Drugs Structure and Effect

1. INTRODUCTION

This appendix provides brief background information on several drugs that have been considered in this document. Readers desiring more detailed information should consult the references listed.

2. BASIC INFORMATION ON COMMON DRUGS OF ABUSE

2.1. Cannabis

Description

There are three main forms of cannabis: marijuana, a flaky greenish substance with a characteristic sweet odour formed from dried leaves and flower clusters of the hemp plant (*Cannabis sativa*); hashish (dried cannabis resin and the compressed flowers); and hash oil (an oil-based extract of hashish).

Structure

The primary physiologically active agent in Cannabis is delta-9 tetrahydrocannabinol, or THC (Figure 1.). This molecule has the formula $C_{21}H_{30}O_2$, and a molecular weight of 314.5. The equilibrium vapour concentration of THC in air at room temperature and atmospheric pressure is about 61 ppt, making this chemical about 60 times more vapourous than heroin but 4 times less vapourous than cocaine.

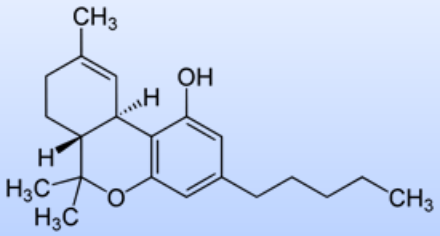


Fig. 1 Tetrahydrocannabinol

The THC content can vary considerably and depends on how and where the marijuana is grown, its genetic characteristics, and the part of the plant that is used. For example, THC concentration is highest in the flowering tops of the female plants, and hydroponically-grown marijuana tends to have a much higher THC content than outdoor-grown marijuana.

There is some concern about the increased potency of cannabis relate in part to the relative balance between THC and cannabidiol (CBD), which is a non-psychoactive substance found in most cannabis products that moderates the THC effect. Environmental Science and Research studies demonstrated that the THC level varied between 4.35% and 25.3% during the study completed under Ministry of Health licence between 2004 and 2006. When ESR last tested the Class C drug in 1996, they found an average THC level of just 6%.[1]

Production

Cannabis comes from the plant *Cannabis sativa*. Although this plant is native to Asia, it has been cultivated nearly worldwide, and most marijuana is now produced in the Western Hemisphere.

Ingestion

Marijuana is usually smoked in a cigarette or a “reefer”, or through a water pipe or bong. Cannabis oils and resins can also be “spotted”, taken via a vapouriser, or eaten. Smoking cannabis is the fastest way to absorb THC and to achieve a cannabis “high”, with THC entering the bloodstream within minutes. That high is short-lived, typically lasting between one and two hours. However, when used repeatedly, cannabis can be detected in the bloodstream for several days after use.

Short Term Effects

The short-term or immediate effects of using cannabis include euphoria and relaxation, a loss of inhibition, altered perceptions, a heightened sense of sound and vision, and impairment of short-term memory and attention, motor skills, reaction time, and skilled activities. These effects tend to be expected, even sought after. However, some users experience more adverse short-term effects including anxiety, panic, and depression.

Cannabis increases the heart rate, but not in a particularly harmful way unless the user has a pre-existing heart condition. The effect of cannabis use on the heart and blood vessels is similar to the effects of moderate exercise.[2]

Cannabis use has a much lower risk of fatal overdose or other life-threatening conditions than many other psychoactive drugs. It has been estimated that a lethal dose of cannabis is in the range of 15 grams to 70 grams, which is many times greater than what even heavy users would consume in a day.[3]

Adverse Effects

The risk of cannabis dependence[i] increases with the frequency and duration of use. Overseas research suggests that approximately 9% of all those who have ever used cannabis, and one in six of those who begin using cannabis in adolescence, become cannabis dependent.[4] In New Zealand, the Dunedin Multidisciplinary Health and Development Study found that 18.3% of cannabis users in its cohort were cannabis dependent at age 26.[5] This proportion was similar to that observed for alcohol (17.9%) but lower than that observed for tobacco (34%). Cannabis dependent users were more likely to be male and Mäori.

As with smoking tobacco, smoking cannabis can have an adverse effect on respiratory and other functions. Regular cannabis smokers are at increased risk of chronic bronchitis, respiratory infections, and pneumonia when compared to non-smokers. Cannabis may cause emphysema and cancers of the lung and aerodigestive tract. Adults who continue to smoke cannabis into middle age may also be at increased risk of cardiovascular disease.[6]

Regular and long-term cannabis use may lead to some minor impairment in cognitive functioning, including deficits in verbal learning, memory and attention. Debate continues about the extent of these impairments, and whether they can be recovered after cannabis use stops.[7]

There is increasing evidence of a causal relationship between cannabis use and mental health disorders, particularly psychosis and schizophrenia. Research in this area is on-going. Reaching a firm conclusion is made more complicated by the fact that the onset of schizophrenia usually occurs in the late teens and early twenties, which is when cannabis use may also be most prevalent.[8] However, it appears that heavy cannabis users are at increased risk of psychotic symptoms and disorders, particularly when the user has an existing history of or susceptibility to those symptoms or disorders, there is a family history of such disorders, or use has begun in the early teens.3

2.2. Synthetic cannabinoids

Description

Synthetic cannabinoids function similarly to tetrahydrocannabinol (THC), the principal psychoactive component in cannabis.

Structure

Like THC, synthetic cannabinoids have structural features that allow binding to one of the known cannabinoid receptors in the brain and other organs to produce cannabis-like pharmacological activity. Currently, there are many compounds with chemically unrelated structures that fall under this definition and could be classified as;[9]

I. Classical cannabinoids
II. Nonclassical cannabinoids
III. Hybrid cannabinoids

[i] Dependence is normally characterised by symptoms including an increased tolerance to a drug, withdrawal symptoms, more prolonged and intense use of a drug, and unsuccessful attempts to control use.

IV. Aminoalkylindoles
V. Eicosanoids
VI. Others

Production
A number of methods for synthesizing synthetic cannabinoids have been described in detail in the scientific literature.[10] Precursor chemicals can also be obtained from commercial chemical suppliers. In general, syntheses of classical, nonclassical or hybrid cannabinoids are much more elaborate and complicated due to the presence of asymmetric centres in these compounds. As a result, stereoselective synthesis or elaborate separation of stereoisomers is often necessary to isolate the desired compound. Compounds without asymmetric centres like most aminoalkylindoles, can be easily synthesized with standard laboratory equipment and readily available reagents.

Short Term Effects
Short term effects of ingesting synthetic cannabinoids are similar to those experienced with cannabis use.

Adverse Effects
So far, little is known about the pharmacology and toxicology of these compounds. Some case reports have shown that health-related problems associated with the use of these herbal products seem to be very similar to problems reported after cannabis use.[11] Cardiovascular problems and psychological disorders such as panic attacks were among the frequently reported symptoms. A number of these substances may have a higher addictive potential compared to cannabis due to quicker development of tolerance. Some synthetic cannabinoids, which act as full agonists at the receptor, could possibly cause severe or even life-threatening intoxications when overdosed. Furthermore, due to its structural features in certain aminoalkylindoles, some carcinogenic potential could also be possible.

2.3. Amphetamine

Description
Amphetamines belong to the phenethylamine class of drugs called ‘psychostimulants’ (also commonly known as ‘speed') that stimulate the central nervous system. It usually appears as a whitish yellow powder, and occasionally in liquid form.

Phenethylamines work by increasing energy levels, concentration, and motivation, and thus this class of compound are used by some college and high-school students as a study and test-taking aid. It has been, and is still, used by militaries around the world and by some professional, collegiate and high school athletes. Amphetamine was formerly in widespread use by truck drivers to combat symptoms of somnolence and to increase their concentration during driving

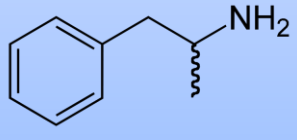


Fig. 2 Amphetamine

Structure
The amphetamine molecule has the formula $C_9H_{13}N$, and a molecular weight of 135.2 and the structure is shown in Figure 2. *N.B.* Amphetamine is a chiral compound.

Amphetamine is the parent compound of its own

structural class, comprising a broad range of psychoactive derivatives, from empathogens, MDA (3,4-methylenedioxy-amphetamine) and MDMA (3,4-Methylenedioxy-N-methamphetamine) known as ecstasy, to the *N*-methylated form, methamphetamine known as 'meth', and to decongestants such as ephedrine (EPH) . Amphetamine is a homologue of phenethylamine. These compounds are shown in Figure 3. Because of their prevalence, ecstasy and methamphetamine are considered separately in this document.

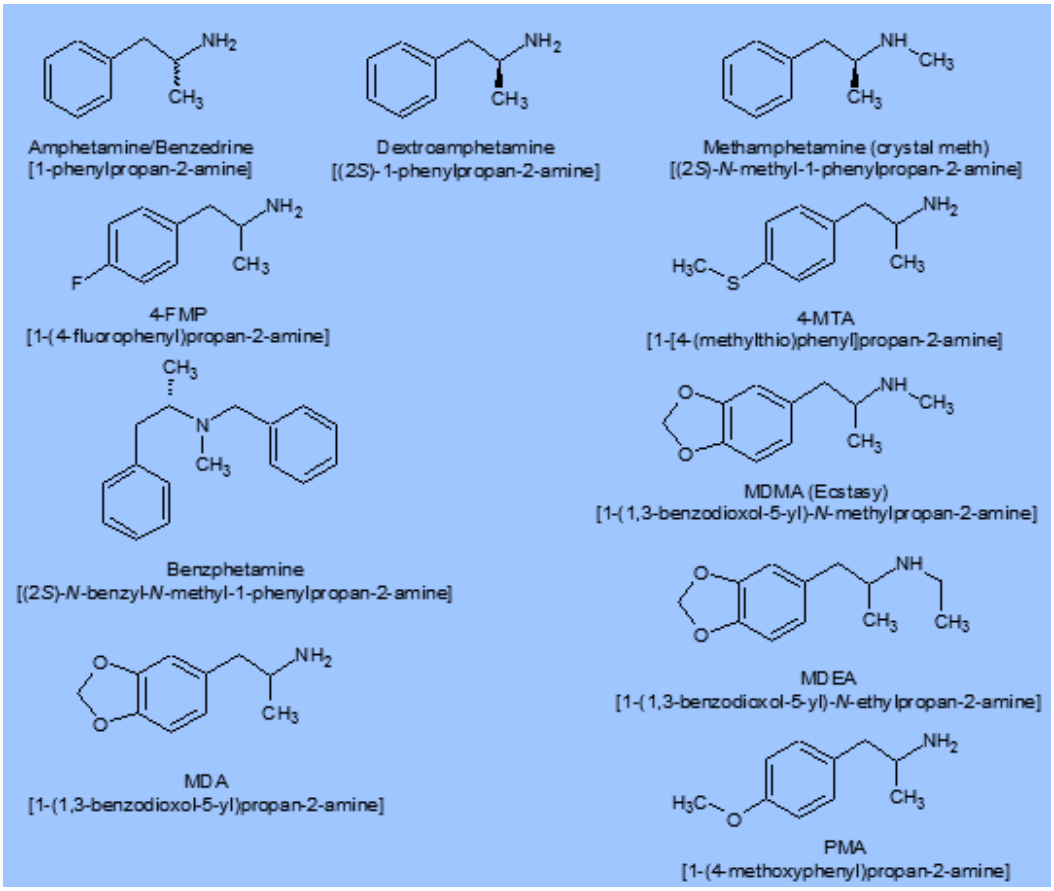


Figure 3. Derivatives of Amphetamine

Production

Most amphetamines are produced in backyard laboratories and contain a mixture of pure amphetamines and other substances such as sugar, glucose, bicarbonate of soda and ephedrine. These additives can be highly poisonous. They can cause collapsed veins, tetanus, abscesses and damage to the heart, lungs, liver and brain. And because the user doesn't know whether they are using 5 per cent or 50 per cent pure amphetamines, it is easy to overdose by accident.

Ingestion

Amphetamines are most commonly swallowed, injected or smoked. They are also 'snorted', or 'sniffed', through the nose.

Short Term Effects
The effects of any drug vary from person to person, depending on an individual's size, weight and health, how the drug is taken, how much is taken and the person's mood. The quality and purity of the drug used will also influence its effects.

Soon after taking amphetamines, the person will experience an increase in energy levels and alertness with a corresponding speeding up of bodily functions (heart rate, breathing and blood pressure). Restlessness may also be experienced and this may develop into anxiety, irritability and aggression - sometimes people feel a sense of power and superiority over others.[12]

Very high quantities of amphetamines can cause paleness, headaches, dizziness, blurred vision, tremors, irregular heartbeat, stomach cramps, sweating, restlessness, irregular breathing and loss of co-ordination. High quantities can also create an 'amphetamine psychosis', characterised by paranoid delusions, hallucinations and aggressive or violent behaviour for no apparent reason.

As the effects of amphetamines begin to wear off, a person may experience a range of symptoms including uncontrolled violence, tension, radical mood swings, depression and total exhaustion.

Adverse Effects
Regular use of amphetamines may result in a variety of problems including anxiety and tension, high blood pressure and tachycardia, 'amphetamine psychosis' lowered immune function and brain damage. There is some evidence that brain cells can be damaged by regular use of MDMA (ecstasy) resulting in reduced memory function and possibly other impairments in thinking. These symptoms usually disappear a few days after the person stops using amphetamines.

Due to the unknown strength and mix of street amphetamines, some users have overdosed and experienced strokes, heart failure, seizures and high body temperature.[12]

2.4. Methamphetamine

Description
Methamphetamine is a synthetic psychostimulant drug. There are several forms of methamphetamine: powder or speed (typically of a low purity); pure ("P") or base (locally manufactured with a higher purity than powder); ice or crystal meth (a high purity imported form of methamphetamine); and pills (containing a small amount of methamphetamine which is often combined with ketamine). Although imported crystal methamphetamine is often thought to be more potent than locally manufactured methamphetamine, recent analysis suggests there is little difference in purity between the two.[13]

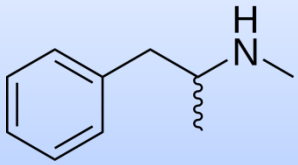


Fig. 4. Methamphetamine

Structure

Methamphetamine hydrochloride, is a commonly abused drug that is referred to variously as “speed,” “meth,” and “ice.” This bitter tasting, crystalline substance has the molecular formula $C_{10}H_{15}N.HCl$, a molecular weight of 185.7, and a melting point in the range of 170 ºC to 175 ºC, Its structure is shown in Figure 4.

The saturated vapour concentration of methamphetamine at room temperature and atmospheric pressure is approximately 214 ppm, making this by far the most vapourous of the illicit drugs considered in this study. In principle, this means that vapour detection of this drug should be relatively straightforward, but particle detection might be difficult due to the tendency of particles to evaporate rapidly.

Production

Methamphetamine can be synthesized from the reaction of benzyl methyl ketone and methylamine or more commonly made by the reduction of ephedrine or pseudoephedrine, which produces the more active d-methamphetamine isomer. The manufacture of methamphetamine brings with it serious social Adverse Effects including risks to public health, as well as the costs associated with the clean-up and decontamination of methamphetamine laboratories or “clan labs”. The chemicals used to manufacture methamphetamine are generally highly flammable, corrosive, and explosive.[14] As phosphine gas is generated in these processes, the risk of explosion, chemical burns or poisoning is high. This creates a dangerous situation for those involved in the manufacturing process, others living in or near the clan lab (including children), law enforcement officials, emergency service personnel, and medical practitioners treating those exposed to toxic chemicals.[14, 15]

Ingestion

Methamphetamine can be taken intranasally (snorted), taken orally, smoked, or injected. Injecting or smoking methamphetamine has a faster onset and stronger effect than other modes of administration. The rate of injecting methamphetamine is low in New Zealand, although it may now be becoming a more popular method. Methamphetamine’s effects can last for several hours for speed, and up to 24 hours for crystal methamphetamine.[16]

Short Term Effects

The short-term effects of using methamphetamine can include euphoria, increased activity and energy levels, disinhibition, a sense of well-being, increased confidence, decreased appetite, and agitation.[14] New Zealand’s Illicit Drug Monitoring System (IDMS) for 2008, which reported on frequent drug use and its related Adverse Effects, found that frequent methamphetamine users also reported experiencing insomnia (85%), blurred vision (56%), and chest pains (33%).[13]

Adverse Effects

In comparison to cannabis, methamphetamine is a relatively new drug on the market, only coming to prominence in New Zealand in the late 1990s. Evidence about its related Adverse Effects is therefore less available and more contested.

There are no known deaths due to methamphetamine overdose in New Zealand. However, large doses can cause potentially life-threatening conditions, such as hyperthermia, renal and liver failure, cardiac arrhythmias, heart attacks, cerebrovascular haemorrhages, strokes and seizures.[17] Toxic reactions can occur irrespective of "dose, frequency of use or route of administration, and have been reported with small amounts and on the first occasion of use".

Methamphetamine use can cause a number of psychological Adverse Effects. The 2008 IDMS found that the most common psychological problems reported by frequent methamphetamine users in New Zealand from their methamphetamine use were short temper (72%), strange thoughts (70%), anxiety (62%), and paranoia (45%).[13] Long-term users of methamphetamine may also experience a number of psychotic symptoms including paranoia, auditory hallucinations, mood disturbances and delusions. These symptoms can last from hours up to days, with those who have pre-existing psychotic disorders at greater risk of experiencing them. Methamphetamine can also cause depressive symptoms, suicidal thoughts, and anxiety disorders.[17]

Frequent methamphetamine users may be at increased risk of adverse impacts to their physical health, including respiratory problems, stroke, irregular heartbeat, extreme anorexia, and neurotoxicity.[14] Cardiovascular health may also be affected.[17] There is evidence that methamphetamine use causes changes to the brain,[18] and this may impair cognitive functioning.[17] In addition, methamphetamine use may often lead to teeth and skin problems.[13]

There is evidence that methamphetamine users are at increased risk of transmission of communicable diseases. Injecting users who share needles are at a high risk of HIV/AIDS, and hepatitis B and C. Methamphetamine has also been found to increase sexual arousal and this can lead to risky sexual behaviour and disease transmission. [14, 17]

Finally, the New Zealand Police have noted that methamphetamine production is strongly linked to organised crime.[19] Other reports have concluded that organised crime, often gangs, controls the methamphetamine market.[20] NZ-ADAM participants identified the amphetamine black market (including methamphetamine) as being more violent or risky than the other drug markets covered (cannabis, ecstasy, and heroin).[21]

2.5. Ecstasy

Description

MDMA (3,4-methylenedioxy-*N*-methylamphetamine) is an entactogenic drug of the phenethylamine and amphetamine class of drugs. In popular culture, MDMA has become widely known as "ecstasy", usually referring to its street pill form, although this term may also include the presence of possible adulterants.

Ecstasy use has become one of the most commonly used

recreational drugs in New Zealand. Although it has been associated with nightclubs and electronic music, ecstasy is also used in homes and private parties.

In most New Zealand and international studies ecstasy is classified as an amphetamine-type stimulant rather than a hallucinogen due to its chemical structure.

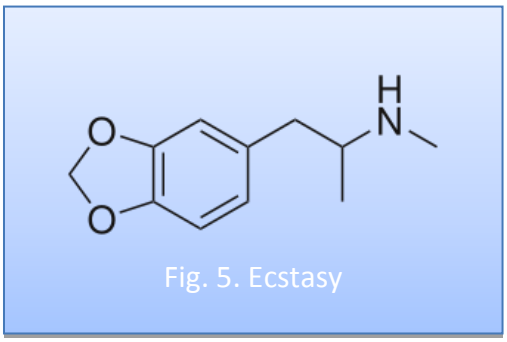


Fig. 5. Ecstasy

Structure

Amphetamine, is a commonly abused drug that is referred to variously as “speed,” “meth,” and “ice.” This bitter tasting, crystalline substance has the molecular formula $C_{10}H_{15}N.HCl$, a molecular weight of 185.7, and a melting point in the range of 170 ºC to 175 ºC, Its structure is shown in Figure 5.

Production

Unlike amphetamines, ecstasy is relatively hard to make and requires sophisticated chemical and pharmaceutical knowledge and equipment to make it.

There are numerous synthetic methods in the literature to convert Safrole to MDMA. Safrole (Figure 6.) is a colourless or somewhat yellow oil extracted from the root bark or fruit of the Sassafras plant into a liquid form.

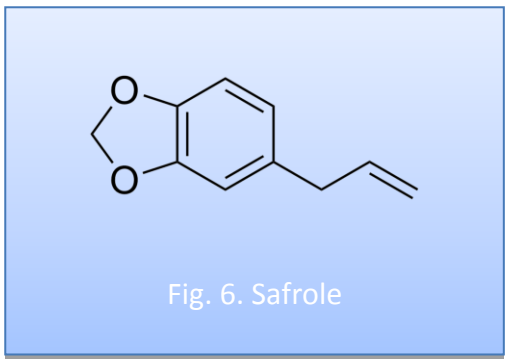


Fig. 6. Safrole

Relatively small quantities of essential oil are required to make large numbers of MDMA pills. The essential oil typically contains between 80 and 94% safrole. This would allow 500 ml of the oil, which retails at between $20 and $100, to be used to produce an estimated 1,300 to 2,800 tablets containing approximately 120 mg of MDMA each.[22]

Ingestion

MDMA is ingested orally most commonly in the tablet form

Short Term Effects

The primary effects attributable to MDMA consumption are predictable and fairly consistent among users. In general, users report feeling effects within 30–60 minutes of consumption, hitting a peak at approximately 1–1 1/2 hours, reaching a plateau that lasts about 2–3 hours, followed by a comedown of a few hours, which may be accompanied by fatigue and minor effect.

The most common effects reported by users include, a general and subjective alteration in consciousness resulting in a strong sense of inner peace, euphoria and self-acceptance. Diminished aggression with feelings of empathy, and intimacy are accompanied by an intensification of all of the bodily senses (hearing, touch, smell, vision, taste). Mild psychedelia, consisting of mental imagery may also occur.

Many studies, particularly in the fields of psychology have suggested that MDMA has therapeutic benefits and facilitates therapy sessions in certain individuals. Clinical trials are now testing the therapeutic potential of MDMA for post-traumatic stress disorder (PTSD) and anxiety associated with terminal cancer.[23]

Adverse Effects
Ecstasy increases the desire to be physically active which carries with it the risk of overheating, exhaustion, seizures and collapse. People with a history of heart disease, hypertension, epilepsy, liver problems or diabetes are at greater risk of harm from ecstasy use.

Higher doses do not appear to enhance the desirable effects of ecstasy, but do increase the risk of negative side-effects.

There is limited evidence that ecstasy use causes damage to some parts of the brain, but it is unclear whether this damage is permanent. Long-term ecstasy use is uncommon, likely due to the increase in undesirable effects and diminishing of the pleasurable effects over time. However, regular ecstasy users may find they are not eating or sleeping enough and that they become run down and susceptible to cold, flu, and infections.

2.6. Cocaine

Description
Cocaine is another highly addictive drug that, in pure form, is a white crystalline substance. Cocaine is extracted from the coca leaf grown in Central and South America

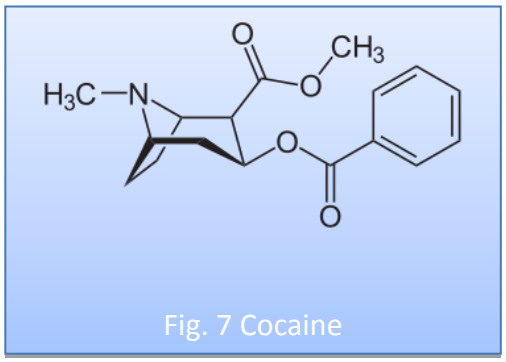


Fig. 7 Cocaine

Structure
The molecular structure of cocaine is shown in Figure 7. The molecular formula is $C_{17}H_{21}NO_4$, and the molecular weight is 303.4. The melting point is 98 ºC. The vapour concentration at room temperature and atmospheric pressure is about 0.25 ppb, or approximately 250 times higher than that of heroin. This vapour pressure means that vapour detection of cocaine is possible in some circumstances, but collection of particle contamination is still highly desirable to maximize the probability of detection.

Production
Cocaine is extracted from the coca leaf, which grows on the *Erythroxylon coca tree* indigenous to South America. Of the worldwide production of coca leaf more than half comes from Peru and most of the remainder from Bolivia and Colombia.

Ingestion
This crystalline or powder form can be ingested orally, nasally or by inhalation or as a suppository. The most common method for ingestion is nasally ("snorting"). Powder cocaine is typically about 70 % pure and can be mixed with materials such as baking soda to form a grainy substance known as "crack," which is smoked and imparts an almost immediate "high" to users. Cocaine can be used medically in small quantities as a local anaesthetic.

Short Term Effects

Cocaine is a powerful nervous system stimulant.[24] Its effects can last from 15–30 minutes to an hour, depending on the route of administration. Cocaine increases alertness, feelings of well-being and euphoria, energy and motor activity, feelings of competence and sexuality. Athletic performance may be enhanced in sports where sustained attention and endurance is required. Anxiety, paranoia and restlessness are also frequent. With excessive dosage, tremors, convulsions and increased body temperature are observed.

Adverse Effects

With acute or prolonged use, the drug can cause itching, tachycardia, hallucinations, and paranoid delusions. Overdoses cause tachyarrhythmias and a marked elevation of blood pressure, which can be life-threatening. Chronic cocaine intake causes insatiable hunger, aches, insomnia/oversleeping, lethargy, and persistent runny nose are often described as very unpleasant. Depression with suicidal ideation may develop in very heavy users.

Physiological changes caused by cocaine withdrawal include vivid and unpleasant dreams, insomnia or hypersomnia, increased appetite and psychomotor retardation or agitation.[24]

2.7. Opiates

Description

Opiates include morphine, codeine, opium, heroin and a wide range of pharmaceutical drugs such as methadone and buprenorphine all of which are derived from the opium sap of the poppy plant. The picture opposite is of the split poppy pod exuding pure opium. Because of its potency, heroin is discussed separately in this document.

Structure

Opiates belong to the large biosynthetic group of benzylisoquinoline alkaloids. As shown in Figure 8, all opiates are structurally similar and vary only in the type and number of substituents.

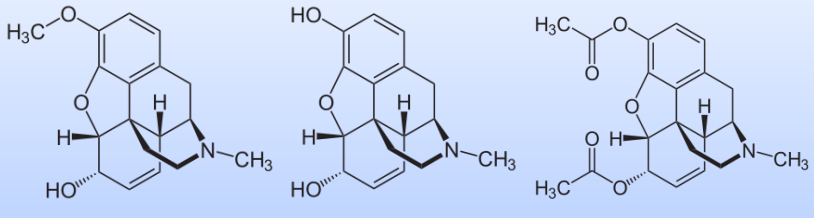


Fig. 8. Codeine, Morphine and Heroin Opiates

Production

The full synthesis of opiates from naphthoquinone or from other simple organic starting materials is tedious and not economical. Thus, most of the opiate-type analgesics in use

today are extracted from opium, the yellow brown liquid produced from the opium poppy (Papaver Somniferum) or semi-synthesized from thebaine. The methods of extraction have been known, honed, and carried out by numerous individuals for an extremely long period of time. The only barrier that arises is the sheer bulk of poppies necessary to produce an appreciable amount of morphine.

This poppy is grown principally in South Central Asia, from Pakistan and Afghanistan east to Burma, and to a lesser degree in Southeast Asia. Due to New Zealand's geographic isolation it is difficult to import heroin and raw opium in bulk, so the majority of opiates abused in New Zealand have been prescription medicines (*e.g.*, morphine sulphate tablets and methadone), poppies and 'home bake'. The prevalence of opiate use remained relatively stable.

The Opioid class of chemicals share similar pharmacological profiles with the opiates. These drugs are decidedly easier to synthesize than the opiates, baring the availability of direct precursors. Some of these drugs, such as Fentanyl, are produced through "total synthesis" from relatively innocuous and easy to obtain chemicals. It is this fact that results in the emergence every few years of "heroin substitutes" which consist of Fentanyl or Pethidine analogs. Carfentanyl (Figure 9), which is another *incredibly* powerful opioid. The popular quote from "Future Synthetic Drugs of Abuse" is that one kilogram of carfentanyl is equivalent to 40 metric tons of pure heroin.

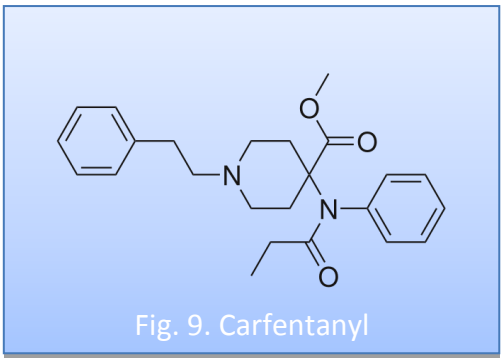


Fig. 9. Carfentanyl

Ingestion

Opiates are usually used intravenously, though some forms of opiate drugs can be smoked (opium) or snorted (white heroin).

Short Term Effects

The opiates impart a depressant effect when ingested. Despite its structural similarity to morphine, thebaine is the exception in that it produces a stimulant effect similar to that of the amphetamine class of compounds.

Reported effects include euphoria, drowsiness, respiratory depression, constricted pupils and nausea

Adverse Effects

Although the prevalence of opiate use is relatively low, the associated social and health effects (e.g., crime and the potential spread of blood-borne viruses) are serious.

There is strong evidence from other Western countries that high rates of crime are associated with the injecting of illegal opiates. As a result of low rates of employment among injecting drug users (IDUs), combined with the high costs of illegal drugs, many IDUs turn to crime as a way of funding their drug use.

2.8. Heroin

Description

Heroin, also known as diamorphine, diacetylmorphine, or acetomorphine, is a highly addictive drug derived from morphine. In its pure form, heroin is a white, odourless, crystalline compound, and “China White” has been used as a slang term for very pure Southeast Asian heroin. If exposed to air for a prolonged period of time, heroin tends to turn pinkish and sometimes emits an acetic acid odour.

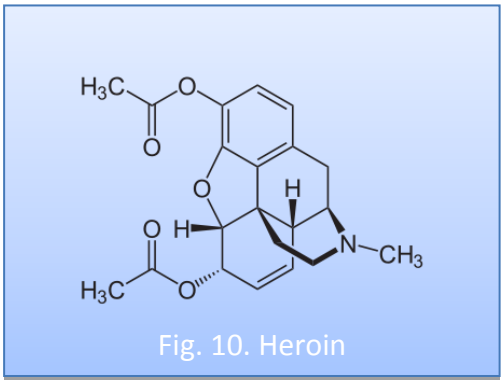


Fig. 10. Heroin

Structure

The chemical structure of heroin is shown in Figure 10. The molecular formula is $C_{21}H_{23}NO_5$, giving the compound a molecular weight of 369.4. The density of the solid is 1.56 g per cubic centimetre. The melting point is 173 ºC, and the boiling point is about 273 ºC. The vapour concentration at room temperature and atmospheric pressure is approximately 1 ppt. This is the lowest value of all the drugs discussed in this appendix, making heroin an extremely difficult molecule to detect from its vapour. In virtually all applications, collection of particulate contamination is necessary to successfully utilize trace detection.

Production

Heroin is derived from the opium poppy in the same manner as the other opiates. Heroin, or more correctly—diacetylmorphine is the most common semi-synthetic opiate drug produced. Synthesis simply involves the acetylation of morphine through the action of acetic anhydride. The only barriers to the production of heroin are the availability of appreciable amount of morphine and acetic anhydride.

Ingestion

Heroin is normally dissolved in solution and taken intravenously, though white heroin may be snorted.

Short Term Effects

Users report an intense rush, an acute transcendent state of euphoria that occurs while diacetylmorphine is being metabolized into 6-monoacetylmorphine (6-MAM) and morphine in the brain. The feeling of euphoria is accompanied by a warm flushing of the skin, a dry mouth and the feeling of having "heavy" arms and legs. After the initial rush, users will go into an alternately wakeful and drowsy state sometimes called "on the nod." Because heroin suppresses the central nervous system, the user experiences "cloudy" mental function. Users will begin to breathe at a slower rate and their breathing can reach a point of respiratory failure.[25]

Tolerance quickly develops, and users need more of the drug to achieve the same effects. Its popularity with recreational drug users, compared to morphine, reportedly stems from its ability to produce more euphoria than other opioids, especially upon injection.

Adverse Effects
Like most opioids, unadulterated heroin does not cause many long-term complications other than dependence and constipation. Adulterated "street" heroin however is considered to be one of the most harmful drugs especially if consumed intravenously. Dangers from this practice include, risk of infection from the hepatitis virus, HIV and other blood-borne viruses and poisoning from contaminants added to "cut" or dilute heroin. Physical dependence can result from prolonged use of all opioids, resulting in withdrawal symptoms on cessation of use

2.9. LSD

Description
Lysergic acid diethylamide, abbreviated LSD is a semisynthetic psychedelic drug of the ergoline family (Hallucinogen). The figure shows impregnated “Pink Elephant Blotters”, a common way of ingesting LSD.

Due to the high potency of this compound, the masses involved are small and concealing and transporting illicit LSD is much easier than smuggling other illegal drugs

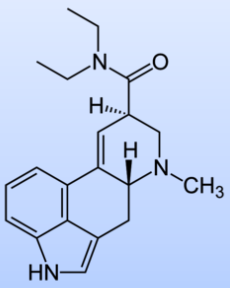


Fig. 11. LSD

Structure
It consists of prismatic crystals and has the molecular formula $C_{20}H_{25}N_3O$, a molecular weight of 323.4, and a melting point in the range of 80 ºC to 85 ºC. Its saturated vapour concentration at room temperature and atmospheric pressure is approximately 1.2 ppt. This extremely low value, similar to that of heroin, means that it is difficult or impossible to detect from its vapour in many circumstances and that trace detection needs to be focused on particle collection.

Production
Because an active dose of LSD is very minute, a large number of doses can be synthesized from a comparatively small amount of ergotamine tartrate. Manufacturing LSD requires laboratory equipment and experience in the field of organic chemistry. It takes only two to three days to produce 30 to 100 grams of pure compound.

Ingestion
LSD is typically delivered orally, usually on a substrate such as absorbent blotter paper, a sugar cube, or gelatin. In its liquid form, it can also be administered by intramuscular or intravenous injection. LSD is very potent, with 20–30 µg (micrograms) being the threshold dose.

Short Term Effects
LSD causes expansion and an altered experience of senses, emotions, memories, time, and awareness for 6 to 14 hours, depending on dosage and tolerance. Generally beginning within thirty to ninety minutes after ingestion, the user may experience anything from

subtle changes in perception to overwhelming cognitive shifts. Changes in auditory and visual perception are typical. [26]

In the New Zealand Health Behaviours Survey – Drug Use 2003 report, 1.2% of people reported past year use of LSD. LSD has been used experimentally to treat various psychiatric disorders. It is also a commonly abused drug.

Adverse Effects
LSD is non-addictive, is not known to cause brain damage, and has extremely low toxicity relative to dose, although in rare cases adverse psychiatric reactions such as anxiety or delusions are possible. There are some cases of LSD inducing a psychosis in people who appeared to be healthy before taking LSD.

2.10. PCP

Description
Phencyclidine, also known as angel dust or PCP, is a depressant that is a common drug of abuse in the United States. In its pure (free base) form, PCP is a yellow oil or as white-tan crystals or powder when in the salt form (PCP hydrochloride).


PCP in both crystalline form and a vial of PCP dissolved in water

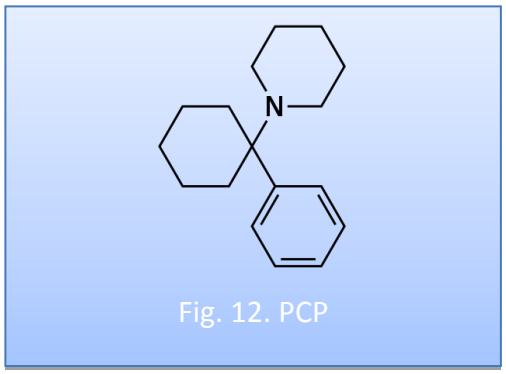


Fig. 12. PCP

Structure
This compound, prepared by various synthetic routes, has molecular formula $C_{17}H_{25}N$ and a molecular weight of 243.4. It consists of colourless crystals, with a melting point of 46 ºC and a boiling point of approximately 136 ºC. Vapour pressure data are not available at present.

Production
Synthesis of PCP requires knowledge of synthetic chemistry and the appropriate apparatus. The manufacture of PCP is a two-stage reaction involving easily obtainable precursors e.g. piperidine, cyanide, and cyclohexanone.. The total reaction time for completion requires 16 to 18 hours.

Ingestion
PCP comes in both powder and liquid forms (PCP base is dissolved most often in ether), but typically it is sprayed onto leafy material such as cannabis, mint, oregano, parsley, or ginger leaves, and then smoked.

In the salt form, PCP can be insufflated. However, most PCP on the illicit market often contains a number of contaminants as a result of makeshift manufacturing, causing the colour to range from tan to brown, and the consistency to range from powder to a gummy mass. These contaminants can range from unreacted piperidine and other precursors, to

carcinogens like benzene and cyanide-like compounds such as PCC (piperidinocyclohexyl carbonitrile).

Short Term Effects

Behavioral effects can vary by dosage. Low doses produce numbness in the extremities and intoxication, characterized by staggering, unsteady gait, slurred speech, bloodshot eyes, and loss of balance. Moderate doses (5–10 mg intranasal) will produce analgesia and anesthesia. High doses may lead to convulsions. Users frequently do not know how much of the drug they are taking due to the tendency of the drug to be made illegally in uncontrolled conditions.[27]

Adverse Effects

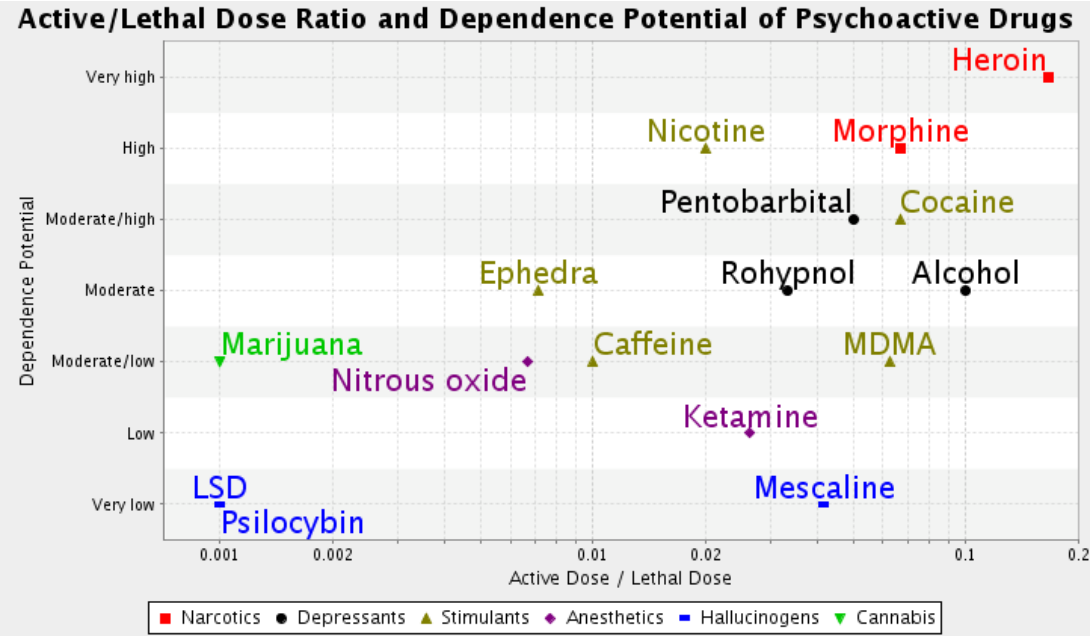
The drug has been known to alter mood states in an unpredictable fashion, causing some individuals to become detached, and others to become animated. Intoxicated individuals may act in an unpredictable fashion, possibly driven by their delusions and hallucinations. PCP may induce feelings of strength, power, and invulnerability as well as a numbing effect on the mind. Occasionally, this leads to bizarre acts of violence included acts of self-injury including suicide, and attacks on others or destruction of property.[28]

3. PHYSICAL PROPERTIES OF SOME COMMON ILLICIT DRUGS

Drug	Molecular Weight	Formular	Equilibrium vapour concentration*	Equilibrium vapour concentration (PPM)[29,30,31]
Methamphetamine	185.7	$C_{10}H_{15}N.HCl$	214 ppm	214
Cocaine	303.4	$C_{17}H_{21}NO_4$	0.25 ppb	0.00025
Tetrahydrocannabinol	314.5	C21H30O2	61 ppt	0.000061
LSD	323.4	$C_{20}H_{25}N_3O$	1.2 ppt	0.0000012
Heroin	369.4	$C_{21}H_{23}NO_5$	1.0 ppt	0.0000010

* In air at room temperature and atmospheric pressure, *ppm = parts per million; ppb = parts per billion; ppt = parts per trillion.

4. DOSE DEPENDANCE AND ADICTIVE PROPERTIES OF SOME ILLICIT DRUGS



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