Chapter 4

The Major Stimulants: Cocaine and Amphetamines

S. F. is a brilliant, young physician attending a case conference at a metropolitan medical center where he is a resident. He has been on call for thirty-six hours and cannot concentrate on the presentation. S. F. is lonely, depressed, and overworked. All he can think about is his fiancée, Martha, who is several hundred miles away. He knows that her father will not permit her to marry until he is able to support her, and with his loans and meager salary, that could take years. He excuses himself from the conference, takes a needle syringe from the nurses’ station, and locks himself in a bathroom stall. He fills the syringe with cocaine and plunges the needle into his arm. Within seconds, the young doctor feels a rush of euphoria. His tears dry up; he regains his composure and quickly rejoins the conference.

—The date is 1884, the place is Vienna, and the doctor is Sigmund Freud.
The time, place, and identity of S. F. in this fictionalized clinical vignette, based upon the facts of Freud’s life, may have surprised you, but unfortunately the overall picture of cocaine abuse is all too familiar.1 The year could have been 1984 (or any year since then) instead of 1884, and the individual involved could have been anyone twenty-eight years old, as Freud was at the time, or some other age. Freud was extremely lucky; he never became dependent upon cocaine, though a close friend did and millions of people have since Freud’s time. The story of cocaine is both ancient and modern. While its origins stretch back more than four thousand years, cocaine abuse continues to represent a major portion of the present-day drug crisis. For this reason, it is important to understand its history, the properties of the drug itself, and the ways in which it has the ability to destroy a person’s life.

This chapter will focus not only on cocaine but also on another group of stimulant drugs, referred to collectively as amphetamines. Although cocaine and amphetamines are distinct in terms of their pharmacology (their characteristics as biochemical substances), there are enough similarities in their behavioral and physiological effects and patterns of abuse to warrant their being discussed together. In general, cocaine and amphetamines represent the two major classes of psychoactive stimulants, drugs that energize the body and create feelings of euphoria. Other less powerful stimulants, such as nicotine, caffeine, and clinical antidepressants, will be discussed in later chapters.

The History of Cocaine

Cocaine is derived from small leaves of the coca shrub (Erythroxylon coca), grown in the high-altitude rain forests and fields that run along the slopes of the Peruvian and Bolivian Andes in South America. Like many other psychoactive drugs, cocaine use has a long history. We can trace the practice of chewing coca leaves, which contain about 2 percent cocaine, back to the Inca civilization, which flourished from the thirteenth century until its conquest by the Spaniards in 1532, as well as to other Andean cultures dating back five thousand years.

Ancient Inca records indicate that coca chewing was appreciated for giving increased strength and stamina to workers who labored in this harsh mountainous environment. Coca was even used to measure time and distance: A journey would commonly be described in terms of the mouthfuls of coca leaves that a person would chew in making the trip. Coca was considered a gift from the god Inti to the Incas, allowing them to endure life in the Andes without suffering.2

To this day, coca chewing is part of the culture of this region. It is estimated that about 2 million Peruvian men who live in the Andean highlands, representing 90 percent of the male population in that area, chew coca leaves.3 These people, called acullicadores, mix their own blend of coca, chalk, lime, and ash to achieve the desired effects, whether it is to fight fatigue or socialize with friends.4

This pattern of cocaine use among these people produces few instances of toxicity or abuse. The reason lies in the very low doses of cocaine that chewed coca leaves provide; in this form, absorption from the digestive system is slow, and relatively little cocaine is distributed to the brain (Chapter 3). A much more serious problem has been the introduction of an addictive mixture of coca paste containing a much higher percentage of cocaine combined with tobacco, called a bazuco, which is then smoked as a cigarette. Making matters worse, dangerously high levels of kerosene, gasoline, and ether are involved in the coca-refining process and end up in the cigarettes themselves.5

Cocaine in Nineteenth-Century Life

Coca leaves were brought back to Europe from the Spanish colonies soon after the conquest of the Incas, but their potency was nearly gone after the long sea voyage. Perhaps, it was said at the time, the reported effects of coca were merely exaggerations after all. Coca leaves were ignored for nearly three hundred years. By the late 1850s, however, the active ingredient of the coca plant had been chemically isolated. In 1859, Alfred Niemann, a German chemist, observed its anesthetic effect on his tongue and its bitter taste, and named it “coca.” Interest in the drug was renewed, and by the 1860s the patent medicine industry in the United States and Europe (see Chapter 1) lost no time in taking advantage of cocaine’s appeal.

Commercial Uses of Cocaine

By far the most successful commercial use of cocaine in the nineteenth century was a mixture of coca and wine invented in 1863 by a Corsican chemist and businessman, Angelo Mariani. We know now that the combination of alcohol and cocaine produces a metabolite with
an elimination half-life several times longer than cocaine alone, so the mixture tends to be quite intoxicating (see Health Alert on page 91). No wonder “Vin Mariani” became an instant sensation. A long list of endorsements by celebrities accumulated over the next few decades from satisfied customers such as U.S. President William McKinley, Thomas Edison, the surgeon general of the U.S. Army, General Ulysses S. Grant, Sarah Bernhardt, Jules Verne, the Prince of Wales, the czar of Russia, and Popes Pius X and Leo XII. In a letter to Mariani, Frederic Bartholdi, the sculptor of the Statue of Liberty, wrote that if he had been drinking Vin Mariani while designing the statue, it would have been more than three times taller. We can only assume that this comment was intended to be complimentary.

Meanwhile in the United States, Atlanta pharmacist John Pemberton promoted an imitation form of Vin Mariani that he called French Wine Cola. Shortly after, in 1885, he took out the alcohol, added soda water, and reformulated the basic mixture to combine coca with the syrup of the African kola nut containing about 2 percent caffeine: Coca-Cola was born. Early advertisements for Coca-Cola emphasized the drink as a brain tonic that made you feel more productive and as a remedy for such assorted nervous ailments as sick headaches and melancholia (a word used at the time to mean depression). The medicinal slant to the early promotion of Coca-Cola is probably the reason why soda fountains began to appear in drugstores.

A number of competing brands with similar formulations sprang up with names such as Care-Cola, Dope Cola, Kola Ade, and Wiseola. Eventually, public pressure brought about official restrictions on the patent medicine industry, which, by the beginning of the twentieth century, was marketing more than fifty thousand unregulated products. The Pure Food and Drug Act of 1906 specified that all active ingredients had to be listed on patent medicine labels. In Canada, the Proprietary and Patent Medicine Act of 1908 banned cocaine from patent medicines entirely, but in the United States no further restrictions on cocaine sales or use were imposed until the Harrison Act of 1914 (see Chapter 2).

The Coca-Cola Company, aware of the growing tide of sentiment against cocaine, changed the formula in 1903 from regular coca leaves to decocainized coca leaves, which eliminated the cocaine but retained the coca flavoring that remains to this day. The “pause that refreshed” America would henceforth be due only to the presence of sugar and caffeine.

The use of cocaine was also becoming a major factor in the practice of medicine. In the United States, William Halstead, one of the most distinguished surgeons of the time and one of the founders of Johns Hopkins Medical School, studied the effect of cocaine on anesthetizing nerves and whole limbs. In the process, he acquired a cocaine habit of his own (which was replaced several years later by a dependence on morphine). It was in Europe, however, that the psychological implications of cocaine were most extensively explored, ironically through the triumphs and tragedies of Sigmund Freud.

Freud and Cocaine

In 1884 Freud was a struggling young neurologist, given to bouts of depression and self-doubt but nonetheless determined to make his mark in the medical world. He had read a report by a German army physician that supplies of pure cocaine could help soldiers endure fatigue and feel better in general. Freud secured some cocaine for himself and found the experience exhilarating; his depression lifted, and he felt a new sense of boundless energy. His friend and colleague Dr. Ernst von Fleischl-Marxow, addicted to morphine and enduring a painful illness, borrowed some cocaine from Freud and found favorable...
results as well. Freud immediately saw the prospects of fame and fortune. In a letter to his fiancée, Martha Bernays, he wrote: “If it goes well I will write an essay on it and I expect it will win its place in therapeutics by the side of morphium [morphine] and superior to it.”¹¹

Before long, Freud was distributing cocaine to his friends and his sisters and even sent a supply to Martha. In the words of Freud’s biographer Ernest Jones, “From the vantage point of our present knowledge, he was rapidly becoming a public menace.”¹² We can gain some perspective on the effect cocaine was having on Freud’s behavior at this time through an excerpt from a personal letter to Martha:

Woe to you, my Princess, when I come. I will kiss you quite red and feed you till you are plump. And if you are forward you shall see who is the stronger, a gentle little girl who doesn’t eat enough or a big wild man who has cocaine in his body [underlined in the original]. In my last severe depression I took coca again and a small dose lifted me to the heights in a wonderful fashion. I am just now busy collecting the literature for a song of praise to this magical substance.¹³

Within four months, his “song of praise” essay, Über Coca (Concerning coca), was written and published.
Unfortunately, the sweetness of Freud’s romance with cocaine turned sour. Freud himself escaped becoming dependent upon cocaine, though later in his life he clearly became dependent on nicotine (see Chapter 11). His friend, Fleischl, however, was not so lucky. Within a year, Fleischl had increased his cocaine dose to twenty times the amount Freud had taken and had developed a severe cocaine-induced psychosis in which he experienced hallucinations that snakes were crawling over his skin (a phenomenon now referred to as formication). Fleischl suffered six years of painful agony and anguish until his death.

The story of Freud’s infatuation with cocaine and his later disillusionment with it can be seen as a miniature version of the modern history of cocaine itself. Between 1880 and 1910, the public reaction to cocaine went from wild enthusiasm to widespread disapproval. As this chapter will later describe, a similar cycle of attitudes swept the country and the world between 1970 and 1985.

Cocaine’s effect on sexual arousal is often cited as having been the basis for calling it “the aphrodisiac of the 1980s.” On the one hand, interviews of cocaine users frequently include reports of spontaneous and prolonged erections in males and multiple orgasms in females during initial doses of the drug. On the other hand, cocaine’s reputation for increasing sexual performance (recall Freud’s reference in his letter to Martha) may bias users toward a strong expectation that there will be a sexually
stimulating reaction, when in reality the effect is a much weaker one. As one cocaine abuser expressed it, “Everybody says that it’s an aphrodisiac. Again, I think some people say it because it’s supposed to be. I think that it’s just peer group identification. . . . I never felt that way. I was more content to sit there and enjoy it.” The fact is that chronic cocaine use results in decreased sexual performance and a loss of sexual desire, as the drug essentially takes the place of sex.

Cocaine produces a sudden elevation in the sympathetic branch of the autonomic nervous system. Heart rate and respiration are increased, while appetite is diminished. Blood vessels constrict, pupils in the eyes dilate, and blood pressure rises. The cocaine user may start to sweat and appear suddenly pale. The powerful sympathetic changes can lead to a cerebral hemorrhage or congestive heart failure. Cardiac arrhythmia results from cocaine’s tendency to bind to heart tissue itself. As you may recall from Chapter 2, cocaine is one of the drugs mentioned most frequently by medical examiners in hospital emergency departments.

The extreme effects of cocaine on bodily organs, particularly the heart, stem from its ability not only to excite the sympathetic system but to inhibit the parasympathetic system as well (Health Alert). Given the high level of sympathetic arousal, it is not surprising that behavioral skills will be adversely affected. In a study of drivers showing reckless behavior on the road, those found to have been under the influence of cocaine were wildly overconfident in their abilities, taking turns too fast or weaving through traffic. One highway patrol officer called this behavior “diagonal driving. They were just as involved in changing lanes as in going forward.” Yet they passed the standard sobriety tests designed to detect alcohol intoxication.

Repeated and continued use of cocaine produces undesirable mood changes that can only be alleviated when the person is under the acute effects of the drug. Chronic cocaine abusers are often irritable, depressed, and paranoid. As was true in Fleischl’s experience with cocaine, long-term abuse can produce the disturbing hallucinatory experience of formation. The sensation of “cocaine bugs” crawling on or under the skin can become so severe that abusers may scratch the skin into open sores or even pierce themselves with a knife to cut out the imaginary creatures. These hallucinations, together with feelings of anxiety and paranoia, make up a serious mental disorder referred to as cocaine psychosis.

When snorted, cocaine causes bronchial muscles to relax and nasal blood vessels to constrict; the opposite effects occur when the drug wears off. As the bronchial muscles contract and nasal blood vessels relax, chronic abusers endure continuously stuffy or runny noses and bleeding of nasal membranes. In advanced cases of this problem, the septum of the nose can develop lesions or

**Health Alert**

**Cocaine after Alcohol: The Increased Risks of Cocaethylene Toxicity**

The risks of dying from cocaine arise from the drug’s powerful excitatory effects on the body. Abnormal heart rhythms can lead to labored breathing and cardiac arrest; increased blood pressure can produce a cerebral hemorrhage, and increased body temperature can trigger epileptic seizures.

The potential for any of these toxic reactions is, unfortunately, increased when alcohol is already in the bloodstream. The biotransformation of cocaine and alcohol (ethanol), when ingested in combination, produces a metabolite called cocaethylene. One effect of cocaethylene is a three- to five-fold increase in the elimination half-life of cocaine. As a result, cocaine remains in the bloodstream for a much longer time. More important, cocaethylene has a specific excitatory effect on blood pressure and heart rate that is greater than that produced by cocaine alone.

While the combination of alcohol and cocaine is associated with a prolonged and enhanced euphoria, it also brings an eighteen- to twenty-five-fold increased risk of immediate death. The fact that 62–90 percent of cocaine abusers are also abusers of alcohol makes the dangers of cocaethylene toxicity a significant health concern.

Sources:

**cocaethylene**

A set of symptoms, including hallucinations, paranoia, and disordered thinking, produced from chronic use of cocaine.
become perforated with small holes, both of which present serious problems for breathing.

When applied topically on the skin, cocaine has the ability to block the transmission of nerve impulses, deadening all sensations from the area. This local anesthetic effect of cocaine remains its only legitimate medical application. In procedures in which tubes are passed through the nose or throat, cocaine is applied on the membranes to ease the discomfort.

There are, however, potential problems in the use of cocaine even for these specific, beneficial circumstances. One danger is that cocaine may be inadvertently absorbed into the bloodstream. There is also the possibility for abuse. Finally, the local anesthetic effects are brief because cocaine breaks down so rapidly. Synthetic drugs such as lidocaine (brand name: Xylocaine) have the advantage of being widely used as local anesthetics during dental procedures.

Cocaine greatly enhances the activity of dopamine (see Health Line in Chapter 3, page 79), and, to a lesser extent, norepinephrine in the brain. In the case of both neurotransmitters, the actual effect is to block the reuptake process at the synapse, so the neurotransmitters stimulate the postsynaptic receptors longer and to a greater degree. Unlike the amphetamines (discussed later in this chapter), the structure of cocaine does not resemble the structure of either norepinephrine or dopamine, so why cocaine should block their reuptake so effectively is not at all clear. Nonetheless, what has been determined is that the acute effect of euphoria experienced through cocaine is directly related to an increase in dopamine in the region of the brain that controls pleasure and reinforcement in general: the nucleus accumbens (see Chapter 3).

**Medical Uses of Cocaine**

**How Cocaine Works in the Brain**

Chronic cocaine abuse, however, leads to the loss of about 20 percent of the dopamine receptors in this region of the brain over time. The depletion of dopamine receptors among long-term cocaine abusers has been observed up to four months after the last cocaine exposure, even though the cocaine abuser no longer has cocaine in his or her system. As a result, there is a tendency toward a decline in the experience of pleasure from any source. In fact, cocaine abusers frequently report that their craving for cocaine no longer stems from the pleasure they felt when taking it initially. Their lives may be in shambles and the acute effects of euphoria from cocaine may no longer be strong, but they still crave the drug more than ever. In other words, there is now a dissociation between “liking” and “wanting.”

One feature of cocaine is quite unlike that of other psychoactive drugs. While cocaine abusers over repeated cocaine exposures develop a pattern of drug tolerance to its euphoric effect, they develop a pattern of sensitization (a heightened responsiveness) with respect to motor behavior and brain excitation. This phenomenon, referred to as the kindling effect, makes cocaine particularly dangerous, since cocaine has the potential for setting off brain seizures. Repeated exposure to cocaine can lower the threshold for seizures, through a sensitization of neurons in the limbic system over time. As a result of the kindling effect, deaths from cocaine overdose may occur from relatively low dose levels.

**Present-Day Cocaine Abuse**

The difficult problems of cocaine abuse in the United States and around the world mushroomed during the early 1970s and continue to the present day, though the incidence of abuse is down from peak levels reached around 1986. In ways that resembled the brief period of enthusiasm for cocaine in 1884, attitudes during the early period of this “second epidemic” were incredibly naive. Fuelled by media reports of use among the rich and famous, touted as the “champagne of drugs,” cocaine became synonymous with the glamorous life.

The medical profession at this time was equally nonchalant about cocaine. The widely respected *Comprehensive Textbook of Psychiatry* (1980) stated the following: “If it is used no more than two or three times a week, cocaine creates no serious problem... At present chronic cocaine use does not usually present a medical problem.”

These attitudes began to change as the 1980s unfolded. The death of actor-comedian John Belushi in 1982, followed by the drug-related deaths of other enter-
tainers and sport figures (see Drugs... in Focus, page 32) produced a reversal of opinion about the safety and desirability of cocaine. The greatest influence, however, was the arrival of crack cocaine on the drug scene in 1985, which will be examined in the next sections.

From Coca to Cocaine

To understand the full picture of present-day cocaine abuse, it is necessary to examine the various forms that cocaine can take, beginning with the extraction of cocaine from the coca plant itself (Figure 4.2). During the initial extraction process, coca leaves are soaked in various chemical solvents so that cocaine can be drawn out of the plant material itself. Leaves are then crushed, and alcohol is percolated through them to remove extraneous matter. After sequential washings and a treatment with kerosene, the yield is cocaine that is approximately 60 percent pure. This is the coca paste, which, as mentioned earlier, is combined with tobacco and smoked in many South American countries.

Cocaine in this form, however, is not water-soluble and therefore cannot be injected into the bloodstream. An additional step of treatment with oxidizing agents and acids is required to produce a water-soluble drug. The result is a white crystalline powder called cocaine hydrochloride, about 99 percent pure cocaine and classified chemically as a salt.

When in the form of cocaine hydrochloride, the drug can be injected intravenously or snorted. The amount injected at one time is about 16 mg. Intravenous cocaine can also be combined with heroin in a highly dangerous mixture called a speedball.

If cocaine is snorted, the user generally has the option of two methods. In one method, a tiny spoonful of cocaine is carried to one nostril while the other nostril is shut, and the drug is taken with a rapid inhalation. In the other method, cocaine is spread out on a highly polished surface (often a mirror) and arranged with a razor blade in several lines each containing from 20 to 30 mg. The cocaine is then inhaled into one nostril by means of a straw or rolled piece of paper. During the early 1980s, a $100 bill was a fashionable alternative, emphasizing the level of income necessary to be using cocaine in the first place.

From Cocaine to Crack

Options beyond the intake of cocaine hydrochloride widened with the development of free-base cocaine during the 1970s and crack cocaine (or simply crack) during the mid-1980s. In free-base cocaine, the hydrochloride is removed from the salt form of cocaine, thus liberating it as a free base. The aim is to obtain a smokable form of cocaine, which, by entering the brain more quickly, produces a more intense effect. The technique for producing free-base cocaine, however, is extremely hazardous, since it is necessary to treat cocaine powder with highly flammable agents such as ether. If the free base still contains some ether residue, igniting the drug will cause it to explode into flames.

Crack cocaine is the result of a cheaper and safer chemical method, but the result is essentially the same: a smokable form of cocaine. Treatment with baking soda yields small rocks, which can then be smoked in a small pipe. When they are smoked, a cracking noise accompanies the burning, hence the origin of the name “crack.”

How dangerous is crack? There is no question that the effect of cocaine when smoked exceeds the effect of cocaine when snorted; for some users, it even exceeds the...
effect of cocaine when injected. Inhaling high-potency cocaine (the purity of cocaine in crack averages about 75 percent) into the lungs, and almost immediately into the brain, sets the stage for uncontrollable psychological dependence. And at a price of $3 to $20 per dose, cocaine is no longer out of financial reach (Table 4.1). The answer is that crack is very dangerous indeed.

Beyond its effect on the user, however, is the effect on the society where crack is prevalent. Women who are crack abusers find that their drug cravings overwhelm their maternal instincts, resulting in the neglect of the basic needs of their children, either in postnatal or prenatal stages of life. In New York, for example, the number of reported cases of child abuse and neglect increased from 36,000 in 1985 to 59,000 in 1989, a change largely attributed to the introduction of crack. As discussed in Chapter 2, the enormous monetary profits from the selling of crack caused inner-city crime and violence to skyrocket (Figure 4.3).26

While crack abuse remains a problem, the number of new crack abusers has declined substantially, particularly in the inner-city communities of the United States. While 36 percent of all males over 36 years old who were arrested in New York in 1998 had used crack, little more than 4 percent of those 15 to 20 years old had done so. A principal reason for this change in prevalence rates has been the present-day stigmatized image of the “crack head,” considered by one’s peers to be a social loser in his or her community.27

In 2002, the National Survey on Drug Use and Health estimated that approximately 33 million Americans aged 18 or older had used cocaine at some time in their lives, 5.4 million had used it during the past year, and 1.9 million had used it during the past month. Approximately 8.2 million Americans had used crack at some time in their lives, 1.4 million had used it during the past year, and 541,000 had used it during the past month (Health Alert).28

### Table 4.1
<table>
<thead>
<tr>
<th>STREET NAME</th>
<th>TYPE OF COCAINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>blow, C, coke, big C, lady, nose candy, snowbirds, snow, stardust, toot, white girl, happypudding, cola, flake, pearl, Peruvian lady, freeze, geeze, doing the line</td>
<td>Cocaine</td>
</tr>
<tr>
<td>freebase, base</td>
<td>Free-base cocaine</td>
</tr>
<tr>
<td>crack, rock, kibbles and bits, crell</td>
<td>Crack cocaine</td>
</tr>
<tr>
<td>beam me up Scottie, space cadet, tragic magic</td>
<td>Crack cocaine combined with PCP (see Chapter 6)</td>
</tr>
<tr>
<td>speedball</td>
<td>Cocaine combined with heroin</td>
</tr>
<tr>
<td>Frisco special, Frisco speedball</td>
<td>Cocaine combined with heroin and LSD</td>
</tr>
</tbody>
</table>

Although the incidence of cocaine abuse in the United States is presently lower than it was during the 1980s, medical emergencies associated with cocaine use, as measured through the DAWN statistics, have increased dramatically. In 2002, there were approximately 199,000 cocaine-related emergencies reported by metropolitan hospitals, about two and a half times the number reported in 1990. It is evident that emergency departments have borne a great burden in the acute care of cocaine abusers. What options are there for the long-term treatment of individuals with cocaine dependence?
During the first twenty-four to forty-eight hours, the physical injury and minimal psychological discomfort. To achieve total withdrawal with the least possibility of complication and total abstinence: The cocaine abuser aims to use again—to keep the pain away. They'll do almost anything to keep from crashing on cocaine. And on top of that they'll do just about anything to keep their supply coming. Postcocaine anguish is a strong inducement to use again—to keep the pain away.32

The varieties of treatment for cocaine abuse all have certain features in common. The initial phase is detoxification and total abstinence: The cocaine abuser aims to achieve total withdrawal with the least possibility of physical injury and minimal psychological discomfort. During the first twenty-four to forty-eight hours, the chances are high that there will be profound depression, severe headaches, irritability, and disturbances in sleep.33

In severe cases involving a pattern of compulsive use that cannot be easily broken, the cocaine abuser needs to be admitted for inpatient treatment in a hospital facility. The most intensive interventions, medical supervision, and psychological counseling can be made in this kind of environment. The early stages of withdrawal are clearly the most difficult, and the recovering abuser can benefit from around-the-clock attention that only a hospital staff can give.

The alternative approach is an outpatient program, under which the individual remains at home but travels regularly to a facility for treatment. An outpatient program is clearly a less expensive route to take, but it may work only for those who recognize the destructive impact of cocaine dependence on their lives and enter treatment with a sincere desire to do whatever is needed to stop.34

For cocaine abusers who have failed in previous attempts in outpatient treatment or for those who are in denial of their cocaine dependence, an inpatient approach may be the only answer (Health Line). For many abusers, it is important to stay away from an environment where cocaine and other drugs are prevalent and peer pressure to resume drug-taking behavior is intense. This factor is particularly crucial among adolescents:

Peer acceptance is of utmost importance to adolescents. In order to interrupt the addiction cycle, youth are cautioned to avoid drug-using friends. Since many addicted adolescents are alienated from the mainstream and what few friends they have are users, this challenge can appear overwhelming. Recovering adolescents often comment that they can't find friends who don't at least drink.35

A third alternative is a combined approach in which a shortened inpatient program, seven to fourteen days in length, is followed by an intensive outpatient program that continues for several months (Portrait).

Whether on an inpatient or outpatient basis, there are several approaches for treatment. One alternative is the self-help support group Cocaine Anonymous, modeled after the famous twelve-step Alcoholics Anonymous program (see Chapter 10). In this program, recovering cocaine abusers meet in group sessions, learn from the life experiences of other members, and gain a sense of accomplishment from remaining drug-free in an atmosphere of fellowship and mutual support. In another drug-treatment option, cocaine abusers meet with cognitive-behavioral therapists, who teach them new ways of acting and thinking in response to their environment. During the course of cognitive-behavioral therapy, cocaine

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The parade of celebrities who have struggled against cocaine abuse is seemingly endless. Over the years, we have witnessed their personal triumphs and failures, seen some careers lost and occasionally careers regained. In 1986, the nation was galvanized by the untimely deaths of college basketball player Len Bias and professional football player Dan Rogers, within months of each other, as well as the death of comedian John Belushi four years earlier. In the 1990s, baseball players Doc Gooden and Darryl Strawberry captured headlines less often because of their athletic achievements and more frequently as a result of their struggles with substance abuse. Sometimes the battle has been won (Gooden), sometimes the battle continues (Strawberry). The death of actor River Phoenix in 1993 at the age of twenty-three, due to a combination of cocaine and heroin, underscored the ever-present risks of drug-taking behavior (Chapter 2).

The story of actor Robert Downey, Jr., an Academy Award nominee for his portrayal of the title role in Chaplin in 1992, has been an emotional roller-coaster ride, and we simply have to hold our breath as events unfold. In January 2003, Downey at the age of thirty-seven could remark, “I’m a little older. I’m mildly wiser. My frequent appearances on Court TV have brought me to another level than just always ‘the acting guy’ . . . I think I’ve become very, I don’t want to say real, but I’m very tangible to people.” He made those comments while at the premiere of a new film, his first since completing a year-long court-ordered drug rehabilitation program in 2002. At the time, he was about one year into a three-year probation period, after pleading “no contest” to cocaine possession and being under the influence during a November 2000 arrest in a Palm Springs hotel.

In 1999, Downey had spent a year in prison after being convicted on charges of cocaine possession. Upon his release, Downey landed a major role in the successful “Ally McBeal” TV show, only to be fired from the series in 2000. His drug-abuse problems had first begun making headlines in 1996, when he was found with cocaine, heroin, and a pistol in his car. Downey’s self-destructive lifestyle may or may not be over. Nonetheless, the clear message is that recovery is still possible even after multiple relapses. The key is treatment that is intensive, lengthy, and ongoing. Locking up individuals with a chronic drug-abuse problem without providing any treatment is not the answer. It is also necessary for the public at large to understand the magnitude of the problem that such individuals face. Willpower alone is not enough to overcome such an addiction. As Joseph A. Califano, president of the National Center on Addiction and Substance Abuse at Columbia University and former Secretary of Health, Education, and Welfare in the Carter administration, has expressed it:

*To appreciate the difficulty of shaking an addiction, just think how hard it is to lose weight and keep it off for any extended period of time. Multiply that by a million to get a sense of what it is like to give up a drug forever after your brain has flipped on the addiction switch. A few weeks in a treatment program followed by prompt return to the stress of a weekly TV sitcom or major league pennant contender is an express ticket to relapse.*


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**Seven Rules for Cocaine Abusers Who Want to Quit**

- **The time to stop using cocaine is now.** If you say, “I’ll quit tomorrow,” then you are saying, “I have no intention of quitting.”
- **Stop all at once, not gradually.** Each time you use cocaine, you are fueling the desire for more and postponing the process of recovery.
- **Stop using all other drugs of abuse, including alcohol and marijuana.** Cocaine abusers often think that the problem is with cocaine alone. Use of alcohol and marijuana can be the initial step to a relapse back to cocaine.
- **Change your life-style.** If you encounter conditions that are associated with cocaine, your craving will increase. This problem is particularly difficult in the early stages of cocaine withdrawal.

- **Whenever possible, avoid situations, people, and places that cause drug urges.** Yesterday’s abstinence doesn’t guarantee the same result today. It’s a matter of “one day at a time.” Trying to test yourself by approaching drug situations and monitoring your reaction is a big mistake, according to drug-treatment experts.
- **Find other rewards.** Learn to enjoy life without cocaine. Learn how to reconnect with a drug-free world. You may have even forgotten how to talk about anything except cocaine.
- **Take good care of your body.** Eat right and exercise. Normal eating habits are wrecked while you are abusing cocaine. Chances are good that your physical condition has deteriorated, and you may be suffering from significant vitamin deficiencies. A healthy diet and a program of regular exercise are two major factors in your long-term recovery prospects.

abusers are urged to avoid situations that lead to drug use, recognize and change irrational thoughts, manage negative moods, and practice drug-refusal skills. While the success rates of both approaches are approximately the same for patients in cocaine-abuse treatment overall, some evidence suggests that a cocaine abuser's personal characteristics may affect the kind of treatment that will work best (Figure 4.4). Whatever the approach taken, however, it is clear that an intensive relearning process has to go on, because cocaine abusers often cannot remember a life without cocaine.36

Currently pharmacological approaches in cocaine-abuse treatment, as well as the combination of pharmacological and behavioral approaches, are being vigorously pursued.37 Nonetheless, the potential for relapse is a particularly challenging element among recovering cocaine abusers. A specialist in cocaine-abuse rehabilitation tells this story: “A woman was doing very well in treatment. Then one day she was changing her baby’s diaper. She used baby powder and the sight of the white powder induced a tremendous craving for cocaine.”38 You might recognize this phenomenon as an instance of behavioral conditioning, discussed in Chapter 2 (Drugs . . . in Focus).

The History of Amphetamines

The origin of modern amphetamines dates back almost five thousand years to a Chinese medicinal herb called ma huang (Ephedra vulgaris) that was used to clear bronchial passageways during bouts of asthma and other forms of respiratory distress. According to Chinese legend, this herb was first identified by the Emperor Shen Nung, who also is credited with the discovery of tea and marijuana.

German chemists isolated the active ingredient of ma huang in 1887, naming it ephedrine. It was soon obvious that ephedrine stimulated the sympathetic nervous system in general (see Portrait in Chapter 1). In 1927, Gordon Alles, a research chemist from Los Angeles, developed a synthetic form of ephedrine and named the new drug amphetamine. The pharmaceutical company Smith, Kline and French Laboratories marketed the Alles formula under the brand name Benzedrine in 1932 as a nonprescription inhalant for asthma sufferers. By the beginning of World War II, amphetamine had gained the reputation of being a CNS stimulant appetite suppressant and bronchial dilator.

Amphetamines

One of humanity’s fondest dreams is to have the power of unlimited endurance, to be able to banish fatigue from our lives, to be capable of endless energy as if we had discovered some internal perpetual-motor machine. We all have wanted, at some time in our lives, to be a super-hero. Cocaine, as we know, gives us that illusion. The remainder of this chapter will examine another powerful drug source for these feelings of invincibility: amphetamines. As we will see, the attractions and problems of abuse associated with cocaine and amphetamines are very similar.
**Drugs...in Focus**

**Crack Babies Revisited: Has There Been an Adverse Effect?**

In the late 1980s, at the height of the crack abuse explosion, one particularly alarming possibility concerned the children of women who had been crack abusers during their pregnancies (frequently referred to as “crack babies”). Might these innocents incur long-term mental and physical deficits later in life as a result of in utero exposure to cocaine? The early signs were not promising. These newborns had lower birth weights and smaller head circumferences, and they displayed tremors, excessive crying, disturbed sleep patterns, and diminished responsiveness, all of which were abnormalities typical of cocaine exposure. The question remained, however, whether there would be deficits in social skills and mental ability when these infants grew older.

One of the difficulties in arriving at an answer is the fact that the mothers who are cocaine abusers during their pregnancies are more accurately polydrug abusers, in that they typically abuse alcohol, marijuana, and tobacco as well as cocaine. Studies comparing cocaine-exposed and non–cocaine-exposed children, therefore, must control for prenatal exposure to other drugs, gestational age and size at birth, ethnicity, and gender, as well as the socioeconomic status of the mother. When these factors are taken into account, few if any differences in cognitive functioning and achievement are found.

The consensus among health professionals, therefore, is that developmental difficulties of children can be the result of many risk factors (see Chapter 1), including inadequate prenatal care, poor nutrition, and exposure to licit drugs such as alcohol and nicotine, cocaine exposure itself prior to their birth, however, does not play a unique role. Ongoing studies continue to investigate whether subtle differences might be observed as a delayed influence when children advance into adolescence. Why the intense interest in the effects of in utero exposure to cocaine, when the evidence is so much stronger with respect to the much more widely available illicit drugs of alcohol (Chapter 10) and nicotine (Chapter 11)? As expressed in a recent editorial in the *Journal of the American Medical Association*, the answer might lie beyond the concerns of public health:

> The “crack baby” has become a convenient symbol for an aggressive war on drug users because of the implication that anyone who is selfish enough to irreparably damage an innocent child for the sake of a quick high deserves retribution. This image, promoted by the mass media, makes it easier to advocate a simplistic punitive response than to address the complex causes of drug use.


Wartime conditions, however, provided an additional application for amphetamine: to keep soldiers “pepped up” during long hours of battle. During the war, both U.S. and German troops were being given amphetamine to keep them awake and alert. Japanese kamikazi pilots were on amphetamine during their suicide missions. The advantages over cocaine, the other stimulant drug available at the time, were two-fold: Amphetamine was easily absorbed into the nervous system from the gastrointestinal tract so it could be taken orally, and its effects were much longer lasting.

After the war, amphetamine use was adapted for peacetime purposes. Amphetamine, often referred to as bennies, was a way for college students to stay awake to study for exams and for long-distance truck drivers to fight fatigue on the road. Truckers would take a “St. Louis” if they had to go from New York to Missouri and back or a “Pacific turnabout” if they needed to travel completely across country and back, without stopping to sleep.

In the meantime, the word got around that amphetamine produced euphoria as well. As you might expect, this news created a flourishing black market, as amphetamine began to be sought for recreational purposes. People found ways of opening up the nonprescription amphetamine inhalers, withdrawing the contents, and getting high by drinking it or injecting it intravenously. Since each inhaler contained 250 mg of amphetamine, there was enough for several powerful doses. During the early 1960s, injectable amphetamines could be bought with forged prescriptions or even by telephoning a pharmacy and posing as a physician. By 1965, amendments to federal drug laws tightened the supply of prescription...
amphetamines, requiring manufacturers, wholesalers, and pharmacies to keep careful records of amphetamine transactions, but amphetamines soon became available from illegal laboratories.40

Amphetamine abuse in the United States reached a peak about 1967, declining slowly over the 1970s as other drugs of abuse, notably cocaine, grew in popularity. By 1970, 10 percent of the U.S. population over fourteen years of age had used amphetamine, and more than 8 percent of all drug prescriptions were for amphetamine in some form.41 For about two decades afterward, amphetamine abuse steadily faded from prominence in the drug scene. Cocaine and later crack cocaine became the dominant illicit stimulant of abuse. Only since the mid-1990s has amphetamine abuse resurfaced as a significant social concern.

The Different Forms of Amphetamine

To understand amphetamine abuse, both past and present, it is necessary to know something about the molecular structure of amphetamines themselves and their relationship to important neurotransmitters in the brain. As you can see at the top of Figure 4.5, amphetamine can be represented in terms of carbon (C), hydrogen (H), and nitrogen (N) atoms, in a prescribed arrangement. What you are seeing, however, is only one version of amphetamine, the “right-handed” form, since amphetamine contains a “left-handed” version as well (imagine a mirror image of Figure 4.5). The more potent version is the right-handed form, called dextroamphetamine or d-amphetamine (brand name: Dexedrine). It is stronger than the left-handed form, called levoamphetamine or l-amphetamine, which is not commonly available. A modified form of d-amphetamine, formulated by substituting CH3 (called a methyl group) instead of H at one end, is called methamphetamine. This slight change in the formula allows for a quicker passage across the blood-brain barrier. It is methamphetamine, often called meth, speed, or crank, that has been the primary form of amphetamine abuse in recent years.

How Amphetamines Work in the Brain

We can get a good idea of how amphetamines work in the brain by looking carefully at the molecular structures of dopamine and norepinephrine alongside d-amphetamine and methamphetamine in Figure 4.5. Notice how similar they all are, with only slight differences among them. Because of the close resemblance to dopamine and norepinephrine, it is not hard to imagine amphetamines increasing the activity level of these two neurotransmitters. Specifically, amphetamines cause increased amounts of dopamine and norepinephrine to be released from synaptic knobs and also slow down their reuptake from receptor sites. As described in Chapter 3, dopamine figures prominently in regions of the brain (notably the nucleus accumbens) associated with positive reinforcement. The euphoric effects of amphetamines, and the craving for them during abstinence, are considered to result from changes in dopamine activity.

Acute and Chronic Effects of Amphetamines

The acute effects of amphetamine, in either d-amphetamine or methamphetamine form, closely resemble those of cocaine. However, amphetamine effects extend over a longer period of time. For intervals of eight to twenty-four hours, there are signs of increased sympathetic autonomic activity, such as faster breathing...
and heart rate as well as hyperthermia (increased body temperature) and elevated blood pressure. Users experience feelings of euphoria and invincibility, decreased appetite, and an extraordinary boost in alertness and energy. Adverse and potentially lethal bodily changes include convulsions, chest pains, or stroke. These serious health risks have, unfortunately, been reflected in the DAWN statistics, in which methamphetamine-related hospital emergencies more than doubled from 1990 to 2002.42

Chronic effects of amphetamine abuse are both bizarre and unpleasant, particularly in the case of methamphetamine. Heavy methamphetamine abusers may experience formication hallucinations similar to those endured by cocaine abusers. They may become obsessed with the delusion that parasites or insects have lodged in their skin and so attempt to scratch, cut, or burn their skin in an effort to remove them. It is also likely that they will engage in compulsive or repetitive behaviors that are fixated upon ordinarily trivial aspects of life; an entire night might be spent, for example, counting the corn flakes in a cereal box.43

The most serious societal consequence of methamphetamine abuse is the appearance of paranoia, wildly bizarre delusions, hallucinations, tendencies toward violence, and intense mood swings. In the words of one health professional, “It’s about the ugliest drug there is.”44 Because the symptoms have been observed with the chronic abuse of amphetamines of any type, they are referred to collectively as amphetamine psychosis. These “psychotic” effects, often persisting for weeks or even months after the drug has been withdrawn, so closely resemble the symptoms of paranoid schizophrenia that it has been speculated that the two conditions have the same underlying chemical basis in the brain: an overstimulation of dopamine-releasing neurons in those regions that control emotional reactivity.45 A study of heavy methamphetamine users has shown changes in chemical metabolites in those regions of the brain that are associated with Parkinson’s disease, suggesting that this group may be predisposed to acquiring Parkinson symptoms later in life, due to their methamphetamine exposure.46

Patterns of Methamphetamine Abuse and Treatment

In the United States, the emergence of widespread methamphetamine abuse was intermingled with the marijuana and LSD scene during San Francisco’s “Summer of Love and Peace” in 1967. Almost from the beginning, however, speed freaks—as methamphetamine abusers were called—whose behaviors were anything but loving or peaceful, became the outcasts of that society:

A subculture of drug users who used speed almost exclusively—popping it or shooting it—developed, and began to evince all the symptoms we now associate with classic amphetamine abuse. These wild-eyed, manic burnout cases would blather on endlessly, rip off anything not welded in place, then go into fits of erratic and violent behavior... They were shunned by other sorts of drug users, and ended up congregating with the only segment of the population who could stomach their company—other speed freaks.47

In the meantime, prescription amphetamines, widely administered during the 1960s for weight control and as a way to combat drowsiness, resulted in large numbers of abusers from practically every segment of society. Even though d-amphetamine was classified as a Schedule II drug in 1970 and the number of d-amphetamine prescriptions decreased by 90 percent from 1971 and

amphetamine psychosis: A set of symptoms, including hallucinations, paranoia, and disordered thinking, resulting from high doses of amphetamines.
1986, the pills were still out there, and people found ways to continue an abusive pattern of drug-taking behavior.

**Present-Day Patterns of Methamphetamine Abuse**

The popularity of one drug of abuse or another can often change rapidly, and the present picture with respect to stimulants is no exception. As crack cocaine became increasingly associated with the urban poor and powder cocaine with upscale affluence in the 1980s, amphetamine abuse declined dramatically. In the 1990s, however, as crack cocaine and powder cocaine abuse began to diminish, methamphetamine abuse reemerged on the drug scene. Once identified with the countercultural 1960s, methamphetamine has become a major stimulant of abuse in the United States, with its popularity now concentrated among working-class people rather than among the poor or the affluent (Table 4.2).

Methamphetamine . . . made inroads among many blue-collar people because it did not carry the stigma of being a hard drug. . . . It’s what people used to get them through a shift at the factory or keep up on a construction site.48

Administered by snorting, injecting, or smoking, methamphetamine has become one of the few drugs reported as equally or more prevalent than other illicit drugs in areas outside America’s inner cities.

In the early 1990s, distribution of methamphetamine was dominated by organized groups operating out of southern California and Mexico, with trafficking routes extending through several U.S. states, including Arizona, Colorado, Iowa, Missouri, Nebraska, North Dakota, and Texas. More recently, thousands of “homegrown” methamphetamine laboratories have proliferated in small towns and rural areas throughout the nation. They are typically situated in mobile homes, campers, vans, and easily hidden farm sheds, making their detection by law enforcement agencies extremely difficult. Major drugstores are now setting limits on the quantity of sales of “over-the-counter” cold remedies that contain pseudoephedrine—an essential ingredient in the making of methamphetamine. Because liquid anhydrous ammonia, commonly used as a farm fertilizer, is an ingredient in the making of methamphetamine, fertilizer dealers have begun to install security systems to protect their supplies from theft. Toxic residue from methamphetamine manufacture, approximately five pounds of waste for every one pound of methamphetamine produced, has seeped into the soil and contaminated rivers and streams. Increasing attention has been directed to children who have suffered from inhaling the toxic fumes emitted during the process of methamphetamine manufacture, from the risks of fire and explosions, and from abuse and neglect by methamphetamine-dependent parents.49

Methamphetamine has become a major club drug in New York, Los Angeles, and other cities (see Chapter 1). A smokable form of methamphetamine hydrochloride called ice (also referred to as crystal meth) is particularly worrisome. Its name originates from its quartz-like, chunky crystallized appearance. Ice appeared on the drug scene in Hawaii in the late 1980s, but its abuse did not expand to the mainland to a significant degree until the latter 1990s. The combination of a purity of 98 to 100 percent and a highly efficient delivery route through the lungs produces a high level of potential for dependence and a significant social problem. An association between methamphetamine abuse and increased high-risk sexual behavior among HIV-positive gay or bisexual men has raised public-health concerns.50 Health Line examines another type of stimulant abuse that has received recent attention.

While both methamphetamine and cocaine are similar in their stimulant effects and both trigger a major release of dopamine in the brain, the pattern of drug-taking behavior for each type of drug has its own distinctive char-
Health Line

**Methcathinone Abuse: A New Breed of “Cat”**

Methcathinone is a type of “designer drug,” in that it can be completely synthesized in the laboratory, its chemical structure engineered to closely resemble amphetamine. Because it is a near-relative of an alkaloid called cathinone, commonly found in the leaves of the khat bush in East Africa and southern regions of Arabia, methcathinone is frequently referred to as “cat” (although it is pronounced “cot”).

During the late 1970s and early 1980s, methcathinone was a widely abused drug in the former Soviet Union and Baltic nations. It was estimated that more than half of all drug abusers in that region had used it at least once and that it specifically constituted more than 20 percent of all illicit drug abuse in the Soviet Union. In 1989, samples of methcathinone were brought to Michigan, where laboratories were set up for production and distribution. Since then, an increasing number of cases of methcathinone-related emergencies have appeared in the Upper Peninsula portion of Michigan, as well as in Indiana, Ohio, Minnesota, and Wisconsin. U.S. Customs agents have reported nearly a doubling of khat seizures each year since 1998.

The drug produces roughly the same general effects as does methamphetamine, with one exception: The effects reportedly last much longer, up to six days. Methcathinone is now classified as a Schedule I controlled substance.


On tests that evaluate different forms of cognitive functioning, methamphetamine and cocaine abusers show significant differences in terms of the type of cognitive impairment that is produced. Methamphetamine abusers are impaired on tests of perceptual speed or manipulation of information, effects observed to a lesser extent among cocaine abusers. The greatest difference between the two groups is observed when tests require both speed and the manipulation of information.51

The course of methamphetamine withdrawal—and amphetamine withdrawal in general—is very similar to the course of events described earlier for cocaine. First there is the “crash” when the abuser feels intense depression, hunger, agitation, and anxiety within one to four hours after the drug-taking behavior has stopped. Withdrawal from amphetamines, during total abstinence from the drug, takes between six and eighteen weeks, during which the intense craving for amphetamine slowly subsides.

As in cocaine-abuse treatment, there are inpatient and outpatient programs, depending on the circumstances and motivation of the abuser. Self-help groups such as Cocaine Anonymous can be useful as well, since the symptoms of amphetamine withdrawal and cocaine withdrawal are nearly identical. Fortunately, relatively few methamphetamine abusers attempt treatment...
because they perceive themselves as in control over their drug use. As a recent report has expressed it:

*This perception is particularly dangerous because the crossover from initial use to loss of control is rapid for meth users, and generally they have lost control long before they can acknowledge it... This attitude of denial makes it difficult to convince meth abusers to enter and stay in treatment.*

Overall, methamphetamine abusers find it extremely difficult to become drug-free, and their relapse rate is one of the highest for any category of illicit or licit drug abuse.

**Stimulant Drug Treatment**

Commonly prescribed stimulant medications for the treatment of ADHD include oral administrations of dextroamphetamine (brand name: Dexedrine), a combination of dextroamphetamine and amphetamine (brand name: Adderall), pemoline (brand name: Cylert), and an amphetamine-like drug, methylphenidate (brand name: Ritalin).

Ritalin accounts for about 90 percent of all prescriptions written for ADHD. In this drug’s original formulation, the rapid onset and short duration of Ritalin requires two administrations during a school day: one at breakfast and another at lunchtime, supervised by a school nurse. In the evening, blood levels of Ritalin decline to levels that permit normal sleep. Adderall has a longer duration of action, making it possible to administer a single dose and avoiding school involvement in treatment. In comparative studies, Ritalin and Adderall have been found to be equivalent in effectiveness.

Recently, new drug treatments for ADHD have become available that are essentially variations of the traditional methylphenidate medication. They include a sustained-release formulation (Concerta), a formulation that produces an initial rapid dose of methylphenidate followed by a second sustained-release phase (Metadate), and a chemical variation of methylphenidate that allows for a longer duration of action (Attanade, Focalin).

About 70 percent of the approximately 1 million children in the United States who take stimulants for ADHD each year respond successfully to the treatment. In 1999, a major study examining the effects of medication over a fourteen-month period found that medication was more effective in reducing ADHD symptoms than behavioral treatment and nearly as effective as a combined approach of medication and behavioral treatment. The major side effect of stimulant medications, however, is a suppression of height and weight gains during these formative years, reducing growth to about 80 to 90 percent normal levels. Fortunately, growth spurts during the summer, when children are typically no longer taking medication (referred to as “drug holidays”), usually compensate for this problem. Recent studies indicate that stimulant treatment for ADHD in childhood does not increase the risk for substance abuse later in life. In fact, the risks for future problems with alcohol and other drugs appear to be reduced.

Until recently, the phenomenon of reducing hyperactivity with methylphenidate and related stimulant drugs, rather than increasing it, had been quite puzzling to professionals in this field. It is now known that orally administered methylphenidate and related stimulant
drugs produce a relatively slow but steady increase in dopamine activity in the brain. This change in brain chemistry is hypothesized to have two effects that are beneficial to an individual with ADHD. First, increased dopamine may amplify the effects of environmental stimulation, while reducing the background firing rates of neurons. Thus, there would be a greater “signal-to-noise” ratio in the brain, analogous to having now a stronger radio signal received by a radio that no longer emits a large amount of background static. The behavioral effect would be an improvement in attention and decreased distractibility. Symptoms of ADHD may be a result of not having a sufficient “signal-to-noise” ratio in the processing of information for tasks that require concentration and focus. Second, increased dopamine may heighten one’s motivation with regard to a particular task, enhancing the salience and interest in that task and improving performance. An individual might perform better on a task simply because he or she likes doing it. The slow rate of absorption achieved through oral administration (Chapter 3) avoids the emotional high that is experienced when stimulants are smoked, snorted, or injected.57

The theory that increased dopamine activity accounts for the reduction in ADHD symptoms, however, may be incomplete. In 2003, a selective norepinephrine reuptake inhibitor, atomoxetine (brand name: Strattera) was FDA-approved for the treatment of ADHD in both children and adults. Since Strattera produces an increase in norepinephrine activity in the brain, it is possible that lowered norepinephrine levels may play a role in ADHD as well. Strattera has been marketed as a once-a-day non-stimulant medication that reduces ADHD symptoms by increasing norepinephrine levels—not dopamine levels—in the brain. The full story may be either that both norepinephrine and dopamine are jointly involved in ADHD or that ADHD itself may be two separable disorders, one related to dopamine activity and the other related to norepinephrine activity. According to this hypothesis, the symptoms may overlap to such a degree that it is difficult to distinguish the two disorders on a strictly behavioral basis.

**Ritalin and Adderall Abuse**

In 1996, the Swiss pharmaceutical company Ciba-Geigy sent letters to hundreds of thousands of pharmacies and physicians in the United States, warning them to exert greater control over Ritalin tablets and prescriptions to obtain them. The alert came in response to reports that Ritalin was becoming a drug of abuse among young people, who were crushing the tablets and snorting the powder as a new way of getting a stimulant high. Many high school and college students are obtaining Ritalin and Adderall from classmates who have been prescribed these medications or through drug thefts of unsecured school offices. The drugs are crushed and snorted either for recreational use or to enhance school performance by being able to study late into the night.58

**Other Medical Applications**

Narcolepsy (an unpredictable and uncontrollable urge to fall asleep during the day) is another condition for which stimulant drugs have been applied in treatment. In 1999, modafinil (brand name: Provigil) was approved for treating narcolepsy. The advantage of Provigil over traditional stimulant treatments like dextroamphetamine is that it does not present problems of abuse and produces fewer adverse side effects. Alternative medications for narcolepsy that do not work by stimulating the CNS are presently under development.59

There are also several amphetamine-like drugs available to the public, some of them on a nonprescription basis, for use as nasal decongestants. In most cases, their effectiveness stems from their primary action on the peripheral nervous system rather than on the CNS. Even so, the potential for misuse exists: Some continue to take these drugs over a long period of time because stopping their use may result in unpleasant rebound effects such as nasal stuffiness. This reaction, by the way, is similar to the stuffy nose that is experienced in the chronic administration of cocaine.60

**Summary**

**The History of Cocaine**

- Cocaine, one of the two major psychoactive stimulants, is derived from coca leaves grown in the mountainous regions of South America. Coca chewing is still prevalent among certain groups of South American Indians.
- During the last half of the nineteenth century, several patent medicines and beverages were sold that
contained cocaine, including the original (pre-1903) formulation for Coca-Cola.

- Sigmund Freud was an early enthusiast of cocaine as an important medicinal drug, promoting cocaine as a cure for morphine dependence and depression. Soon afterward, Freud realized the strong dependence that cocaine could bring about.

Acute Effects of Cocaine
- Cocaine produces a powerful burst of energy and sense of well-being. In general, cocaine causes an elevation in the sympathetic autonomic nervous system.

Chronic Effects of Cocaine
- Long-term cocaine use can produce hallucinations and deep depression, as well as physical deterioration of the nasal membranes if cocaine is administered intranasally.

Medical Uses of Cocaine
- The only accepted medical application for cocaine is its use as a local anesthetic.

How Cocaine Works in the Brain
- Within the CNS, cocaine blocks the reuptake of receptors sensitive to dopamine and norepinephrine. As a result, the activity level of these two neurotransmitters in the brain is enhanced.

Present-Day Cocaine Abuse
- Compared with the permissive attitude toward cocaine use seen during the 1970s and early 1980s, attitudes toward cocaine use since the second half of the 1980s have changed dramatically.
- The emergence in 1986 of relatively inexpensive, smokable crack cocaine expanded the cocaine-abuse problem to new segments of the U.S. population and made cocaine abuse one of the major social issues of our time.

Treatment Programs for Cocaine Abuse
- Cocaine abusers can receive treatment through inpatient programs, outpatient programs, or a combination of the two. Relapse is a continual concern for recovering cocaine abusers.

Amphetamines
- Amphetamines, the second of the two major psychoactive stimulants, have their origin in a Chinese medicinal herb, used for thousands of years as a bronchial dilator; its active ingredient, ephedrine, was isolated in 1887.
- The drug amphetamine (brand name: Benzedrine) was developed in 1927 as a synthetic form of ephedrine. By the 1930s, various forms of amphetamines, specifically d-amphetamine and methamphetamine, became available around the world.

Acute and Chronic Effects of Amphetamines
- Amphetamine is effective as a general arousing agent, as an antidepressant, and as an appetite suppressant, in addition to its ability to keep people awake for long periods of time.
- While the acute effects of amphetamines resemble those of cocaine, amphetamines have the particular feature of producing (when taken in large doses) symptoms of paranoia, delusions, hallucinations, and violent behaviors, referred to as amphetamine psychosis. The bizarre behaviors of the “speed freak,” the name given to a chronic abuser of methamphetamine, illustrate the dangers of amphetamine abuse.

Patterns of Methamphetamine Abuse and Treatment
- With the emphasis on cocaine abuse during the 1980s, amphetamine abuse was less prominent in the public mind. Recently, however, there has been a resurgence of amphetamine-abuse cases involving methamphetamine, particularly in nonurban regions of the United States.
- Treatment for methamphetamine abuse generally follows along the same lines as treatment for cocaine abuse.

Medical Uses for Amphetamines and Similar Stimulant Drugs
- Amphetamine-like stimulant drugs have been developed for approved medical purposes.
- Methylphenidate (brand name: Ritalin), pemoline (brand name: Cylert), and dextroamphetamine (brand name: Adderall) are three examples of drugs prescribed for children diagnosed with attention deficit/hyperactivity disorder (ADHD). Recently, there has been growing concern over the recreational use of these medications.
- Other medical applications for amphetamine-like drugs include their use as a treatment for narcolepsy and as a means for temporary relief of nasal congestion.
Key Terms

- amphetamine, p. 98
- amphetamine psychosis, p. 101
- attention deficit/hyperactivity disorder (ADHD), p. 104
- cocaine, p. 87
- cocaine hydrochloride, p. 93
- cocaine psychosis, p. 91
- crack cocaine or crack, p. 93
- d-amphetamine, p. 100
- formication, p. 90
- free-base cocaine, p. 93
- ice, p. 102
- kindling effect, p. 92
- methamphetamine, p. 100

Endnotes


25. Ibid., p. 44.


28. Substance Abuse and Mental Health Services Administration (2003). Results from the National Survey on Drug Use and Health: Detailed tables. Rockville MD: Office of Applied Studies, Substance Abuse and Mental Health Services Administration, Table 1.18A.


32. Nuckols, Cocaine, p. 42.

33. Ibid., pp. 71–72.

34. Weiss and Mirin, Cocaine, p. 125.


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CHAPTER 4

The Major Stimulants: Cocaine and Amphetamines