

## Section 3: Facts about Methamphetamine Signs and Symptoms, Biology, and Awareness

### In This Section:

**Basic Facts about Methamphetamine**, Source: This information was accessed in 2011 from [www.methresources.gov](http://www.methresources.gov) which now redirects to the ONDCP website (2012).

**Signs and Symptoms of Methamphetamine**, Source: This information was accessed in 2011 from *NIDA InfoFacts: Methamphetamine* which is no longer available on the NIDA website.

**Anatomy of a Meth User**, [www.kci.org](http://www.kci.org)

**Methamphetamine Abuse and Addiction**, National Institute on Drug Abuse (NIDA) Research Report Series <http://www.nida.nih.gov/PDF/RRMetham.pdf>

**Methamphetamine and Teens**, Source: This information was accessed in 2011 from [www.theantidrug.com](http://www.theantidrug.com) which now redirects to [www.drugfree.org](http://www.drugfree.org).

**Biology, Behavior and the Brain: Methamphetamine Addiction**, Source: This information was accessed in 2011 from [www.nationalmethcenter.org](http://www.nationalmethcenter.org), a website which is now disabled.

### Links:

**Frontline: The Meth Epidemic**, [www.pbs.org/wgbh/pages/frontline/meth/](http://www.pbs.org/wgbh/pages/frontline/meth/) (video)

**NIDA Drug Facts: Methamphetamine**,

[www.drugabuse.gov/drugs-abuse/methamphetamine](http://www.drugabuse.gov/drugs-abuse/methamphetamine)

**NIDA Drug of Abuse: Methamphetamine**,

[www.drugabuse.gov/publications/drugfacts/methamphetamine](http://www.drugabuse.gov/publications/drugfacts/methamphetamine)

Source: National Institute on Drug Abuse (NIDA)

**Methamphetamine Use and Risk for HIV/AIDS**, Centers for Disease Control (CDC) HIV/AIDS Fact Sheet [www.cdc.gov/hiv/resources/factsheets/meth.htm](http://www.cdc.gov/hiv/resources/factsheets/meth.htm)

**Technical Support Document: Toxicology/Clandestine Drug Labs:**

**Methamphetamine**, California Office of Environmental Health Hazard Assessment, Volume 1, Number 8

[http://oehha.ca.gov/public\\_info/pdf/TSD%20Methamphetamine%20Meth%20Labs%2010'8'03.pdf](http://oehha.ca.gov/public_info/pdf/TSD%20Methamphetamine%20Meth%20Labs%2010'8'03.pdf)

## **Basic Facts about Methamphetamine**

Methamphetamine is an addictive stimulant drug that strongly activates certain systems in the brain. Methamphetamine is closely related chemically to amphetamine, but the central nervous system effects of methamphetamine are greater. Both drugs have some medical uses, primarily in the treatment of obesity, but their therapeutic use is extremely limited.

The chemicals or ingredients needed to manufacture methamphetamine are often illegally diverted from legitimate sources. Some of these precursor chemicals include pseudoephedrine (contained in over-the-counter cold medicines), anhydrous ammonia (used primarily as an agricultural fertilizer and industrial refrigerant), and red phosphorus (used in matches).

Methamphetamine comes in more than one form – it can be smoked, snorted, injected, or orally ingested, though smoking has become more common recently. Smoking leads to very fast intake into the brain, which multiplies the user's potential for addiction and health implications.

Street methamphetamine is referred to by many names, such as "speed," "meth," and "chalk." Methamphetamine hydrochloride, clear chunky crystals resembling ice, which can be inhaled by smoking, is referred to as "ice," "crank," "crystal," "tina," and "glass."

*Source:* This information was accessed in 2011 from [www.methresources.gov](http://www.methresources.gov) which now redirects to the ONDCP website (2012).

## Signs & Symptoms of Methamphetamine

There are certain signs associated with meth use that can be noticeable from the first time someone tries the drug. Not every user will display every one of these symptoms; other illicit drugs may also cause similar signs.

Signs of early meth use include:

- Euphoric "high" state (excessively happy)
- Decreased appetite
- Increased physical activity
- Anxiety, shaking hands, nervousness
- Incessant talking
- Rapid eye movement
- Increased body temperature (can rise as high as 108 degrees and cause death)
- Dilated pupils
- Sweating not related to physical activity

If you suspect someone might be using meth, symptoms can include:

- Paranoia
- Sleeplessness and severe depression
- Nausea, vomiting, diarrhea
- Extreme irritability and anxiety
- Seizures
- Teeth grinding, bad teeth, and body odor
- Skin ulceration and infections, the result of picking at the skin or imaginary bugs
- Auditory and visual hallucinations
- Violent and erratic behavior
- Nervousness
- Anhedonia - loss of pleasure
- Dryness of mucous membranes
- Burnt or blistered lips and/or fingertips from holding hot "Ice Pipes"

**Source:** This information was accessed in 2011 from *NIDA InfoFacts: Methamphetamine* which is no longer available on the NIDA website.

# ANATOMY OF A METH USER

Extreme loss of appetite  
Malnutrition  
Anorexia

Extreme rise in body temperature, which can cause brain damage  
Loss of vision  
Tooth decay  
Dry mouth  
Permanent nerve damage

Self-inflicted wounds from removing hallucinatory 'crank bugs' / 'meth bites'  
Sores take longer to heal

Breakdown of muscle tissue which may lead to kidney failure  
Putrid body odor

Bone loss from mineral and vitamin deficiencies  
Hair loss

Respiratory failure  
Toxic vapors scorch or burn the esophagus and lungs  
Crystals form in lungs  
Chest pain  
High blood pressure  
Build-up of fluid in the lungs and brain  
Liver damage  
Kidney and lung disorders

**METH RESPECTS NO ONE!**

www.kci.org  
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Meth is different; it isn't going away.  
Once it gets into your community, it stays.

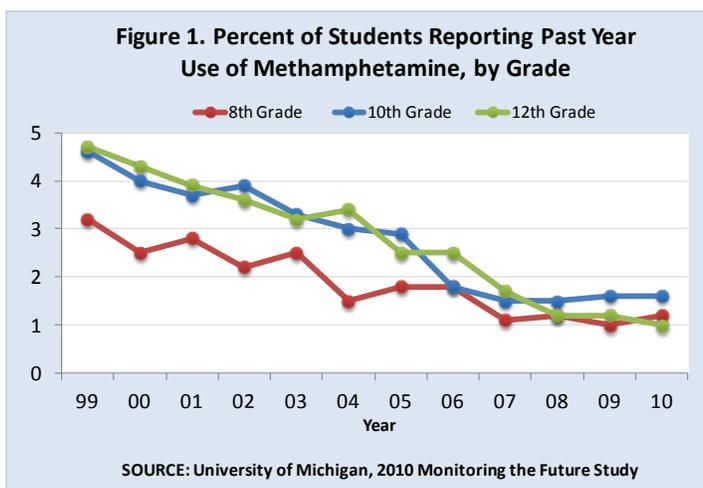
Source: [www.kci.org](http://www.kci.org)

## Methamphetamine Addiction: Progress, but need to remain vigilant— November 2011

A Research Update from the National Institute on Drug Abuse

### Declines in Methamphetamine Abuse by Youth

- Approximately 13 million people 12 years and older have abused methamphetamine in their lifetimes; in 2010, approximately 353,000 were current users (NSDUH).
- According to NIDA's 2010 Monitoring the Future Survey, the abuse rate among 8th, 10th, and 12th graders declined significantly between 1999 and 2007 and has remained unchanged since then (Figure 1).
- Abuse remains noteworthy in certain areas of the country with indicators suggesting particular problems in Hawaii, the West Coast, and the Midwest.
- Methamphetamine's potent addiction liability and destructive health and social consequences make its abuse particularly dangerous.

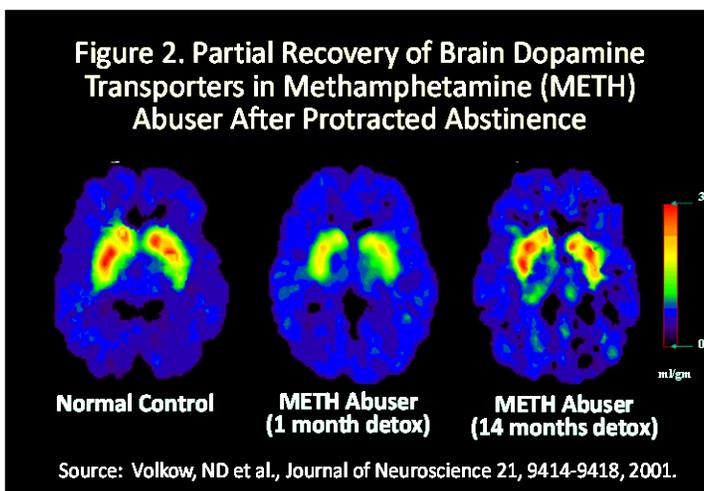


Methamphetamine acts by increasing the release of dopamine in the brain, which leads to feelings of euphoria. However, this surge of pleasure is followed by a “crash” that often leads to repeated use of the drug and eventually to difficulty feeling any pleasure at all, especially from natural rewards. Long-term methamphetamine abuse also results in many damaging physical and psychiatric effects, such as:

- Addiction
- Violent Behavior
- Anxiety
- Confusion
- Insomnia
- Psychotic symptoms (e.g. paranoia, hallucinations, delusions)
- Cardiovascular problems (e.g. rapid heart rate, irregular heartbeat, increased blood pressure, stroke).

### What Does Methamphetamine Do to the Brain?

Methamphetamine's adverse effects on the brain are clear. Imaging studies have demonstrated changes in the dopamine system (important for reward, motivation, and learning) as well as structural and functional deficits in brain areas associated with emotion and memory. These may account for the psychiatric and cognitive problems observed in chronic abusers. Fortunately, some of the methamphetamine-induced deficits in dopamine function have been shown to recover, at least partially, with extended abstinence (Figure 2). But even



with the partial recovery found in some brain regions following protracted abstinence, other regions do not show recovery of function—suggesting that long-lasting and even permanent brain changes may result from methamphetamine abuse.

## Methamphetamine and HIV

Methamphetamine is inextricably linked with HIV, hepatitis C, and other sexually transmitted diseases. Its abuse increases the risk of contracting HIV not only through the use of contaminated injection equipment, but also through increased risky sexual behaviors and through physiological changes that may favor HIV transmission.

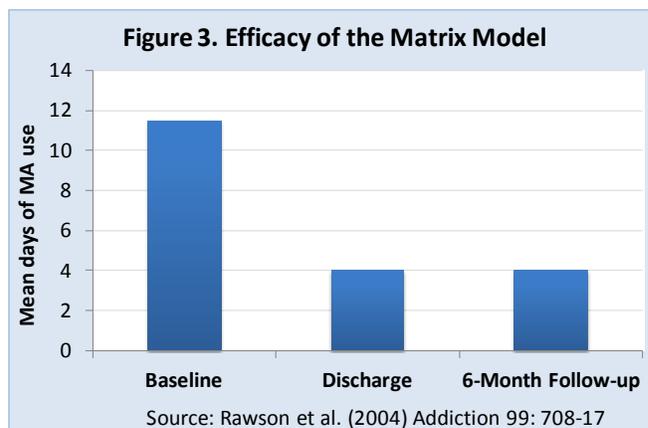
Methamphetamine abuse may also affect HIV disease progression. For example, clinical studies suggest that current methamphetamine abusers on highly active antiretroviral therapy may be at greater risk of developing AIDS than non-users, possibly due to poor medication adherence or interactions between methamphetamine and HIV medications. Similarly, preliminary studies suggest that interactions between methamphetamine and HIV itself may lead to more severe consequences for HIV-positive patients who abuse methamphetamine, including greater brain damage and cognitive impairment. More research is needed to better understand these interactions.

## Treatments for Methamphetamine Addiction

Methamphetamine addiction can be successfully treated. For example, the Matrix Model consists of a 16-week intervention that includes intensive group and individual therapy to promote the behavioral changes needed to remain abstinent, prevent relapse, and establish a lifestyle unrelated to drugs. When applied to methamphetamine abusers, the Matrix Model has been shown to significantly reduce drug use (Figure 3).

Motivational Incentives for Enhancing Drug Abuse Recovery (MIEDAR), an incentive-based method for promoting cocaine and methamphetamine abstinence, is another treatment that has demonstrated efficacy in methamphetamine abusers through NIDA's National Drug Abuse Clinical Trials Network.

There are currently no medications approved for the treatment of methamphetamine addiction. However, NIDA has made medications development a high priority. For example, a recent clinical trial revealed that the antidepressant bupropion, marketed as Welbutrin® is effective in reducing methamphetamine abuse in low/moderate users. Additional clinical trials of bupropion, and other medications (e.g., the antidepressant Mirtazapine) are currently underway. NIDA is also pursuing the novel approach of using vaccines, where antibodies are generated against the drug itself, to treat methamphetamine addiction. The antibodies would bind methamphetamine while it is still in the bloodstream, reduce its entry into the brain, and block its rewarding effects.



For further information please visit NIDA on the web at [www.drugabuse.gov](http://www.drugabuse.gov) or contact:

Public Information and Liaison Branch  
Office of Science Policy and Communications  
Phone 301-443-1124/Fax 301-443-7397  
[information@nida.nih.gov](mailto:information@nida.nih.gov)

## **Meth And Teens (Source: *Parents: The Anti-Drug*)**

Methamphetamine is an addictive stimulant drug that strongly activates certain systems in the brain. Methamphetamine is closely related chemically to amphetamine, but the central nervous system effects of methamphetamine are greater. Both drugs have some medical uses, primarily in the treatment of obesity, but their therapeutic use is limited.

Street methamphetamine is referred to by many names, such as "speed," "meth," and "chalk." Methamphetamine hydrochloride, clear chunky crystals resembling ice, which can be inhaled by smoking, is referred to as "ice," "crystal," and "glass."

### **Health Hazards**

**Neurological hazards.** Methamphetamine releases high levels of the neurotransmitter dopamine, which stimulates brain cells, enhancing mood and body movement. It also appears to have a neurotoxic effect, damaging brain cells that contain dopamine and serotonin, another neurotransmitter. Over time, methamphetamine appears to cause reduced levels of dopamine, which can result in symptoms like those of Parkinson's disease, a severe movement disorder.

**Addiction.** Methamphetamine is taken orally or intranasally (snorting the powder), by intravenous injection, and by smoking. Immediately after smoking or intravenous injection, the methamphetamine user experiences an intense sensation, called a "rush" or "flash," that lasts only a few minutes and is described as extremely pleasurable. Oral or intranasal use produces euphoria - a high, but not a rush. Users may become addicted quickly, and use it with increasing frequency and in increasing doses.

**Short-term effects.** The central nervous system (CNS) actions that result from taking even small amounts of methamphetamine include increased wakefulness, increased physical activity, decreased appetite, increased respiration, hyperthermia, and euphoria. Other CNS effects include irritability, insomnia, confusion, tremors, convulsions, anxiety, paranoia, and aggressiveness. Hyperthermia and convulsions can result in death.

**Long-term effects.** Methamphetamine causes increased heart rate and blood pressure and can cause irreversible damage to blood vessels in the brain, producing strokes. Other effects of methamphetamine include respiratory problems, irregular heartbeat, and extreme anorexia. Its use can result in cardiovascular collapse and death.

### **How Dangerous Is It to Teens?**

While meth use in the U.S. has been declining, widespread media coverage about the drug often raises many questions and causes parents to worry about whether their children are exposed to or using this dangerous substance. Meth is a stimulant drug used for the euphoria it produces and for weight loss and increased libido. The down side of the high is addiction

and a variety of toxic short- and long-term effects. One of the most serious and unpleasant side effects is "meth mouth," where the users' teeth rot from the inside out.

Parents need to talk to their kids about meth and the reality of what it does to the body. Parents also need to know when their teen might be using meth. Some of the most common signs and symptoms are extremely dilated pupils, dry or bleeding nose and lips, chronic nasal or sinus problems and bad breath. Because meth is a stimulant, users also experience hyperactivity and irritability. This includes a lack of interest in sleep and food, leading to drastic weight loss or anorexia. It may also cause users to be aggressive, nervous, and engage in disconnected chatter.

Some short-term effects are irritability, anxiety, insomnia, Parkinson-like tremors, convulsions and paranoia. Longer-term effects can include increased heart rate and blood pressure, damage to blood vessels in the brain, stroke and even death. Psychotic symptoms can sometimes persist for months or years even after the user has stopped taking the drug.

**Meth use is declining among youth.** The Monitoring the Future study shows that among 8th, 10th, and 12th graders, meth use has declined by 28, 47, and 51 percent respectively in the past three years.

It is important to note that **marijuana is still the single largest drug of abuse in this country** — 15 million current or past month users compared to one million meth current or past month users. **Meth is often in the news because of its dramatic effects and consequences.** Illegal meth labs often explode, creating danger to communities through fires. Meth labs on public lands create dangers to hikers and tourists, and children of meth users are often abandoned or neglected and are flooding the social services systems in many areas. Meth is easily made with common ingredients and readily available household equipment, making it widely and inexpensively available.

Adult methamphetamine addicts often become so obsessed with the drug that they neglect their children. Twenty percent of the meth labs raided in 2002 had children present. In addition to general neglect, children living in meth labs face a variety of dangers including the usual meth lab hazards — fires, explosions and exposure to extremely toxic chemicals. Chronic exposure to meth lab chemicals can damage the brain, liver, kidneys and spleen and can also cause cancer.

**If you suspect a teen in your life is using meth or is exposed to meth, the time for a courageous conversation is now.** Discuss the risks and effects of using this substance. Even without addiction, experimentation is too great a gamble. If something interrupts your conversation, pick it up the next chance you get.

Source: This information was accessed in 2011 from [www.theantidrug.com](http://www.theantidrug.com) which now redirects to [www.drugfree.org](http://www.drugfree.org).

## **Biology, Behavior, and the Brain: Methamphetamine Addiction**

Methamphetamine is a powerful drug, roaring through our reservations at an alarming rate of "speed." Maybe you've seen a movie that depicts some of the paranoid behaviors of a meth addict, or maybe there's someone from your own life experience who has used crystal meth. I know that has been true in my life. Though we may have seen the outward effects of crank use, most of us have no idea how this deadly, persuasive menace affects us at a biochemical level.

Classified by the scientific community as a psychomotor stimulant, methamphetamine acts as a chemical messenger in the sympathetic nervous system. This is the system responsible for "fight or flight" and other similar behaviors. For this reason, scientists call methamphetamines, cocaine, and other central stimulants sympathomimetics, meaning they act upon the sympathetic nervous system.

### **Chemical Characteristics of Methamphetamines**

Chemical messengers, or neurotransmitters, communicate information at specific receptor sites. Methamphetamine is a compound that mimics a neurotransmitter at **serotonin** (5-HT) and **dopamine** (DA) receptor sites, which means that it relays information as though it were that specific neurotransmitter. The relationship between receptor and receptor site is similar to that of a lock and its key; the receptor site (lock) is prepared to receive only information that the specific neurotransmitter (key) recognizes as its chemical counterpart.

Methamphetamine increases the release and blocks the uptake of dopamine. These monoamines, along with norepinephrine, (NE), and epinephrine (E), play a critical role in understanding the way in which methamphetamines act upon neurotransmitters in the sympathetic nervous system and act on the behavior of the organism.

### **Behavioral Effects of Methamphetamine**

The dopamine and serotonin systems influence aggressive, defensive, social and sexual behaviors. Users of methamphetamines exhibit exaggerations in these behaviors. Bipolar (manic-depressive) people might also behave this way. People using speed also exhibit behaviors similar to a schizophrenic.

In animal studies, methamphetamine consumption stimulates locomotor activity, and produces stereotypic behaviors. These have been related to the norepinephrine, dopamine and serotonin systems.

*Drug-related stereotypy* is term referring to repetitive behaviors. In rats, stereotypic behaviors may include head sways, hyperactivity, avoidance behaviors, and automutilation (self-mutilation).

E.Rylander, a researcher in the 1960's, studied several Danish methamphetamine users. He was the first to note a behavior known as *Punding*. Punding is performing a useless task compulsively again and again. This seems to be the human equivalent of drug-related stereotypy.

Interestingly, these Danish users reported being aware of their Punding behavior, but were unable to cease performing it. The behavior could be assembling, disassembling, and reassembling an apparatus after a compulsive fashion. Punding is known colloquially as "*tweaker habits*," and could include coloring, writing, playing cards, or taking apart items in a prolonged and bizarre manner.

Amphetamine psychosis is another prominent aspect of methamphetamine use, and is nearly identical to full-blown schizophrenia. There is a direct relationship between this psychosis and the alterations in the DA system. Other similarities include hallucinations, aggression, and increased excitability.

### **Biology, Behavior, and the Brain**

Animal studies have cast a fascinating light into drug studies at a cellular level. The basic assumption behind all drug use is that it does not take place repeatedly in the absence of some kind of reinforcement or reward. One contemporary model used as a framework for the biological basis of addiction is called the "Brain Reward System." This model studies the psychological and chemical aspects of drug addiction, proposing that an organism engages in a drug-seeking behavior because it is somehow rewarding for them to do so. Experiments show that an animal will work to obtain electrical stimulation to the lateral hypothalamic brain region. Drugs such as methamphetamine lower the threshold for this rewarding brain stimulation.

For psychologists, these are important activities to investigate, because it is essential to understand what the "hook" is for people who get "hooked." (The trouble with drugs is that people who use 'em just keep on using!) The answer to the question, "WHY" is a bit involved, however.

### **Biopsychology and Addiction**

Biopsychology is the study of behavior from a biological perspective. Researchers have established that central stimulants, including methamphetamine, have very specific actions on certain brain structures. These structures, including the brain's pleasure centers, are stimulated, which creates a pleasurable effect on the organism. Studies also show that when an animal receives a stimulant, its reward threshold (minimum level at which an organism becomes sensitive to a pleasurable stimulus) is reduced, an immediate response to a small amount of drug. This electrochemical stimulation is what produces sensations of euphoria.

The sensation of euphoria encourages the organism to repeat the pleasure-producing behavior, but a tricky thing happens after the user experiences the initial enjoyment: It quits being as enjoyable. The reward threshold increases again, meaning that while these drugs may be pleasurable at first, the sensitivity to the drug quickly goes down, and the drug fails to yield the same euphoric results.

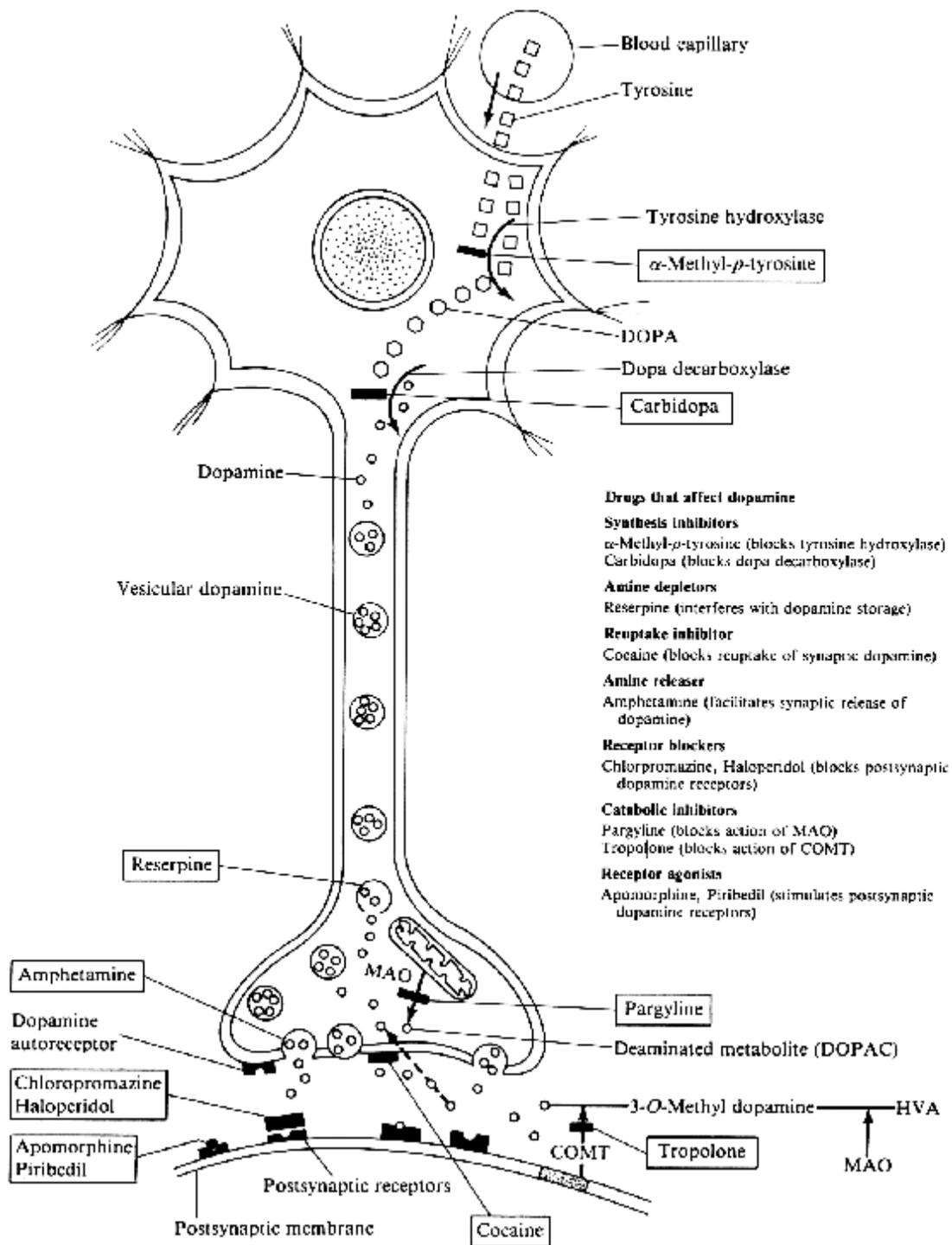
This phenomenon is called "Chasing the Ghost" by drug users. There could be an internal mechanism that serves to protect the system from toxification (poisoning), yet the insanity of addiction drives the creature to pursue the pleasurable sensation again and again.

The destructive action of this drug is compelling and profound. Though it is unlikely that drugs will affect every being identically, this overview of the biopsychology of methamphetamine use paints a dark image for anyone who considers using meth.

One might wonder how an understanding of neurotransmitters and Brain Reward Systems can have any impact on the monstrous problem of drug addiction. Some argue that it is a problem only experienced by people of weak moral constitutions or defective characters. In reality, methamphetamine abuse and addiction is an affliction of many people in many cultures. "Fathers, soldiers, sons," anyone can join the ranks of methamphetamine addicts. It remains a leveling influence, a great "respector of no one."

**Source:** This information was accessed in 2011 from [www.nationalmethcenter.org](http://www.nationalmethcenter.org), a website which is now disabled.

# Dopamine Pharmacology



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