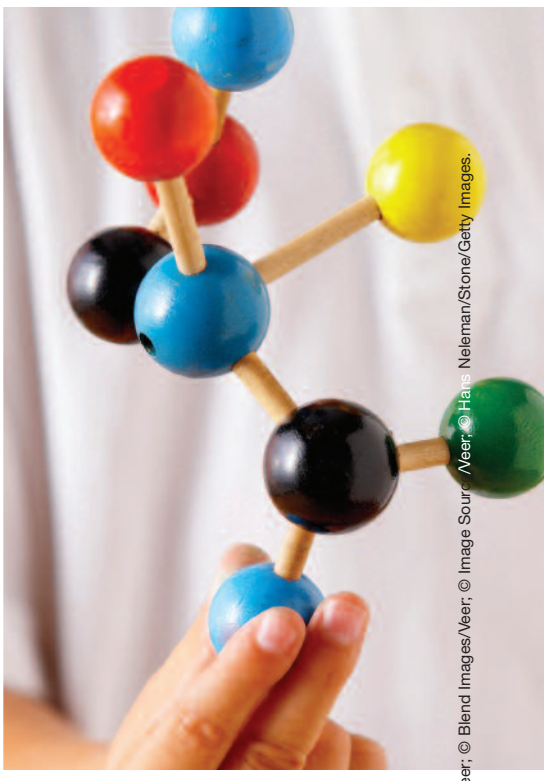
Genetics and Addiction

Scientists are uncovering new information from the field of genetics that will be able to help in the prevention and treatment of drug addiction.



FROM SCHOLASTIC AND THE SCIENTISTS OF THE NATIONAL INSTITUTE ON DRUG ABUSE, NATIONAL INSTITUTES OF HEALTH, U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES

John Crawford has an identical twin. His 16-year-old brother, Keith, is his mirror image. John has brown hair, brown eyes, and a slightly crooked smile. So does Keith. John weighs about 160 pounds. Ditto for Keith. The brothers walk the same, talk the same—their friends tease them because they even bowl the same.

The reason, of course, is that identical twins share exactly the same **genes**, those tiny units of hereditary material (DNA) that carry instructions for forming all the cells in the body and directing their activity. Beyond their physical similarities, the brothers also share less-obvious traits. These range from harmless things such as food preferences—they both love hot chilies—to unseen vulnerabilities, such as a risk for heart disease, diabetes, and drug addiction.

You've probably heard that drug and alcohol abuse runs in families. But what exactly does that mean? John and Keith have a parent who struggles with alcoholism, so are they destined by genetics to face the same fate? The good news is that no single factor determines whether a person will become addicted to drugs. That's because genetics, biology, and environment all influence a person's risk for **drug addiction**, defined as a chronic yet treatable brain disease characterized by compulsive drug seeking and use.

So, while the saying may be that substance abuse "runs in the family," a whole list of other risk factors in addition to genes come into play to determine whether a person gets hooked. These include *biological* factors, such as genetics, one's age, or the presence of other diseases, as well as *environmental* factors, such as diet, stress, or peer pressure. Neither John nor Keith shares their parent's battle with addiction, but the twins know that their family genetics can increase their risk of addiction.

It may be hard to see how a tiny piece of DNA could influence the risk of becoming addicted. The fact is, however, that scientists have identified several genes that can do just that. In reality, every gene comes in different forms, or **variants**, and researchers have discovered that some of these variants can make people more likely to abuse marijuana, heroin, cocaine,

WHO BECOMES ADDICTED?

These key factors are involved in the question of who becomes addicted to drugs:

BIOLOGY: The genes that someone is born with—in combination with environmental factors—account for about half of a person's risk for drug addiction. Other biological factors include a person's gender, ethnic background, whether there are mental disorders present, and how each drug affects each person's unique biology.

Developmental stages also affect one's addiction vulnerability. Here, adolescents face a double challenge: One part is that the earlier that drug use begins, the more likely it is to progress to more serious abuse. The other part is that adolescents' brains are still developing in the areas that govern decision making, judgment, and self-control. Because of this, teens are especially prone to risk-taking behaviors, including trying drugs.

ENVIRONMENT: Environmental factors can be broken down into two categories. "Risk factors" include those that make drug use more likely. Examples include lack of parental supervision or chaotic home environments; substance abuse at home; associating with peers who use drugs; and even the availability and cost of drugs. "Protective factors" reduce the potential for drug use. Examples include parental monitoring and involvement; strong neighborhood, community, or school attachments; or strong family connections.

Assessing personal risk is a complex issue—and risk factors for one person may be quite different from those for another. However, eliminating risk factors, or increasing protective factors, are actions that can help keep you safe from drug abuse. •••

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and other illegal, as well as legal, drugs. Certain genes can actually influence the way in which a person responds to drugs.

For instance, Harvard University scientists recently studied twins to gauge their responses to marijuana. They studied 352 pairs of **identical twins** (like Keith and John, these twins developed from one fertilized egg and share the exact same genes) and 255 pairs of **fraternal twins** (siblings who developed from two fertilized eggs in the womb at the same time and have different sets of genes). All the study participants admitted to having smoked marijuana more than five times in their lives. On a questionnaire in which the participants were asked to rate how "good" or "bad" the drug made them feel, the answers of the identical twins were significantly more alike than those of the fraternal twins.

This finding suggests that genes can have a major impact on the effects of a drug once it is introduced into the body. A specific example comes from studies of the enzyme "CYP2A6." Research has found that people have a greater resistance to nicotine—the addictive drug in tobacco—if they have a genetic variant that decreases the function of CYP2A6. The decrease in CYP2A6 slows the breakdown of nicotine and protects individuals against nicotine addiction. This case illustrates that genetic variants can not only increase the risk of addiction, but can sometimes also lower it by protecting someone from the effects of a drug, for example.

First identifying which genes are involved in the addiction process, then determining which forms of those genes increase the risk—and which are protective—is serious business. Genetic information will help to identify who may be at greater risk for addiction, and suggest targets for innovative medications to treat those who become addicted. And, just as important, knowing one's genetic risks, like John and Keith Crawford do, helps in making smart choices. ●●●

Vocabulary

Match each word in Column A to its meaning in Column B.

COLUMN A	COLUMN B
1. genes	A. siblings who developed from two fertilized eggs and who share different sets of genes
2. drug addiction	B. siblings who developed from one fertilized egg and who share identical genes
3. variant	C. tiny units of hereditary material (DNA) that carry instructions for forming all the cells in the body and directing their activity
4. identical twins	D. a chronic brain disease that affects the way you think and behave
5. fraternal twins	E. one of a number of specific forms that can be displayed by a gene

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