

## Drugs of Abuse

TCAS has provided toxicological guidance, written assessments and expert testimony in hundreds of drug-related cases. Virtually all drugs of abuse are well-documented in the peer-reviewed toxicological literature with clearly-established endpoints. However, drugs of abuse are often taken in combination with alcohol or prescription medications which can result in drug interactions and a variety of intensified reactions. Drug abuse co-contaminants (such as contaminated needles and adulterants such as levamisole, tetramisole, lidocaine, benzocaine, etc.) can also cause adverse health effects, complicating the observed behavior or cause-of-death determination.

Historically, drugs identified in blood samples were reported quantitatively (amount) while drugs identified in urine were typically reported qualitatively above a regulatory cutoff level (e.g. "present" or "not detected"). Although such immunoassays generally allow for rapid analyses, the results can vary in the range of compounds detected; e.g. some detect specific drugs while others recognize only certain classes of drugs.<sup>1</sup>

Today, most modern laboratories use both immunoassay and mass spectrometry methods for drug analyses. These include Gas Chromatograph/Mass Spectrometry (GC/MS), Liquid Chromatography/Mass Spectrometry (LC/MS), QTRAP Mass Spectrometry (also known as LC-Tandem/Mass Spectrometry or LC-MS/MS) and/or Enzyme Immunosorbent Assay (EIA) instrumentation to detect and measure amounts of drugs in blood, urine and other biological samples.

The increasing accuracy of antemortem and postmortem biological sample analyses for illicit drugs and prescription medications have correspondingly improved the accuracy and reliability of forensic drug testing. These methods are increasingly viewed as viable investigative tools in cases ranging from DUI to homicide investigations.

## Benzodiazepines

[▶ Show all results for "Benzodiazepines".](#)



Benzodiazepines are a class of psychoactive drugs intended to treat anxiety, panic attacks, depression, insomnia, seizures, nausea and other neurological conditions. Although commonly prescribed, this class of medication presents significant toxicological issues. Benzodiazepines have sedative, hypnotic, anxiolytic, anticonvulsant, muscle relaxant and amnesic properties which work on the central nervous system and which act selectively on gamma-aminobutyric acid-A (GABA-A) receptors in the brain.<sup>2</sup> There are numerous generic formulations of benzodiazepines including alprazolam (Xanax™), diazepam (Valium™), clonazepam (Klonopin™), lorazepam (Ativan™), zolpidem (Ambien™) and others. Toxicity can be significantly altered if combined with ethanol, opiates or tricyclic antidepressants.

TCAS has significant experience in assessing the toxic effects of benzodiazepines on behalf of defendants and plaintiffs, singularly and in combination with other pharmaceuticals. Please [contact our office](#) for toxicological guidance relating to benzodiazepines.



Drugs of abuse are well-documented in the peer-reviewed toxicological literature.<sup>(a)</sup>

## Cocaine

► [Show all results for "Cocaine"](#)



Cocaine toxicity occurs primarily in drug users but can also occur as a result of accidental overdose when used as a local anesthetic or as a consequence of patient hypersensitivity to cocaine alkaloids. The powdered form of cocaine is either inhaled through the nose (where it is absorbed through nasal tissue) or dissolved in water and injected directly into the bloodstream. "Crack" is a form of cocaine that has been processed into a rock crystal that can be smoked. The crystal is heated to produce vapors that are absorbed into the bloodstream through the lungs.<sup>3</sup> Cocaine can cause excessive central nervous system stimulation and vasoconstriction and can result in several hyper-stimulation toxicological endpoints including hypertension, behavioral changes, organ ischemia and/or organ injury.

TCAS has performed many cocaine assessments in a variety of expert capacities. A [recent cocaine assessment](#) in our [toxicological case studies](#) illustrates the importance of applying generally-accepted, peer-reviewed methods to drug screening procedures.

## Opiates

► [Show all results for "Morphine, Heroin, Methadone"](#)



Opiates (morphine, heroin, methadone, codeine and others) belong to a class of naturally-occurring alkaloids derived from the opium poppy plant. Opiates are distinguished colloquially from opioids (see below) in that opioids are partly or wholly synthesized. As a consequence of improper or over-dosage in non-tolerant individuals, respiratory depression and death may result. Secondary effects can also occur due to adulterants commonly found in illegal heroin and contaminated needles. The National Survey on Drug Use and Health (NSDUH) has reported that there are presently more than 1 million "chronic heroin users" in the U.S.<sup>4</sup> Toxicological effects include both short- and long-term endpoints stemming primarily from excessive oral or intravenous use resulting in tolerance, increasing dosage and dependence.

TCAS has substantial experience assessing the toxicological effects of opiates, both singly and in combination with other pharmaceuticals. We have produced numerous reports with respect to drug interactions and health effects and have provided postmortem forensic evaluations with respect to drug alkaloid concentrations, causative effects including additive effects, cause of death, correct disease identification and other factors in many medical malpractice matters. Please [contact our office](#) for additional information.

## Opioids

► [Show all results for "Opioids"](#)



Opioids are a class of analgesic narcotics available only by prescription. Used to treat moderate to severe pain, some opioids are also classified as drugs of abuse. Opioids reduce the sending of pain messages to the brain by binding to opioid receptors ( $\mu$ -receptors) in the brain, spinal cord and other areas of the body. Opioids come in many forms with many brand names. These include fentanyl (Actiq™, Duragesic™, Fentora™), hydrocodone (Lorcet™, Lortab™, Norco™, Vicodin™), hydromorphone (Dilaudid™, Exalgo™), meperidine (Demerol™), methadone (Dolophine™, Methadose™), morphine (Avinza™, Kadian™, MS Contin™, Ora-Morph SR™), oxycodone (OxyContin™, Oxyfast™, Percocet™, Roxicodone™) and others.

TCAS has been regularly retained and has [refuted or demonstrated causation](#) based on objective forensic evidence on behalf of both plaintiffs and defendants and has also provided objective forensic evidence in federal criminal matters as well. Dr. Sawyer has assessed the toxic effects of opioids in a variety of capacities both singularly and in combination with other pharmaceuticals. Please [contact our office](#) for additional information.

## THC (Cannabis, Marijuana)

► [Show all results for "THC and Marijuana"](#)



THC (delta 9-tetrahydrocannabinol) is the primary psychoactive constituent of cannabis (marijuana). THC produces a variety of pharmacological effects in animals and humans. One of the world's most widely abused substances, cannabis preparations are typically smoked or ingested orally in foods. Acute exposures can lead to dependence and behavioral disturbances. Heavy use may increase risk for psychotic disorders. THC can be detected in the blood and other body fluids following exposure through active or passive inhalation and exposure through breastfeeding. Accurate THC detection depends on proper laboratory analytical procedures to detect and measure metabolites.

Many toxicological studies explore the mechanisms of action from pharmacokinetic and pharmacodynamic standpoints. As the prevalence of recreational use of cannabis continues to increase worldwide (particularly among young people) and in view of the recent multi-state legislation permitting its limited use in the U.S., research on the chronic adverse effects and retention of THC cannabinoids in human subjects is accelerating.<sup>5</sup> A toxicological assessment of THC intoxication involves measured THC in samples (preferably with active and metabolite levels), dosage and duration, timeframe, circumstances, bioavailability, limits of detection, properties of the ingested cannabis and effects of other substances that may have been concurrently ingested. Interestingly, more than 2,000 different compounds are produced by pyrolysis during cannabis combustion.

TCAS has been regularly retained by both defendants and plaintiffs in a wide range of THC-related cases such as illustrated in a [recent case study](#). Please [contact our office](#) for additional information.

## Club Drugs

► [Show all results for "Club Drugs"](#)



"Club drugs" refer to a group of psychoactive drugs frequently abused by young adults at concerts, all-night dance parties, dance clubs and bars. The most common club drugs include Methylenedioxymethamphetamine (MDMA, also known as *Ecstasy*), Gamma-hydroxybutyrate (GHB, also known as *G*, *Liquid Ecstasy* and *Soap*), Ketamine (also known as *Special K*, *Vitamin K* and *Jet*), Rohypnol (also known as *Roofies*), Methamphetamine (also known as *Speed*, *Ice*, *Crystal Meth* and *Crank*) and Lysergic Acid Diethylamide (LSD or *acid*).<sup>6</sup>

Although some of these drugs are approved for certain medical uses, they are most commonly employed as drugs of abuse. All have profound toxicological effects and can cause adverse health effects and sometimes death. Acting directly on the central nervous system, these substances cause changes in mood, awareness and behavior and are more dangerous when combined with alcohol or other drugs of abuse. Popular at so-called "raves" and sometimes employed as "date rape" drugs, the effects of these substances can (among other effects) reduce a person's ability to resist an attack or sexual assault. Because some club drugs are colorless, odorless, and tasteless, they can be added without detection to beverages by individuals who want to intoxicate or sedate others.<sup>7</sup>

TCAS has significant experience assessing the toxicological effects of club drugs. We have conducted numerous toxicological assessments, provided expert testimony in "date rape" cases and produced reports with respect to drug interactions and health effects. We have also provided postmortem forensic evaluations with respect to club drug causative effects and toxicity in both forensic and criminal matters. Please [contact our office](#) for additional information.

---

### Notes and References

1. California Academy of Family Physicians, "[Urine Drug Testing in Clinical Practice](#)," 2015
2. National Center for Biotechnology Information, "[GABA-A receptor subunits and benzodiazepine binding](#)," *British Journal of Biomedical Science*, 2001;58(2):111-21.
3. National Institute on Drug Abuse, "[DrugFacts: Cocaine](#)," National Institutes of Health, 2014.
4. Office of National Drug Control Policy (ONDCP), "[Heroin Facts and Figures](#)," 2015
5. U.S. National Library of Medicine, "[Chemistry, Metabolism, and Toxicology of Cannabis](#)," 2012
6. U.S. National Library of Medicine, "[Club Drugs](#)," National Institutes of Health, 2014.
7. Federal Bureau of Investigation, "[Club Drugs](#)," U.S. Department of Justice, 2015.

---

### Images

a. Public domain thumbnail images courtesy [www.scx.hu](http://www.scx.hu), photos by Ezran Kamal, "Rotorhead," Adam Ciesielski

---

#### A Message from Dr. William R. Sawyer Chief Toxicologist, TCAS, LLC



*"Assessing the direct and indirect impacts of drugs of abuse requires close attention to detail. Adhering to generally-accepted, peer-reviewed methods and the results of human studies are the best ways to ensure credible results that will stand up to scientific scrutiny."*

[Home](#) | [Experience](#) | [Toxic Substances](#) | [Case Studies](#) | [CV](#) | [News](#) | [About](#) | [Site Map](#) | [Contact](#)  
[Toxic Exposures](#) | [Environmental Testing](#) | [Risk Assessment](#) | [Forensic Toxicology](#) | [Causation Evaluation](#)  
[Dioxin](#) | [LNAPL](#) | [Hazardous Substances](#) | [Heavy Metals](#) | [Alcohol Toxicology](#) | [Drugs of Abuse](#)  
[Environmental Hazards](#) | [Industrial Chemicals](#) | [Hydrocarbons](#) | [Metals & Compounds](#) | [Pesticides](#)  
[Pharmaceutical Toxicology](#) | [Consumer Products](#) | [Human Health Risk Assessments](#)

#### Toxicology Consultants & Assessment Specialists, LLC

**(800) 308-0080** or [send a message](#)

6450 Pine Avenue, Sanibel, FL 33957 **(239) 472-2436**

29 Fennell Street, Skaneateles, NY 13152 **(315) 685-2345**

View Dr. Sawyer's profiles on [LinkedIn.com](#), [AlmExperts.com](#) and [Jurispro.com](#)

Copyright 2017 TCAS, LLC, All Rights Reserved

---

This is an informational and instructional website devoted to toxicology. It presents both original and edited public-domain content compiled as a useful educational resource. References and footnotes have been included wherever possible and image sources have been cited where appropriate. Although most pages can be printed or downloaded as PDF files (and we encourage you to make constructive use of our information), this website is copyrighted and material may only be reproduced and/or distributed with prior permission from TCAS, LLC.