

# She's Hooked

The allure of alcohol, drugs and cigarettes ebbs and flows with a woman's monthly cycle

BY EMILY ANTHES

**ADDICTION** has long been considered a man's disease. Men are far more likely to use illicit substances, and partly for that reason, research on addiction for decades included only male users. Thus, far more is known about drug dependence in men than in women, and treatment programs and centers have been based on the needs of men.

But there are signs that the gender gap is closing, as drug and alcohol use have become more socially acceptable for girls and women. Indeed, drinking and alcohol dependence have grown increasingly prevalent among women in recent decades, but not among men, reported psychiatrist Richard A. Grucza of Washington University in St. Louis in a 2008 study.

And in a reversal of past trends, teenage girls are now trying marijuana, alcohol and cigarettes at higher rates than boys are, according to recent results from the National Survey on Drug Use and Health. Meanwhile the survey demonstrated that overall illegal drug use among both girls and women rose from 5.8 to 6.3 percent between 2007 and 2008 as the rate for boys and men dipped from 10.4 to 9.9 percent.

What is more, a growing literature on female addicts shows that they are not much like their male counterparts. Women may be uniquely vulnerable to substance abuse and its effects, because



Women seem particularly susceptible to addiction: they quickly become heavy users and suffer greater harm from drug use than men do.

female sex hormones affect the brain's reward circuitry, influencing women's response to drugs. The studies point to new drug treatments for addiction as well as practical tips for women who want to quit using.

## The Weaker Sex?

Although scientists have been studying drug use in women on a small scale since the 1970s, progress was relatively

meager before 1994, when the National Institutes of Health mandated that most clinical research include women and minorities. As research on gender differences greatly accelerated, investigators uncovered hints that girls and women may be more vulnerable to addiction and substance abuse than men are. Scientists noticed that women more quickly escalate to heavy drug use and more readily succumb to the accompanying social and physical damage. Even female rats obsessively self-administer addictive drugs more readily than male rodents do.

Reproductive hormones may underlie this susceptibility. Removing the ovaries of female rats so that the animals no longer produce estrogen can diminish their tendency to seek out stimulants such as cocaine and amphetamine. In addition, giving estrogen to female rats whose ovaries have been removed can shorten the path to addiction. In 2004 neuroscientist Jill B.

Becker of the University of Michigan at Ann Arbor and her colleagues reported that it took six days for ovary-free rats to start repeatedly helping themselves to infusions of cocaine—in this setup, by poking their noses into a hole. In contrast, rats receiving supplemental estrogen succumbed to the same compulsion after just four days.

Researchers believe that estrogen spurs addiction by stimulating the

Scientists believe that **estrogen stimulates** the brain's reward pathways, enhancing the "high" from drugs.

brain's reward pathways, enhancing the "high" from drugs. Administering estrogen to rats that have had their ovaries removed boosts levels of dopamine, a neurotransmitter involved in the perception of rewards such as food, sex and drugs.

### Hormone High

In female mammals, estrogen does not act alone, however. Its hormonal partner, progesterone, appears to oppose estrogen's ability to promote addictive tendencies. In 2006 Becker's team reported that giving both estrogen and progesterone to female rats lacking ovaries does not accelerate obsessive cocaine use in the rodents, suggesting that progesterone may be an antidote to estrogen's pleasure-seeking influence.

And more recent work confirms that women's response to drugs varies across the menstrual cycle, as the relative levels of estrogen and progesterone naturally wax and wane. In a 2007 study clinical neurobiologist Suzette M. Evans of Columbia University and the New York State Psychiatric Institute and her colleagues found that stimulants are far more pleasurable to women during the estrogen-dominated follicular phase, which occupies the approximately two weeks from the onset of a woman's period until she ovulates, than during the luteal phase after ovulation, when both estrogen and progesterone are high.

A woman's perception of other kinds of rewards—such as money, food and sex—may also vary during her menstrual cycle. In a 2007 study researchers at the NIH scanned women's brains using functional MRI as the women played slot-machine games. They found that women's reward circuitry was more active when they won jackpots during the estrogen-governed phase of their cycles than during the progesterone-infused phase that follows. The ebb and flow of female hormones could thus have broad

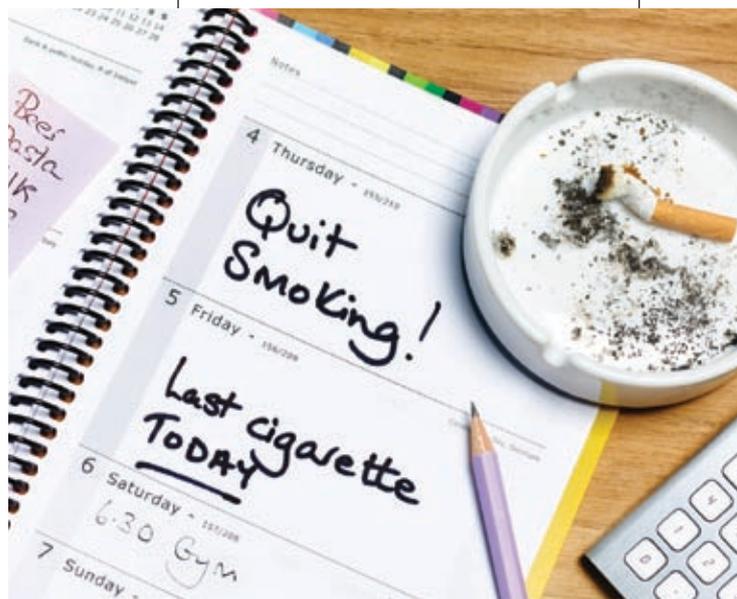
Women are more likely to succeed in quitting smoking if they start on a day when their natural progesterone levels are high.

effects on the perception of pleasures and incentives, influencing women's motivation to engage in a wide variety of behaviors.

### A Smarter Way to Stop

Artificially boosting progesterone levels in women tempers the "high" they get from drugs. In a 2006 study Evans's team gave 11 female cocaine users progesterone when their bodies' natural levels of the hormone were low. The treated women reported feeling a reduced high as compared with the one they got at the same point in their cycles in the absence of additional progesterone. (In contrast, progesterone did not influence the subjective experience of cocaine smoking in the 10 male addicts they tested, although the researchers are not sure why.) If progesterone dampens the pleasure of drugs, it might help treat addiction in women—something Evans is currently testing in female cocaine addicts.

Short of a chemical fix, paying attention to the calendar could help women succeed at quitting smoking, drinking or using drugs. In a study published in 2008 Sharon S. Allen, a family medicine doctor at the University of Minnesota Medical School, and her colleagues asked half of 202 female smokers to try to quit



during the second part of their cycles—when progesterone levels are high—and the others to make the attempt earlier in their cycles. The results were stunning: 34 percent of the women in the first group had not smoked 30 days later as compared with only 14 percent of those who tried to stop smoking when progesterone levels were low. "When women are smoking early in their cycle, they're getting more of a kick from their nicotine, more pleasure maybe, so it might be harder to quit," Allen explains. In this mix of hormones, brain chemicals and desire—as in many other parts of life—timing may be everything. **M**

EMILY ANTHES is a freelance science and health writer living in Brooklyn, N.Y. Her work has appeared in *Scientific American Mind*, *Discover*, *Popular Mechanics*, *Slate*, *New York Magazine* and the *Boston Globe*, among other publications.

### (Further Reading)

- ◆ **Women under the Influence.** National Center on Addiction and Substance Abuse at Columbia University. Johns Hopkins University Press, 2005.
- ◆ **Women and Sex/Gender Differences Research Program.** National Institute on Drug Abuse: [www.drugabuse.gov/WHGD/WHGDHome.html](http://www.drugabuse.gov/WHGD/WHGDHome.html)