus" (*Lohophora williamsi*) growing in the deserts of Central America. Of the four alkaloids, alkaloids mescaline is most important. The extracts are used as an intoxicating drink called 'Mescal buttons'.

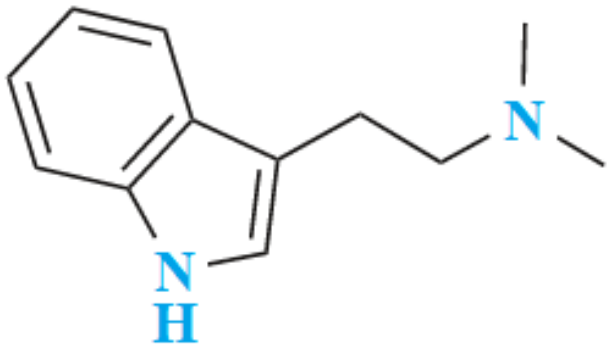


Mescaline

3-15mg/kg produces the moderate effects and duration of action is 1-56 hours 200mg of Mescaline Sulphate produces intoxicating effects. This is the oldest known drug with a primary hallucinogenic action.

❖ DIMETHYLTRYPTAMINE (DMT)

N, N-Dimethyltryptamine (DMT) is a hallucinogen obtained from the seeds and leaves of certain South American plants such as *Piptadenia pergyina* and *Virola calophylla*, as well as in the tropical legume *Mucuna pruriens*.

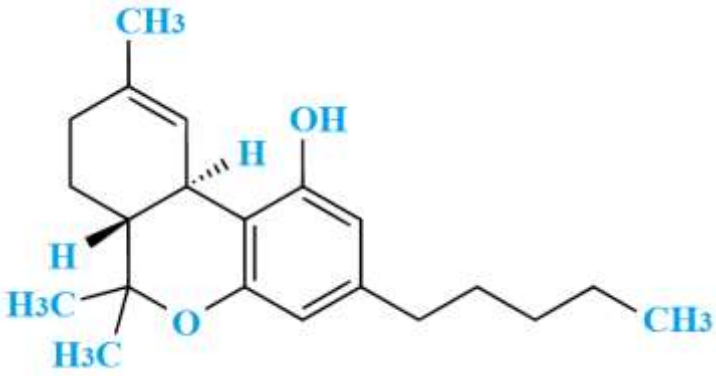


Dimethyltryptamine

Dimethyltryptamine (DMT) is not absorbed from the gastrointestinal tract, and so is typically snorted, smoked, or injected. This elicits a virtually instantaneous onset of visual hallucinations, bodily dissociation, extreme shifts in mood, and auditory phenomena. Effects peak within 2 minutes after injection, and resolve in 20 to 30 minutes. This has earned it the name "businessman's trip". Physical effects include mydriasis, raised body temperature, tachycardia and hypertension.

❖ TETRAHYDROCANNABINOL (THC)

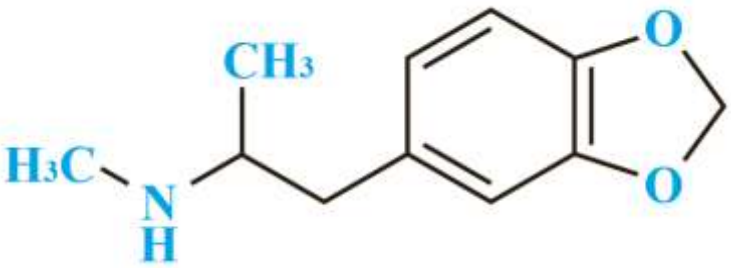
Tetrahydrocannabinol is the active principle of *Cannabis indica* (Marijuana). For time immemorial it has been the most popular recreational and ritualistic intoxicant. All parts of the male and female plant contain active principles.



Tetrahydrocannabinol (THC) is absorbed in to the blood stream through the walls of the lungs, when smoked and through the walls of stomach or intestine when ingested. The blood stream carries THC in to the brain that produces the 'high' effects of the drug. It exerts quicker action through inhalation. The Tetra hydrocannabinols are labile compounds that may change when exposed to U-V light or acid. The typical psychological effects are due to them.

❖ **METHYLENEDIOXYMETHAMPHETAMINE (MDMA)**

Methylenedioxymethamphetamine (MDMA) is the classical member of a large series of phenethylamine designer drugs and has become one of the main drugs of abuse in many countries in Northern Europe. Clandestine production is centered largely in Europe.



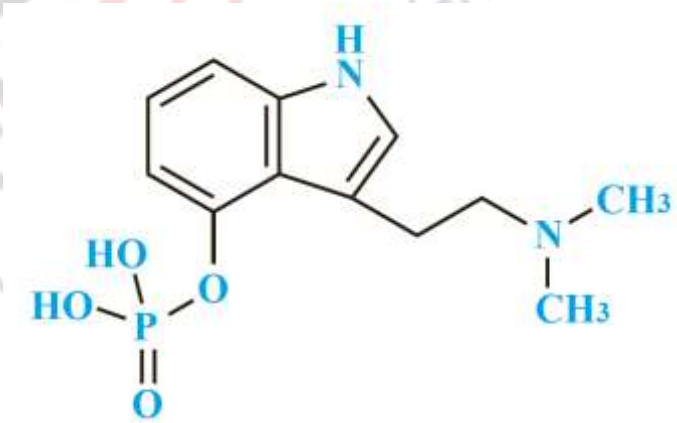
Methylenedioxymethamphetamine (MDMA)

A number of homologous compounds with broadly similar effects, such as methylenedioxyamphetamine (MDA), MDEA and N-methyl - 1- (1, 3- benzodioxol - 5 - yl) -2 - butanamine (MBDB) have also appeared, but have proved less popular. These substances are collectively known as the 'ecstasy' drugs. MDMA is the most common drug encountered in 'ecstasy' tablets.

The tablets are typically 10mm in diameter, either flat or biconvex, and weigh approximately 200–300 mg. The MDMA content varies, but is generally in the range 30–100 mg per tablet. The tablets normally carry a characteristic logo or imprint. These designs are not restricted to MDMA tablets but may be found on amphetamine and other illicit products. In other words, the logo and other physical characteristics provide no reliable information on the drug content. The main pharmacological effect of MDMA is an increase in secretion and inhibition of re-uptake of serotonin, dopamine and norepinephrine in the brain. MDMA causes euphoria, a feeling of empathy, increased energy and tactile sensation. In some cases MDMA can cause mild stimulation and severe stimulation similar to that of cocaine. MDMA can impair judgment, resulting in dangerous behaviour. The short-term health risks associated with taking MDMA include hypertension, hyperthermia and dehydration, while the main long-term effect includes severe depression due to permanent disruption of serotonin production in the CNS.

❖ PSILOCYBIN

Psilocybin is produced synthetically or extracted from the *psilocybe mexicana* mushroom and other mushroom species. It is chemically related to LSD. The drug is most often sold in the mushrooms themselves and are known by names like "psychedelic mushrooms," "magic mushrooms," and "'shrooms".



Psilocybin

Usually taken orally, psilocybin is found in dried or fresh mushrooms or as a powder in capsules. It is sometimes brewed into a tea. Typical doses range from 4 to 10 milligrams, but are hard to control because the active amount of hallucinogens in mushrooms differ widely according to the genus, strength, and condition (fresh or dried) of the mushrooms.

4. Signs and Symptoms

Hallucinogens produce a dream- like state with disorientation, loss of contact with reality. There is distortion of visual perception such as swaying of the field of vision, objects appear distorted similar to images in a curved mirror and faces may appear grotesque. There is an awareness of intense luminosity of colour and on closing eyes colourful images appear to surge. There is alteration of time sense and music appears tangible. Ability to concentrate is impaired. Ataxia is not a prominent feature. The person feels relaxed and is extremely happy; may sometimes laugh uncontrollably or become sad or weep. With higher doses, panic reactions and sinking sensations are common.

5. Medico- legal Aspect of Hallucinogens

Few of the hallucinogenic drugs are primary causes of death but some may lead to traumatic deaths because of the abnormal behavior of the person who is under their influence. Hallucinogens are also known as psychotomimetic, psychotogen, psychedelics or psychodysleptics. These are drugs that cause excitation of Central Nervous System characterized by:

- ✓ Hallucination
- ✓ Mood changes
- ✓ Anxiety
- ✓ Sensory distortion
- ✓ Delusion
- ✓ Depersonalization
- ✓ Increased pulse rate, temperature and Blood pressure
- ✓ Dilatation of pupil
- ✓ Psychic dependence
- ✓ Depressive or suicidal psychosis.

6. Forensic Analysis

❖ **FAST BLUE B SALT TEST**

a. Filter Paper Method-

Preparation of reagent:

- **Solid reagent** : Dilute & mix Fast Blue B Salt with anhydrous Sodium Sulphate in the ratio of 1:100
- **Solution 1** : Petroleum ether
- **Solution 2** : A 10% w/w aqueous solution of Sodium Bicarbonate

Procedure:

Two filter papers are folded to form fluted funnels and kept on each other. Small amount of suspected sample is placed into the corner of the upper funnel of the paper and added two drops of **Solution 1**. Allow the liquid to penetrate to the lower filter paper funnel. Discard the upper filter paper and dry the lower filter paper. Now add a very small amount of the solid Fast Blue B reagent to this lower paper and add two drops of **Solution 2**. A purple–red coloured stain on the filter paper indicates the presence of cannabis product.

b. Test Tube method-

Preparation of reagent:

- **Solid reagent** : Dilute & mix Fast Blue B salt with anhydrous Sodium Sulphate in the ratio of 2.5:100
- **Solution 1** : Chloroform
- **Solution 2** : 0.1N aqueous Sodium Hydroxide solution

Procedure:

Small amount of suspected material is taken in a test tube; a very small amount of the solid reagent and 1 ml of solution 1 is added to it. Shake well for one minute and add 1 ml of solution 2. Shake the test tube for two minutes, and allow this test tube to stand for 2 minutes. A purple red colour in the lower layer of chloroform indicates the positive result of the presence of cannabis product.

❖ DUQUENOIS-LEVINE TEST

Preparation of reagent:

5 drops of Acetaldehyde and 0.4 gms of Vanillin are dissolved in 20 ml of 95% Ethanol.

Procedure:

Small amount of suspected material is taken in a test tube and shaken with 2 ml reagent for 1 minute, add 2 ml of conc. HCl and shake it well. Allowed it to stand for 10 minutes and then add 2 ml of chloroform. Appearance of violet colour in chloroform layer (lower layer) indicates the presence of cannabis.

❖ ALTERNATE TEST

Preparation of reagent:

5 drops of acetaldehyde and 0.4gms of vanillin are dissolved in 20 ml of 95% ethanol.

Procedure:

The sample is extracted with petroleum ether. Filtered and evaporated to dryness. Added 2 ml. of Duquenois reagent to dissolve the residue add 2ml. Conc. HCl. Shaken and kept for 10min. Transferred the solution into a test tube add 2ml. of Chloroform and shaken. Purple colour in the chloroform layer indicates the Tetrahydrocannabinol.

❖ EHRLICH REAGENT TEST

Preparation of reagent:

1g para-dimethylamine benzaldehyde (p-DMAB) in is dissolved in10ml Methanol and 10ml conc. Ortho Phosphoric Acid is added further.

Procedure:

Take appropriate amount of the sample or few drops of methanol extract of the sample in a depression spot plate and add two drops of Ehrlich reagent. Appearance of a blue to purple colour indicates the presence of LSD.

❖ **MARQUIS REAGENT TEST**

Preparation of reagent:

8-10 drops of 40% Formaldehyde solution is added to 10 ml of Con. Sulphuric acid.

Procedure:

Take appropriate amount of the sample or few drops of Marquis Reagent. Orange colour change to brown color, which finally changes to purple, indicates the presence of LSD.

❖ **FROHDE'S REAGENT TEST**

Preparation of reagent:

50 mgs of molybdic acid or Sodium Molybdate is dissolved in 10 ml of hot concentrated Sulphuric Acid. The resulting solution should be colourless.

Procedure:

Take appropriate amount of the sample or few drops of Frohde's Reagent. Olive green changes to blue, which changes to green indicating the presence of LSD.

❖ **MECKE'S REAGENT TEST**

Preparation of reagent:

0.25 gms of Selenious Acid is dissolved in 25 ml of concentrated Sulphuric Acid

Procedure:

Take appropriate amount of the sample or few drops of Mecke's Reagent. Olive green changes to blue-black indicating the presence of LSD.

❖ **LIEBERMANN'S TEST**

Preparation of Reagent:

Add 5 grams of Sodium nitrate to 50 ml of sulphuric acid with cooling and swirling to absorb the brown fumes.

Procedure:

Take appropriate amount of the suspected material or exhibit on a spot plate add to it 2 – 3 drops of Liebermann's reagent. Occasionally it is required to carry out the test in a test tube and heat it in a water bath at 100°C. The appearance of black colour indicates the presence of mescaline.

7. Summary

- Hallucinogen abuse has been traditionally a Western phenomenon, and drugs of abuse such as LSD and phencyclidine have always been popular only in countries such as the USA, UK, Australia, and parts of Europe.
- The dangers of hallucinogen use do not have as much to do with acute toxicity, as with long-term psychological damage. The inevitable fallout is violent crime manifesting as assaultive behavior, homicides, and suicides. Several horrific crimes have been committed by drug-crazed individuals acting out their bizarre fantasies.
- Drugs with hallucinogenic properties have an obvious deleterious effect on driving. Inability to distinguish illusion from reality results in poor decision making and consequently poorer driving.
- Psilocybe mushrooms, mescaline, LSD, and PCP can yield demonstratively molded hallucinations like seeing objects, shapes or individuals that are not actually existing, and synaesthesias or blending of sensory information such as 'seeing' sounds, or 'hearing' colours.
- LSD is one of the most potent hallucinogenic substances known. LSD can be produced by several different methods, the majority of which use lysergic acid as the starting material. Lysergic acid itself is also produced in clandestine laboratories using, most commonly, ergometrine or ergotamine tartrate as the starting material.
- The hallucinogenic substances psilocin and its phosphate ester psilocybin occur in a number of fungi, particularly those of the genus Psilocybe.