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# 3

## Hey, What's in This Stuff, Anyway?

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*Alcohol and not the dog is man's best friend.*

—W. C. Fields

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### Introduction

There are many admonitions about the dangers of drink across time, place, and culture.

Proverbs 23:29–35 in the Old Testament, for example, presents an insightful description of the progressive effects of alcohol, including those on the central nervous system:

Who has woe? Who has sorrow? Who has strife? Who has complaining? Who has wounds without cause? Who has redness of eyes? Those who tarry long over wine, those who go to try mixed wine. Do not look at wine when it is red, when it sparkles in the cup and goes down smoothly. At the last it bites like a serpent, and stings like an adder. . . . You will be like one who lies down in the midst of the sea, like one who lies on the top of a mast. “They struck me,” you will say, “but I was not hurt; they beat me, but I did not feel it. When shall I awake? I will seek another drink.”

The Old Testament also describes pleasure associated with alcohol: “Shall I leave my wine which cheers gods and men?” (Judges 9:13); “Mark when Amnon’s heart is merry with wine” (2 Samuel 13:28).

This dichotomy was also prevalent in the Aztec city of Tenochtitlán, where drinking *pulque* (a very strong alcoholic beverage) was common practice, but public drunkenness was punishable by death.

The dual message of condemning excess while condoning moderation is at the heart of contemporary science and continued debate on this

subject. In moderation, alcohol appears to have a beneficial effect, not only on the emotions but arguably on health as well (Klatsky, 2006). It is crossing that fine line, when use turns to abuse, that devastation begins to occur.

Everyone has heard the statement, “Alcohol is a depressant.” Why then would anyone drink? Most people drink to feel better, to be more sociable and less depressed, not more so. Indeed, as we watch people who come to a cocktail party, we observe that after the first several drinks they seem to loosen up and become more relaxed. Rather than depressed, they appear to be more enthusiastic, animated, and expressive. As the party continues, and some guests are putting away their fifth or sixth drink, we notice a change in their behavior. Their speech becomes slurred, and they seem unable to comprehend simple concepts. If they drive, they are more likely to become involved in accidents because of delayed reaction time. Continued drinking may result in loss of consciousness.

How can we explain this apparent contradictory effect: initial excitation followed by sedation? As mentioned earlier, the central nervous system has many checks and balances to prevent either chronic overstimulation or understimulation. One mechanism for maintaining a baseline level of neurotransmission is the existence of the two types of synaptic connections mentioned earlier in this chapter. One is the excitatory pathway, which is responsible for increasing the state of arousal. Obviously there must be some means to regulate these excitatory connections, or everyone would be in a chronic state of hyperactivity. The second is inhibitory, serving as a check on neuronal over-excitation. When alcohol is ingested, the inhibitory synapses are depressed first. Excitation momentarily predominates, and the drinker feels exhilaration rather than sedation. As drinking continues, however, the excitatory pathway is also depressed. The stupor and slowed reaction time of excessive drinking set in.

How does this seemingly benign beverage become the self-inflicted poison par excellence? In some ways, the answer may lie in the fact that not everyone who drinks, even excessively, becomes addicted. Historically, alcoholism was regarded as a sign of a weak or vicious personality. Consider these words from an 1897 temperance lecture, describing the behavior of someone under the influence of alcohol: “But see that fiend incarnate with loathsome breath and oath-stained lips as he stumbles across the room to drag the dying wife from her last repose!” (Craig, 1897, p. 446).

## Inheriting Alcoholism

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The contemporary perspective held by the National Council on Alcoholism, Alcoholics Anonymous, and the American Medical Association is quite different from the moral depravity explanation above. Alcoholism is regarded as a chronic and potentially fatal disease that pays little respect to strength or weakness of character. The disease concept, which has been invoked for

other addictions as well, holds that addicts have inherited maladaptive biochemical responses to certain chemicals. Faulty genes lead to the production of faulty enzymes that disturb the normal metabolism of alcohol. This in turn results in a pathological response to the drug.

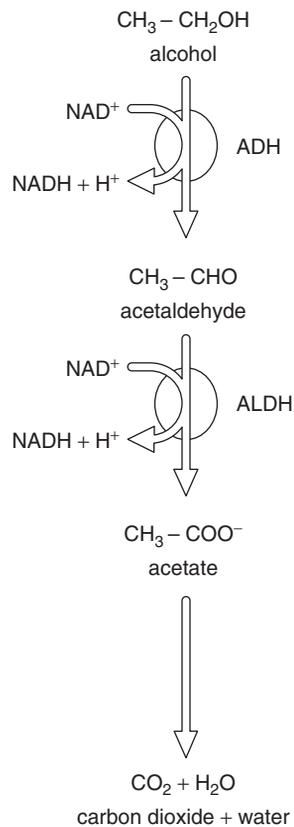
Studies from the field of behavioral genetics have confirmed a heritable aspect of alcoholism. Identical twins, who share the same genes, are about twice as likely as fraternal twins, who share on average 50% of their genes, to resemble each other in terms of the presence of alcoholism. It has also been shown that 50% to 60% of the risk for alcoholism is genetically determined, for both men and women. Genes alone do not preordain that someone will be alcoholic; features in the environment along with gene-environment interactions account for the remainder of the risk (Crabbe, 2002; Heath et al., 1997; Heath & Martin, 1994; Kendler, Neal, Heath, Kessler, & Eaves, 1994; Prescott & Kendler, 1999).

To understand the theory of inherited alcoholism, consider the pathway by which alcohol is metabolized in the liver (Figure 3.1). In the first step, alcohol (ethanol) is converted to acetaldehyde using an enzyme called alcohol dehydrogenase (ADH). This conversion requires a coenzyme, nicotinamide adenine dinucleotide (NAD<sup>+</sup>), which will be important to remember when we discuss the addictive nature of alcohol. In the second step, acetaldehyde is then changed to acetate and finally to carbon dioxide and water. The conversion of acetaldehyde to acetate requires another enzyme known as aldehyde dehydrogenase (ALDH), as well as the same coenzyme (NAD<sup>+</sup>) used in the initial conversion of alcohol to acetaldehyde.

Since enzymes (in this case ADH and ALDH) are involved in the metabolism of alcohol, alterations in their level would change the rate at which alcohol is processed. Further, since the formation of enzymes ultimately depends on our genetic makeup, inappropriate drinking behavior may be partly explained by inherited irregularities of ADH, ALDH, or both. A number of studies show that certain individuals are at genetic risk for alcoholism because they metabolize alcohol differently from others.

For example, Schuckit (1984) has shown that the blood acetaldehyde level is higher in those with a family history of alcoholism. He has further shown that acetaldehyde is converted into acetate at about half the rate in confirmed alcoholics as in nonalcoholics. This explains the established fact that acetaldehyde accumulates in alcoholics. Schuckit also demonstrated that this metabolic irregularity may exist even before heavy drinking. That is, the children of alcoholics, who before the experiment had never ingested alcohol, were unable to convert acetaldehyde to acetate at the normal rate.

On a behavioral level, Schuckit (1984) observed that novice drinkers with family histories of alcoholism sway less after three or four drinks than those without familial alcoholism. This may be a simple test to detect a genetic predisposition to alcoholism (Heinz, 2006). One of the best protections against excessive drinking (perhaps excessive anything, for that matter) is nausea (Schuckit, cited in Heinz, 2006). For people who get sick from drinking too



**Figure 3.1 Metabolism of alcohol.** In the first step, alcohol (ethanol) is converted to acetaldehyde using the enzyme alcohol dehydrogenase (ADH) and the coenzyme nicotinamide adenine dinucleotide ( $\text{NAD}^+$ ). In the second step, acetaldehyde is changed to acetate and finally to carbon dioxide and water. The conversion of acetaldehyde to acetate requires aldehyde dehydrogenase (ALDH), as well as ( $\text{NAD}^+$ ).

much (most of the population), this is a protective factor. The problem is that those who can drink us under the table are at especially high risk. People who can drink more send more alcohol to the brain, increasing the chance that a neurochemical imbalance will occur.

Besides genes, there are experiential factors that increase one's ability to handle large amounts of alcohol. Before we blame our parents for all of our drug and alcohol problems, let us consider other factors besides "faulty" genes. The most obvious one is that addiction may be caused by the altered brain functioning resulting from excessive abuse of a substance (or behavior). Begley (2007) found that the brain exhibits plasticity and will rewire itself in response to challenges in normal neurochemistry caused by drugs

or mind-altering activities. Even our thoughts, either positive or negative, can create changes in the brain.

According to Higley (cited by Heinz, 2006), a research scientist at the National Institute on Alcohol Abuse and Alcoholism, motherless rhesus monkeys (who grew up in the wild or in the lab) reacted less to drinks of high proof alcohol and other substances that affect the impact of the neurotransmitter GABA. As a result of stress-induced reduced sensitivity, these monkeys could drink huge quantities of alcohol, which they did when provided free access. Although genes play a decidedly important role in decreased sensitivity to the effects of alcohol, human studies have shown similar changes in people's brain chemistry as the result of loss and deprivation.

There is reason to believe that genetic influences, similar to the ones identified for alcoholism, may be found for other compulsive behaviors as well. Many years of twin and adoption studies have demonstrated that the heritability of liability for nicotine dependence (ND) is at least 50% (Ball, 2008; Li, 2006).

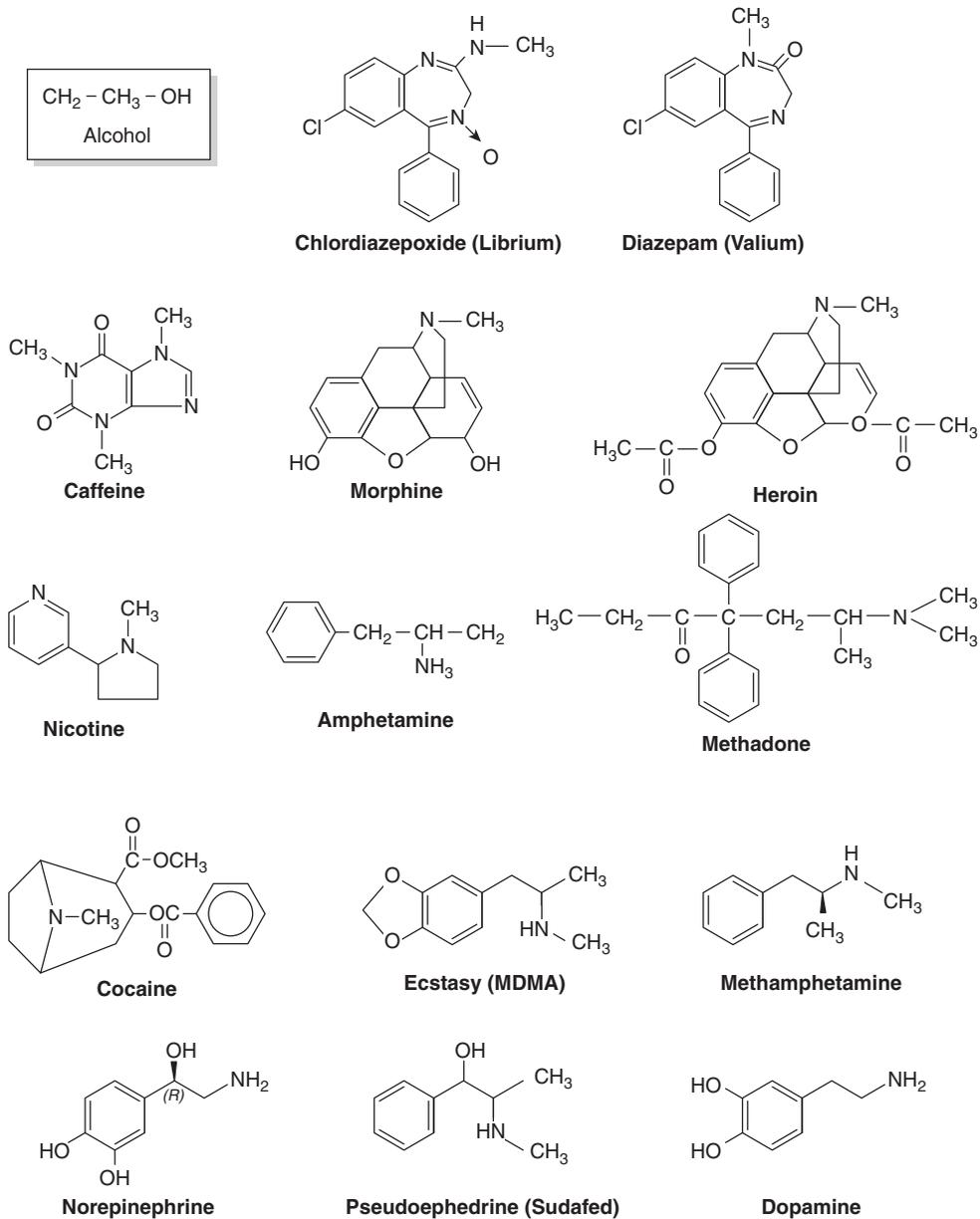
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## The Addictive Quality of Alcohol

Chronic ingestion of alcohol can cause neurochemical imbalances that are characteristic of alcoholism. This does not negate the concept of addictive disease, since many illnesses related to a genetic predisposition can also be worsened by environmental and behavioral factors. Diabetes, for example, is a disease whether it is inherited or environmentally induced. When the alcoholic faces potentially fatal consequences because of his or her uncontrolled behavior, altered biochemical processes may require the problem to be treated as a disease. The individual who alters his or her brain chemistry by excessive drinking is just as addicted as the person who happened to have "faulty" parents.

The concept of alcoholism as a disease, whether environmentally or genetically induced, encourages us to examine the nature of alcohol's addicting power. Often we hear the comment that something (drug or other) is psychologically and not physiologically addicting. Such a distinction is artificial and has no place in a sophisticated discussion on addiction. The distinction implies that the central nervous system (psychological addiction) is somehow separate from the rest of the body's functions (physiological addiction). This is not a useful distinction.

Many theories attempt to explain the addictive quality of alcohol. A cursory look at the molecular structures of the substances that are most addicting leaves one with the feeling that alcohol does not belong in this group. As seen in Figure 3.2, alcohol is the only substance that does not contain the element nitrogen (indicated as N in the formulas). In addition, alcohol is by far the smallest of the molecules in Figure 3.2. Generally, one thinks of addicting molecules as those of moderate size (for example, cocaine) that



**Figure 3.2** **Chemical structures of the mind benders.** Since alcohol is much smaller than the other addicting molecules and contains no nitrogen, scientists have looked to other factors that contribute to its addictive nature.

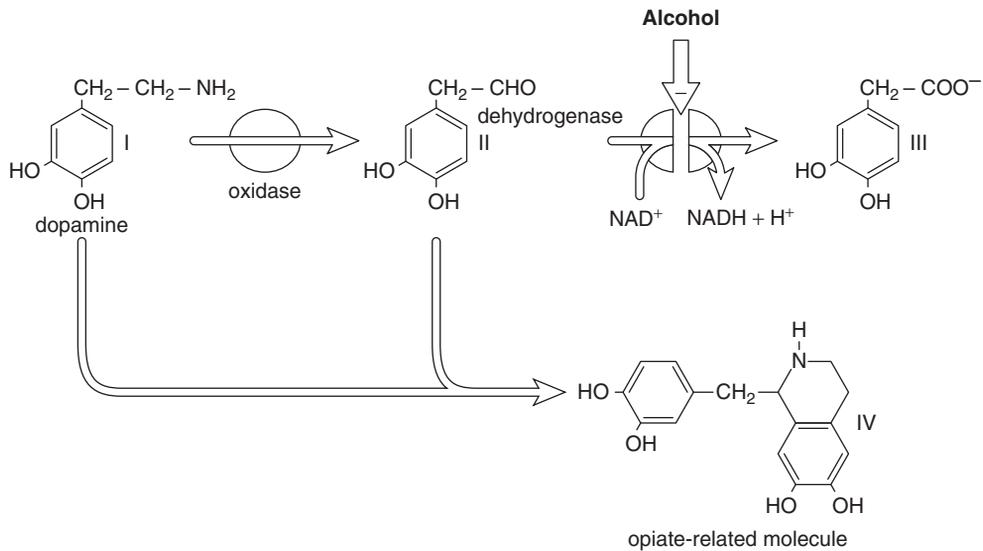
contain nitrogen. Since alcohol is much smaller than the other addicting molecules and contains no nitrogen, scientists have looked to other factors that contribute to its addictive nature.

One of the earlier theories of alcohol addiction (R. D. Meyers, 1989) involves synthesizing opiates in the central nervous system. To understand this model, consider the fate of the neurotransmitter dopamine. The level of neurotransmitters is regulated by their composition and degradation within the central nervous system. This process is necessary to maintain a balanced level of dopamine. Figure 3.3 illustrates the usual metabolic degradation of dopamine, with and without alcohol.

In the first step of degradation, dopamine (I) is converted to 3,4-dihydroxyphenylacetaldehyde (II). Normally, this substance is then converted to 3,4-dihydroxyphenylacetate (III). Note that this last step requires the same coenzyme (NAD<sup>+</sup>) that is required to convert alcohol to acetaldehyde (see Figure 3.1). Consider the person who is a heavy drinker. To metabolize large quantities of alcohol, that person requires large quantities of NAD<sup>+</sup>. Since NAD<sup>+</sup> is not present in unlimited amounts in the body, it is possible that the heavy drinker may not have enough NAD<sup>+</sup> to convert alcohol to acetaldehyde and also to convert dopamine to compound II (Figure 3.3). If this is the case, the body must choose at which metabolic site to use the limited amount of NAD<sup>+</sup>. The choice is easy: alcohol is very toxic. To live, the body of a heavy drinker must metabolize and eliminate the alcohol as quickly as possible. Therefore, the available NAD<sup>+</sup> is used in the removal of alcohol from the system. This could deplete the limited supply of NAD<sup>+</sup> to the point at which compound II is not converted to compound III. When this occurs, the normal reaction flow is blocked. Just as water backs up behind a dam, compound II backs up and becomes present in excess. This excess of compound II then begins to react with unconverted dopamine (I) to form another compound (IV), which has a structure similar to opiate narcotics (see morphine in Figure 3.2).

According to R. D. Meyers (1989), this compound (IV), which is an example of a class of chemicals known as tetrahydroisoquinolines (THIQ), is believed to behave much as opiates or our own internal endorphins. We would expect the THIQs to occupy the same neuronal receptor sites as those occupied by opiates. If this occurs, then the same addictive processes for opiates would be operative for THIQs. In support of the THIQ theory, Meyers created alcoholic rats by injecting THIQ into their brains.

It should be noted that, as with most scientific theories, the THIQ model is by no means the only explanation of alcohol addiction. Certainly alcohol dependence is not identical to opiate addiction. One of many reasons for this difference is the powerful effect that alcohol and its first metabolic product, acetaldehyde, has on many cells in the body, including brain cells. Chronic alcohol ingestion is believed to permanently alter the membranes of nerve cells. This alteration itself could contribute to the addictive nature of alcohol.

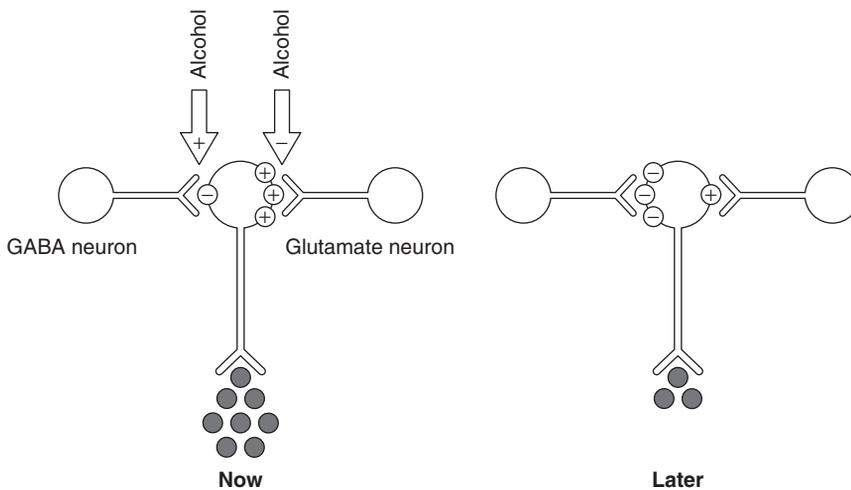


**Figure 3.3** **Effect of alcohol on dopamine metabolism.** Dopamine (I) is converted to 3,4-dihydroxyphenylacetaldehyde (II). Normally, this substance is then converted to 3,4-dihydroxyphenylacetate (III), requiring the same coenzyme ( $\text{NAD}^+$ ) needed to convert alcohol to acetaldehyde. Because of the limited supply of  $\text{NAD}^+$ , compound II is not converted to compound III. Compound II backs up and becomes present in excess. This excess of compound II then begins to react with unconverted dopamine (I) to form another compound (IV), similar in structure to opiate narcotics.

## Neurotransmitter Regulation and Dysfunction

Heinz (2006) considers the effects of other neurochemicals involved in chronic alcohol ingestion—glutamate and GABA (gamma aminobutyric acid). These molecules influence our moods as well the uncomfortable and sometimes dangerous symptoms of withdrawal. Glutamate is an excitatory neurotransmitter that enhances or speeds up neurotransmission along the neuronal pathways. Any substance that enhances glutamate release from the presynaptic neuron will increase the rate of neurotransmission, which may result in arousal, depending on the neuronal pathways involved. GABA is an inhibitory neurotransmitter that slows down neurotransmission. The effect of alcohol on these two neurotransmitters is shown in Figure 3.4.

Alcohol blocks glutamate from binding to its NMDA (N-methyl-D-aspartic acid, a type of glutamate) receptors. This creates a decrease in glutamate-induced neurotransmission resulting in relaxation, such as sleep or even passing out. This is one of the reasons alcohol is often used for its calming effect in stressful situations. Alcohol also enhances the effect of GABA, resulting in a further decrease in neurotransmission (remember, GABA is an inhibitory neurotransmitter). So the effect of decreased glutamate and increased



**Figure 3.4** **Effect of alcohol on neurotransmission.** Alcohol excites inhibitory GABA neurons but inhibits excitatory glutamate neurons (left panel). Increased inhibition coupled with decreased excitation reduces neurotransmitter release (right panel).

GABA may be the drunken stupor, slurred speech, instability, impairment, and sleepiness characteristic of excessive alcohol consumption.

So we see how alcohol produces powerful states of sedation, but the human brain is not to be trifled with. The phrase “synaptic homeostasis” describes the brain’s reaction to sustained attempts to achieve ecstasy by altering our “normal” neurotransmission. Consider the attempt, using alcohol, to achieve relaxation by blocking the binding of glutamate to NMDA receptors. For most moderate alcohol consumers, this works well. However, sustained heavy drinking alters the brain in a way that decreases the effect of the amount of alcohol that initially increased positive feelings. In order to counter this blocking of glutamate to NMDA receptors, the postsynaptic membrane creates more NMDA receptors. More alcohol must be consumed to achieve the desired pleasure. After a while, alcohol is consumed mostly to not feel “crappy,” and the hope of experiencing ecstasy is long gone.

## Harmful Effects on the Mind, Body, and Brain

Aside from understanding alcohol’s relatively transient effects on excitatory and inhibitory neurotransmission and potential health benefits from drinking in moderation (discussed below), a thorough risk–benefit analysis must also consider the dark side. One obvious problem with moderate drinking (e.g., 1–2 drinks per day), as attested to by legions of neurologists, cardiologists, liver specialists, and mental health professionals, is that not everyone who

attempts to have only one or two can actually do so. In addition to the severe brain damage and associated dementia related to chronic and heavy alcohol consumption, one must also consider its effects on other systems of the body. The liver, for example, finds alcohol extremely alarming. Inflammation of the liver (hepatitis) can lead to scarring (cirrhosis) and eventual death. Heavy drinking can increase blood pressure and damage the heart muscle (cardiomyopathy). Alcohol has also been linked to cancers of the mouth, throat, esophagus, colon, and breast. Even moderate drinking carries health risks. Alcohol can disrupt sleep, and it can interact adversely with acetaminophen (Tylenol), antidepressants, painkillers, sedatives, and anticonvulsants. Its harmful effect on judgment is legendary, as evidenced by frequent connections with crime and violence. De Bellis and colleagues (2000) have related use of alcohol by adolescents with decreased size of the hippocampus, the part of the brain associated with conversion of short-term to long-term memory.

### Do I Have a Drinking Problem?

Surely, multiple biological events, as well as powerful psychological and social factors (discussed below), are related to alcohol's addictive properties. Whatever the constellation of causes (which may be different in each person), alcohol addiction remains the world's most serious drug problem. To complicate matters further, most people who abuse alcohol have difficulty in admitting that it presents a serious problem in their lives. The questions in Table 3.1 are suggested for people who want to take an honest inventory of their current relationship with alcohol. They are designed to enhance self-awareness, with the objectives of improved levels of personal and social responsibility. "Thus, a series of questions that circumvent denial have been devised that can identify most people with alcoholism. The list of questions in Table 3.1 provides the most useful single guide I know to the clinical interview" (Vaillant, 1983, p. 296).

## Sobriety and the Brain: What If I Quit?

Let's suppose that you or someone you are trying to help wants to quit drinking. In addition to being mindful of all the psychological booby traps en route to health and well-being, we shall now examine the brain's reactions to getting sober. Case examples of Regis and Mike illustrate two primary neurobiological challenges to sobriety: *conditioned desire* and *conditioned withdrawal*; however, new medications are proving helpful.

Regis stopped drinking about 2 years ago with the help of a buddy who turned him on to AA. His girlfriend works as a waitress in the neighborhood bar and Regis picks her up after work on Saturday nights to spend some time together and to give her a ride home. He doesn't go inside the bar; rather, he waits in the car until the customers begin to leave. Once, after watching patrons becoming energized at the proverbial "last call for alcohol," Regis began to leap from his car, reacting to heavy sensations of scotch in his nostrils and throat.

**Table 3.1** Questions That Circumvent Denial

1. Do you occasionally drink heavily after a disappointment or a quarrel, or when the boss gives you a hard time?
2. When you have trouble or feel under pressure, do you always drink more heavily than usual?
3. Have you noticed that you are able to handle more liquor than you did when you were first drinking?
4. Do you ever wake up the "morning after" and discover that you could not remember part of the evening before, even though your friends tell you that you did not pass out?
5. When drinking with other people, do you try to have a few extra drinks when others will not know it?
6. Are there certain occasions when you feel uncomfortable if alcohol is not available?
7. Have you recently noticed that when you begin drinking you are in more of a hurry to get the first drink than you used to be?
8. Do you sometimes feel a little guilty about your drinking?
9. Are you secretly irritated when your family or friends discuss your drinking?
10. Have you recently noticed an increase in the frequency of your memory "blackouts"?
11. Do you often find that you wish to continue drinking after your friends say that they have had enough?
12. Do you usually have a reason for the occasions when you drink heavily?
13. When you are sober, do you often regret things you have done or said while drinking?
14. Have you tried switching brands or following different plans for controlling your drinking?
15. Have you often failed to keep promises you have made to yourself about controlling or cutting down on your drinking?
16. Have you tried to control your drinking by making a change in jobs, or moving to a new location?
17. Do you try to avoid family and close friends when you are drinking?
18. Are you having an increasing number of financial or work problems?
19. Do more people seem to be treating you unfairly without good reason?
20. Do you eat very little or irregularly when you are drinking?
21. Do you sometimes have the "shakes" in the morning and find that it helps to have a little drink?
22. Have you recently noticed that you cannot drink as much as you once did?

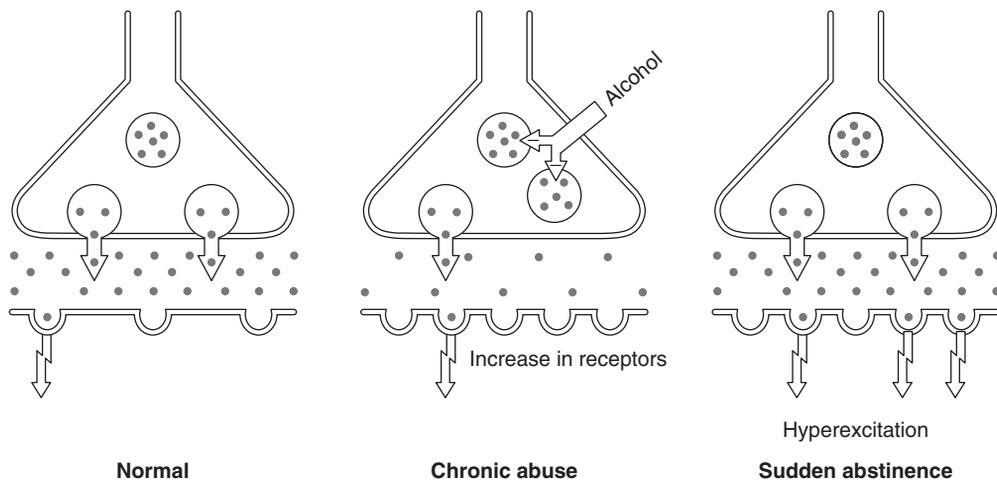
SOURCE: Reprinted by permission of the publisher from *The Natural History of Alcoholism* by George E. Vaillant, pp. 296–297, Cambridge, MA: Harvard University Press. Copyright © 1983 by the President and Fellows of Harvard College.

Regis was experiencing *conditioned desire*. When in situations similar to the ones in which the person had always consumed alcohol, the "feeling of the need for alcohol becomes almost irresistible. Then, even after years of abstinence, consuming a single drink can set off a powerful longing to imbibe more and more" (Heinz, 2006, p. 57).

A related phenomenon is *conditioned withdrawal*.

Mike had been sober for the past 5 years. He had reestablished good relationships with his two children and his wife who had threatened to leave if he didn't "clean up his act." He worked as manager of several commercial buildings. Suddenly, when the buildings were purchased by another corporation, Mike found himself out of a job. His initial response was to seek assistance from an employment agency. As time went on, the agency couldn't open any doors for interviews and Mike started to feel desperate. Tension in his primary relationship began to build as his wife complained about finances and her fears that Mike would fall back into old habits. Just after his older daughter blurted out that he was "becoming a bum," Mike started to think about running down to the pub and downing a few beers. Suddenly, he began to sweat profusely and his hands began to shake. Although he hadn't drunk in years, he felt similar withdrawal effects as after months of binge drinking.

Neuroscience can explain conditioned desire and conditioned withdrawal by tracking the brain's reactions to prolonged and excessive use of alcohol. Although high tolerance to alcohol seems like a beneficial adaptation, it functions more like a curse. As shown in Figure 3.4, alcohol affects neural mechanisms that regulate GABA and glutamate. Figure 3.5 provides an illustration for our discussion of why withdrawal occurs.



**Figure 3.5** **Mechanism of alcohol withdrawal.** The low level of neurotransmitters in chronic alcohol abuse (Figure 3.4) leads to a compensatory increase in the number of postsynaptic receptors (middle panel of Figure 3.5). Under these conditions, a normal amount of neurotransmitters (left panel), as would occur when alcohol is not present, stimulates more receptors and thereby causes hyperexcitation (right panel).

Regis's and Mike's symptoms are related to the brain's adaptation to chronic alcohol abuse. As shown in Figures 3.4 and 3.5, alcohol blocks the binding of glutamate to NMDA receptors. To increase the probability of capturing glutamate, the brain compensates by increasing or sensitizing the number of NMDA receptors in the brains of those who chronically consume alcohol (Figure 3.5, middle). When alcohol use is suddenly interrupted (either through forced abstinence—e.g., jail—or voluntarily, by “going on the wagon”), the receptors continue to be more sensitive (Figure 3.5, right). This hyperactivity results in an overreaction to glutamate (no longer blocked by alcohol), which causes symptoms of withdrawal such as cramps, unstable blood circulation, and anxiety. These symptoms may occur when alcohol is withdrawn for a few days or even overnight. In addition, the excessive neural activity can destroy large numbers of neurons, causing dementia or long-term damage to the neuronal system (Heinz, 2006).

NMDA receptors remain hypersensitive while GABA receptors continue to be undersensitive, resulting from the overactivity of GABA induced by alcohol ingestion (see Figure 3.4). These withdrawal symptoms can be treated with drugs such as chlormethiazole or benzodiazepine, which restore the sensitivity of GABA receptors. Another medication, acamprosate, is effective in suppressing the hyperexcitability of NMDA receptors and seems especially helpful for people like Mike, who suffers from conditioned withdrawal. Heinz (2006) reports that that 30% to 40% of patients who take acamprosate during the first few months of abstinence remain dry for the first year after detoxification. Of course, this leaves a great deal of work for counselors and mentors who are vitally needed to transcend the limits of medical intervention (see *Coping With Cravings and Urges*, p. 68).

Now back to Regis and his apparently conditioned desire. Just as in the case of compensating for excess activity of GABA and decreased activity of glutamate, the brain deals with another major factor in addiction—overstimulation of the reward center. To compensate for what it interprets as excessive bombardment from dopamine, the brain reduces the number of binding sites (called D2 receptors) on neurons that process dopamine. MRI studies show that when people with a history of alcohol dependence, like Regis, look at photographs of beer and wine, the regions of the brain that control attention are aroused more than in nonalcoholics (Heinz, 2006). The fewer D2 receptors available, the more attention is aroused by the sight of an alcohol-related image, and the more difficult it is for the individual to find satisfaction from anything besides alcohol, be it relationships, hobbies, or food. Some may desperately seek dopamine by switching to another drug or a behavioral addiction such as gambling or sex.

Although dopamine directs attention and desire, other neurochemicals—the endorphins—are intimately involved in the experience of pleasure. As discussed above, repeated overstimulation alters the system. Because

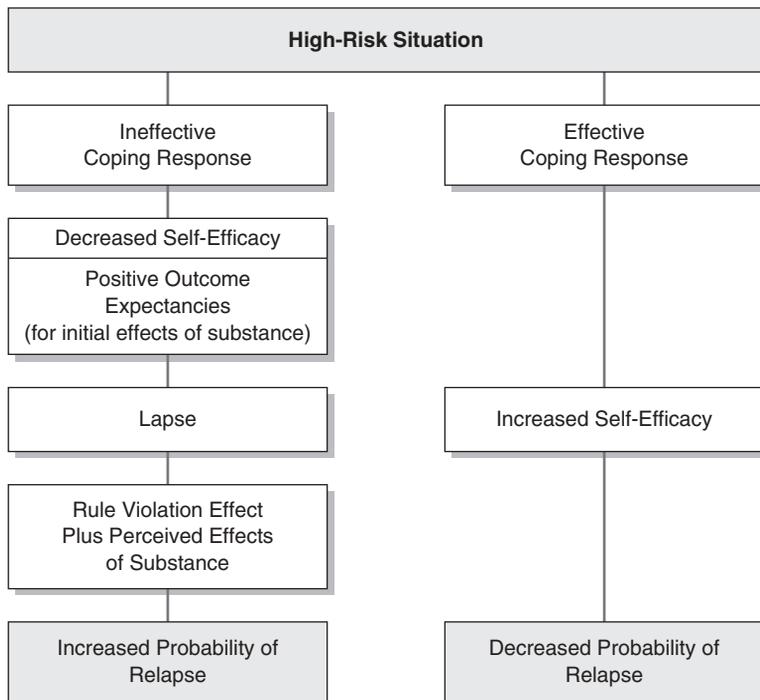
alcoholics develop an increased number of binding sites for the endorphins, when they consume alcohol their neurons bind more endorphins, resulting in increased pleasure from drinking. Naltrexone is a drug that can considerably reduce the risk of relapse by blocking the receptor sites for the endorphins and causing a taste that ranges in quality from foreign to terrible. However, the need for psychosocial intervention is highlighted by the fact that by the second or third dose, the drink begins to taste good. Naltrexone might help to avert the first sip, but after the gate is open, all hell can break loose.

## Coping With Cravings and Urges

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It is obvious that pharmaceutical supports like acamprosate and naltrexone are insufficient by themselves to prevent cravings and urges from triggering old patterns of abuse and dependence. Marlatt's (1985) relapse prevention model, shown in Figure 3.6, has been the foundational tool used by cognitive-behavioral therapists during the past 20 years to provide substance abuse clients with an understanding of how high-risk situations (e.g., negative feelings, peer influence, stimulus cues, interpersonal conflict, change in self-image) can evoke a progression of thoughts and actions that can lead to full-blown relapse. The usual thinking response to a high-risk situation is loss of confidence in one's ability to cope (decreased self-efficacy) coupled with an expectation that a tension-reducing drug or action will bring relief (positive outcome expectancies). The next stage of relapse is acting out the impulse to use by indulging in the perceived tension-relieving behavior (e.g., ingesting alcohol, taking drugs, eating) in some intended measured and controlled manner (lapse). The cognitive dissonance (tension evoked by having overthrown a primary rule of conduct, e.g., abstinence) leads to the co-occurring process of self-justification (e.g., *Who wants to be sober anyway?*) and the perception that the drug or behavior is in fact working as intended (perceived effects). Further, the individual is likely to attribute his or her "fall" to personal weakness (self-attribution). Marlatt has used the term *rule violation effect* to describe the combined influences of cognitive dissonance, self-attribution, and perceived effects, as they set the stage for return to earlier patterns of abuse and dependence (full relapse). Individuals who are interested in quitting are well-advised to give serious consideration to this model by developing and rehearsing alternative patterns of thoughts and actions at each stage of a potential relapse process.

In addition to in-depth reflection on the progression of relapse and alternative patterns of thoughts and action as indicated above, Table 3.2 presents viable strategies for coping with cravings and urges that may threaten our resolve to achieve freedom from any hedonic dependency.



**Figure 3.6** **Marlatt’s model for relapse prevention.** By understanding the sequence of thoughts prior to violating a self-defined rule for maintaining personal responsibility in regard to substance abuse or other potentially harmful behavior (e.g., binge drinking, promiscuity, overeating), a person can learn to restructure his or her dysfunctional thoughts, feelings, and actions in response to high-risk situations.

**Table 3.2** Strategies for Managing Cravings and Urges

Sharing	Talk to family, friends, or someone you trust and ask for their support.
Toughing It Out	Get control over the craving by accepting the discomfort and implementing the following:  Notice how you experience the craving. What are your thoughts and feelings about the craving? Where does it occur in your body?  Is it still a craving, or has it become an urge (when your physical body becomes activated and you take steps to fulfill the craving such as searching out a friend you can get high with)?
Talk Yourself Down	When the craving becomes an urge, focus on your body where you feel the urge. Talk to yourself and take control of your actions, figuring out alternative ways to feel comfortable.
Urge Surfing	Ride out the wave, and visualize relaxing at the shore.
Alternatives	Find another activity that will distract you from the craving or urge.

## Redeeming Alcohol: The Benefits of Booze

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*[N]one seemed to think the injury arose from the use of a bad thing but from the abuse of a good thing.*

—Abraham Lincoln, addressing the Illinois Temperance Society, 1842

*I have taken more out of alcohol than alcohol has taken out of me.*

—Winston Churchill

One of the authors (Milkman) has an ongoing argument with his daughter about the concept of *natural highs*. She claims that there is no such thing as “unnatural” because everything that exists, including plastics, cocaine, atomic bombs, marijuana, and cigarettes, is derived from substances that exist here on earth. From her point of view, there is no valid distinction between “natural” and “unnatural” highs. Even synthesized drugs are “natural” because they are made from chemical elements, which are natural. Can one say, without being moralistic, that moderate consumption of alcohol, even to the point of feeling somewhat euphoric (without risk of harm), is not a natural high?

Following from our definition, that “natural highs are self-induced changes in brain chemistry that result in positive feeling states, health, and well-being for the individual and society,” does moderate consumption of beer, wine, or spirits constitute an alcohol-mediated natural high? To be sure, there are vested interests in showing the bright or dark side of drinking. Presently, however, a preponderance of evidence accrued over the past 30 years (not without controversy) shows substantial health benefits from moderate consumption. Despite centuries of biblical, religious, moral, and medical objections to alcohol, what new evidence supports the proclamation of “health benefits”?

We shall begin our discussion of healthy drinking by defining what qualifies as reasonable or “moderate” consumption. First of all, what actually constitutes a drink? In the United States, “one drink” is usually defined as 12 ounces of beer, 5 ounces of wine, or 1.5 ounces of spirits. Each delivers about 12 to 14 grams of alcohol. Check your bartender’s skills—he or she might pour a shot twice that amount—no doubt doing you a “big favor.” The concept of moderation is even more slippery. In some studies, less than one drink per day is considered moderate, and in others, daily consumption of as much as three to four drinks qualifies (Dufour, 1999). The current consensus, in accordance with the U.S. Department of Agriculture and the Dietary Guidelines for Americans, is no more than one to two drinks per day for men and no more than one drink per day for women (U.S. Department of Health and Human Services [USDHHS], 2004).

## Linking Alcohol and Health

Pathologists first discovered hints of the link between alcohol consumption and cardiovascular health about 100 years ago, noting that the large arteries of people who died of alcohol-related liver disease were remarkably “clean”—that is, free of arteriosclerosis (fatty plaque). According to Klatsky (2006), senior consultant in cardiology at the Kaiser Permanente Medical Center, a meta-analysis of 28 previously published studies on the relationship between alcohol intake and cardiovascular disease (CVD) showed that the risk of acquiring CVD went down as the daily amount of alcohol consumed went up from 0 to 25 grams (about 2 standard drinks). At 2 drinks, an individual's risk of a major coronary heart disease (CHD) “event”—either heart attack or death—“was 20 percent lower than for someone who did not drink at all” (p. 76). Furthermore, at a meeting of the American Heart Association in 2002, Klatsky and colleagues reviewed an updated analysis of 128,934 patients who had checkups between 1978 and 1985. They found that “those who had one or two alcoholic beverages a day had a 32 percent lower risk of dying from CHD than abstainers did” (p. 77).

Further, as presented in an article published by the Harvard School of Public Health (2008) entitled “The Nutrition Source: Alcohol and Heart Disease,” it was discovered that “[m]ore than 100 prospective studies show an inverse association between moderate drinking and risk of heart attack, ischemic (clot-caused) stroke, peripheral vascular disease, sudden cardiac death, and death from all cardiovascular causes” (p. 2). Table 3.3 summarizes the results of some of the largest studies.

## Is Red Wine Better for You?

Nearly 200 years ago, an Irish physician made the observation that angina (chest pain) was less frequent among the French than the Irish and attributed the difference to the “French habits and mode of living” (Black, 1819). The comparatively low rate of cardiovascular disease in France, despite their reputed diet as rich in butter and cheese, has become known as the “French paradox.” The view that health benefits derive from the chemistry of red wine is challenged by the fact that there are many other aspects of French lifestyle that may influence health outcomes. For example, the French diet, particularly for those who live in southern France, is similar to those of other Mediterranean cultures, which are also lower in heart disease.

Some studies suggest that red wine, especially when drunk with a meal, offers more health benefits than beer or spirits, that is, wine-drinking cultures fare better in terms of health (e.g., Rimm, Klatsky, Grobbee, & Stampfer, 1996; St. Leger, Cochrane, & Moore, 1979). Although it has been speculated that besides alcohol, red wine may contain health-augmenting substances, a

**Table 3.3** Results of Some Large Prospective Studies of Alcohol Consumption and Cardiovascular Disease

<i>Participants</i>	<i>Duration</i>	<i>Association With Moderate Alcohol Consumption</i>
Japan Collaborative Cohort Study for Evaluation of Cancer Risk cohort: 97,432 men and women aged 40 to 79 (Lin et al., 2005)	10 years	12–20% decreased risk of all-cause mortality in men and women who consumed less than 23 grams per day of alcohol; heavy drinking increased the risk of all-cause mortality
Kaiser Permanente cohort: 123,840 men and women aged 30+ (Klatsky, Armstrong, & Friedman, 1990)	10 years	40% reduction in fatal myocardial infarction; 20% reduction in cardiovascular mortality; 80% increase in fatal hemorrhagic stroke
Nurses' Health Study: 85,709 female nurses aged 34–59 (Stampfer, Colditz, Willett, Speizer, & Hennekens, 1988)	12 years	17% lower risk of all-cause mortality; an earlier report showed a 40% reduction in risk of CHD and 70% reduction in risk of ischemic stroke
Physicians' Health Study: 22,071 male physicians aged 40–84 (Camargo et al., 1997)	11 years	30–35% reduced risk of angina and myocardial infarction; 20–30% reduced risk of cardiovascular death
Cancer Prevention Study II: 489,626 men and women aged 30–104 (Thun et al., 1997)	9 years	30–40% reduced risk of cardiovascular death; mortality from all causes increased with heavier drinking, particularly among adults under age 60
Eastern France cohort: 34,014 men and women (Renaud, Gueguen, Siest, & Salamon, 1999)	10–15 years	25–30% reduced risk of cardiovascular death
Health Professionals Follow-up Study: 38,077 male health professionals aged 40–75 (Mukamal et al., 2003)	12 years	35% reduced risk of myocardial infarction

SOURCE: Reprinted from *The Nutrition Source*, Department of Nutrition, Harvard School of Public Health, "Alcohol and Heart Disease," <http://www.hsph.harvard.edu/nutritionsource/what-should-you-eat/alcohol-and-heart-disease/index.html>. Copyright © 2008 by the President and Fellows of Harvard College.

Health Professionals Follow-up Study of 38,000 men carried out over a 12-year period showed that, independent of type of beverage (i.e., wine, beer, or spirits) or whether it was drunk with or without food, moderate drinkers were 30% to 35% less likely to have heart attacks than nondrinkers. Men who drank every day were at lower risk than those who drank once or twice per week (Mukamal et al., 2003). As in many aspects of health and nutrition, it appears that the jury is still out regarding red wine.

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## Hold the Press, What About Cancer?

So you no longer smoke, you eat fruits and veggies, exercise robustly, and gracefully pour one or two glasses of red wine each night. Just when drinkers were clapping their hands about how alcohol lowers the risk of heart disease, a major study conducted by the International Agency for Research on Cancer (IARC-WHO; Baan et al., 2007) throws a cat among the pigeons.

Although moderate drinking may improve coronary health, drinking even a small amount of alcohol daily could increase the risk of colon and breast cancer—two of the four major cancer killers. Based on findings from the European Prospective Investigation into Cancer and Nutrition (EPIC), which asked more than 480,000 Europeans about their drinking, those who drank over one drink a day (100 grams in a week) increase their chances of developing colon cancer by about 15%. For those who consume about four drinks daily, the risk is 40% higher. Apparently, the risk is dose dependent—the more you drink, the more your risk goes up (Baan et al., 2007). Regular consumption of more than one drink per day has been associated with an increased risk of breast cancer in women (Hamajima et al., 2002).

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## To Quit or Not to Quit?

How does an ordinary person sensibly decide about how to manage alcohol, truly one of the world's amazing chemicals? Drinking small amounts of alcohol—a shot of hard liquor or a glass of beer or wine daily—does have proven health benefits, that is, heart attacks and strokes caused by blocked arteries are reduced by 10% to 15% (probably because alcohol increases good cholesterol—HDL—and prevents blood platelets from clumping together). On the other hand, according to Rehm, head of public health and regulatory policies at the Ontario Center for Addiction and Mental Health, and his colleagues (Rehm, Patra, & Popova, 2007), alcohol is detrimental for more than 60 diagnoses. After smoking and obesity, alcohol consumption is the third-biggest cause of preventable death in the United States (R. N. Anderson, 2002). In 2002, the most recent year for which data is available, drinking caused 100,000 deaths—including more than 12,000 cancer deaths, comparable to the 13,674 killed in alcohol-related traffic accidents. The same data show that about 30,000 fatal heart attacks were prevented by moderate alcohol consumption. However, the evidence for alcohol preventing heart attacks is less reliable. Compared with teetotalers, those who drink moderately tend to exercise more, have better medical insurance, and have lower fat-to-muscle ratios, that is, they probably have had fewer heart attacks because of factors other than alcohol intake.

At present, we don't know exactly how alcohol affects cancer. Science is pursuing several promising leads: the influence of alcohol on estrogen levels,

which can affect the risk of breast cancer; and how alcohol challenges liver function, which could impair the body's ability to get rid of potential cancer-causing agents.

Inevitably, some who are now considering abstinence are thinking that if they have already caused the damage, why not have some fun? To help you decide, there is additional data. Quitting seems to eventually reverse the added risk. In a study published in the *International Journal of Cancer*, Rehm et al. (2007) showed that the risk of head and neck and esophageal cancer decreased significantly within 10 years of giving up booze and was the same as that for nondrinkers after 20 years. Although even one or two drinks a day raised a woman's breast cancer risk, there was no increased risk for those who reported having a few drinks a week. So where is the tipping point, or put another way, what is the threshold for abuse?

Like many short-term pleasure/long-term pain puzzles, risk–benefit analysis will be different for each person. A person in his or her late teens or early twenties with very low risk of heart disease will probably suffer more damage from loss of judgment associated with drinking than gain any long-term cardiovascular benefits. On the other hand, a 50-year-old man with neither a personal history of alcohol abuse nor family history of colon cancer may enjoy distinct cardiovascular benefits from moderate consumption. Correspondingly, a younger woman with no cardiac risk and a family history of breast cancer would probably do better not to drink. Finally, in deciding whether to drink, you may want to ask, how important is alcohol to your lifestyle and how much benefit do you personally derive in terms of pleasure, anxiety management, and connections with others?

## Chapter Summary

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Beginning with a short discourse on biblical admonitions about the abuse of alcohol, we move to a science-based discussion of why some people seem to be more vulnerable to alcohol than others. Aside from cultural and environmental influences, genetics are implicated because they bring about individual differences (metabolic and neurochemical) in how people react to the same drug. The addictive qualities of alcohol are discussed in terms of the drug's effects on glutamate, GABA, and the brain's internal opiates. A brief discussion of the many organ systems that are harmfully affected by alcohol is followed by an inventory designed to help the reader assess whether he or she is actually at risk for abuse or dependence (see Table 3.1). The chapter moves to a discussion of the psychobiological factors involved in drinking cessation, including conditioned desire and conditioned withdrawal. Marlatt's relapse prevention model is presented as a cognitive-behavioral tool for self-regulation during high-risk situations. Specific strategies are offered as allies in one's resolve to resist potentially harmful cravings and urges. Although alcohol is clearly implicated in premature death, massive harm to

communities and families, and a host of disease states, research during the past 30 years shows cardiovascular benefits for those who consume in moderation. However, recent studies point to increased risk for certain types of cancer, even when drinking is done in moderation. A risk–benefit analysis is suggested for each person in consideration of age, sex, family disease history, and alcohol's perceived contribution (or lack thereof) to quality of life.

