Addiction: A Treatable Chronic Brain Disease
This publication is intended to provide the latest scientific information about addiction to drugs and alcohol. By fully understanding the dynamics of addiction and that treatment is effective, individuals and policy makers are more equipped to make informed choices and adopt science-based policies and programs to prevent and reduce alcohol and drug addiction in Florida.
How Science Has Revolutionized the Understanding of Drug Addiction

When science began to study addictive behavior in the 1930s, people addicted to drugs were thought to be morally flawed and lacking in willpower. Those views shaped society’s responses to drug abuse, treating it as a moral failing rather than a health problem, which led to an emphasis on punitive rather than preventative and therapeutic actions. Today, thanks to science, our views and our responses to drug abuse have changed dramatically. Groundbreaking discoveries about the brain have revolutionized our understanding of drug addiction, enabling us to respond effectively to the problem. As a result of scientific research, we know that addiction is a disease that affects both brain and behavior. This research has identified many of the biological and environmental factors and is now beginning to search for the genetic variations that contribute to the development and progression of the disease. Scientists use this knowledge to develop effective prevention and treatment approaches that reduce the toll drug abuse takes on individuals, families, and communities.¹

Why Do Some People Become Addicted To Drugs, While Others Do Not?

As with any other disease, vulnerability to addiction differs from person to person. In general, the more risk factors an individual has, the greater the chance that taking drugs will lead to abuse and addiction. “Protective” factors reduce a person’s risk of developing addiction.²
What Factors Determine If a Person Will Become Addicted?

No single factor determines whether a person will become addicted to drugs or alcohol. The overall risk for addiction is impacted by the biological makeup of the individual—it can even be influenced by gender or ethnicity, his or her developmental stage, and the surrounding social environment (e.g., conditions at home, at school, and in the neighborhood).

Which Biological Factors Increase Risk of Addiction?

Scientists estimate that genetic factors account for between 40 and 60 percent of a person's vulnerability to addiction, including the effects of environment on gene expression and function. Adolescents and individuals with mental disorders are at greater risk of drug abuse and addiction than the general population.

What Environmental Factors Increase the Risk of Addiction?

Home and Family. The influence of the home environment is usually most important in childhood. Parents or older family members who abuse alcohol or drugs or who engage in criminal behavior can increase children's risks of developing their own drug problems.

Peer and School. Friends and acquaintances have the greatest influence during adolescence. Drug-abusing peers can sway even those without risk factors to try drugs for the first time. Academic failure or poor social skills can put a child further at risk for drug abuse.

What Other Factors Increase the Risk of Addiction?

Early Use. Although taking drugs at any age can lead to addiction, research shows that the earlier a person begins to use drugs the more likely they are to progress to more serious abuse. This may reflect the harmful effect that drugs can have on the developing brain; it also may result from a constellation of early biological and social vulnerability factors, including genetic susceptibility, mental illness, unstable family relationships, and exposure to physical or sexual abuse. Still, the fact remains that early use is a strong indicator of problems ahead, among them, substance abuse and addiction.

Method of Administration. Smoking a drug or injecting it into a vein increases its addictive potential. Both smoked and injected drugs enter the brain within seconds, producing a powerful rush of pleasure. However, this intense “high” can fade within a few minutes, taking the abuser down to lower, more normal levels. It is a starkly felt contrast, and scientists believe that this low feeling drives individuals to repeated drug abuse in an attempt to recapture the high pleasurable state.
Addiction is now understood to be a brain disease because scientific research has shown that alcohol and other drugs can change brain structure and function. Advances in brain imaging science make it possible to see inside the brain of an addicted person and pinpoint the parts of the brain affected by drugs of abuse — providing knowledge that enables the development of new approaches to prevention and treatment.9

How the Medical Community Defines Addiction

American Society of Addiction Medicine – Definition of Addiction, Adopted: April 12, 2011

Addiction is a primary, chronic disease of brain reward, motivation, memory and related circuitry. Dysfunction in these circuits leads to characteristic biological, psychological, social and spiritual manifestations. This is reflected in an individual pathologically pursing reward and/or relief by substance use and other behaviors. Addiction is characterized by inability to consistently abstain, impairment in behavioral control, craving, diminished recognition of significant problems with one's behaviors and interpersonal relationships, and a dysfunctional emotional response. Like other chronic diseases, addiction often involves cycles of relapse and remission. Without treatment or engagement in recovery activities, addiction is progressive and can result in disability or premature death.10

Center for Disease Control

Addiction is a treatable chronic brain disease. Long-term drug use causes profound changes in brain structure and function that result in uncontrollable compulsive drug craving, seeking and use.11

National Institutes of Health

Addiction: A chronic, relapsing brain disease characterized by compulsive drug seeking and use and by long-lasting changes in the brain.12

Addiction meets all characteristics of the disease concept:

(1) a clear biological basis;
(2) unique, identifiable signs and symptoms;
(3) a predictable course and outcome; and
(4) the inability to control the cause of the disease.13
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### Comparison of Relapse Rates Between Drug Addiction and Other Chronic Illnesses

<table>
<thead>
<tr>
<th>Illness</th>
<th>Relapse Rate</th>
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<tbody>
<tr>
<td>Drug Addiction</td>
<td>40 to 60%</td>
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<tr>
<td>Type 2 Diabetes</td>
<td>30 to 50%</td>
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<tr>
<td>Hypertension</td>
<td>50 to 70%</td>
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<tr>
<td>Asthma</td>
<td>50 to 70%</td>
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Relapse rates for drug-addicted patients are comparable to those suffering from diabetes, hypertension, and asthma. Relapse is common and similar across these illnesses (as is adherence to medication). Thus, drug addiction should be treated like any other chronic illness, with relapse serving as a trigger for renewed intervention.


Several decades of comprehensive genetic and neurobiological research have provided indisputable evidence that addiction is a brain disease… that if diagnosed in a timely manner can be properly treated.¹⁴

The areas of the brain affected by drug abuse control thinking, pleasure and critical life functions:

- **brain stem** – controls basic functions critical to life, such as heart rate and breathing;
- **limbic system** – controls the brain’s reward circuit, linking a number of brain structures that control and regulate our ability to feel pleasure; most drugs of abuse target the brain’s reward system by flooding the circuit with dopamine;
- **cerebral cortex** – the front part of the cortex is the thinking center of the brain; it powers our ability to think, plan, solve problems and, make decisions.

Drugs are chemicals and work in the brain by tapping into the brain’s communication system and interfere with the way nerve cells normally send, receive, and process information. Long-term drug abuse impairs brain functioning.¹⁵
Many people also erroneously still believe that drug addiction is simply a failure of will or of strength of character. Research contradicts that position. Thus the majority of the biomedical community now considers addiction, in its essence, to be a brain disease. Addiction involves inseparable biological and behavioral components. It is the quintessential bio-behavioral disorder. Recognizing addiction as a chronic, relapsing brain disorder characterized by compulsive drug seeking and use can impact society’s overall health and social policy strategies and help diminish the health and social costs associated with drug abuse and addiction.\(^{17}\)

Addiction can cause permanent changes in brain structure and chemistry. Illicit substance abuse is a major national public health problem that creates impaired health, harmful behaviors, and major economic and social burdens…but there are effective medical and public health approaches to the problem.\(^{16}\)

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One of the brain areas still maturing during adolescence is the prefrontal cortex — the part of the brain that enables one to assess situations, make sound decisions, and keep our emotions and desires under control. The fact that this critical part of an adolescent’s brain is still a work-in-progress puts them at increased risk for poor decisions such as trying drugs. Also introducing drugs while the brain is still developing may have profound and long-lasting consequences.\(^{18}\)
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Individuals who suffer from addiction often have one or more accompanying medical issues, including lung and cardiovascular disease, stroke, cancer, and mental disorders. Imaging scans, chest X-rays, and blood tests show the damaging effects of drug abuse throughout the body.\(^\text{19}\)

<table>
<thead>
<tr>
<th>The Impact of Addiction Can Be Far Reaching</th>
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<tbody>
<tr>
<td>➤ Cardiovascular disease</td>
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<td>➤ Stroke</td>
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<td>➤ Cancer</td>
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<tr>
<td>➤ Hepatitis B and C</td>
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<td>➤ Lung disease</td>
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<tr>
<td>➤ Mental disorders</td>
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<tr>
<td>➤ HIV/AIDS</td>
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The American Medical Association:
(1) endorses the proposition that drug dependencies, including alcoholism, are diseases and that their treatment is a legitimate part of medical practice, and
(2) encourages all physicians, other health professionals, medical and other health related organizations, and government and other policymakers to become well informed about drug dependencies and to base their policies and activities on the recognition that drug dependencies are, in fact, diseases.\(^\text{20}\)

How Does Science Provide Solutions for Drug Abuse and Addiction?

Scientists study the effects that drugs have on the brain and on people’s behavior. They use this information to develop programs for preventing drug abuse and for helping people recover from addiction. Research helps transfer these ideas into practice in our communities. These significant research findings are documented in numerous studies:\(^\text{21}\)

- From a psychological and neurological perspective, addiction is a disorder of altered cognition. The brain regions and processes that underlie addiction overlap extensively with those that are involved in essential cognitive functions, including learning, memory, attention, reasoning and impulse control. Drugs alter normal brain structure and function in those regions, producing cognitive shifts that promote continued drug use through maladaptive learning and hinder the acquisition of adaptive behaviors that support abstinence.\(^\text{22}\)
- Methamphetamine abusers have prefrontal grey-matter deficit, which may, in part, recover with long-term abstinence.\(^\text{23}\)
• Brain imaging and cognitive studies suggest that structural deficits in the prefrontal cortex may play an essential role in functional impairments in substance abuse disorder.  

• There is evidence for long-term neurotoxicity associated with methamphetamine abuse.

• Decision-making deficits are linked to a dysfunctional ventromedial prefrontal cortex in alcohol and stimulant abusers.

• PET scans have been identified as a promising means to understand drug action, to develop new treatment strategies and to monitor the therapeutic and toxic effects of drugs.

• MRI imaging detected cocaine-induced activity in the brain's mesolimbic and prefrontal cortical circuits and point to the need for further study the interaction between reinforcement and motivational processes relevant to addiction.

• Clinical and radiological studies and experimental models indicate some alcohol-related brain damage appears to be reversible. The pathological explanation for this phenomenon remains uncertain, but studies suggest that some of the damage in specific brain areas can be reversed.

• Neuroscientists over the last two decades have made important advances in tracing the molecular events that occur in the brain as memories are formed and preserved. Most recently, researchers delineated what appears to be a key pathway in this process: Reversible changes in DNA regulate the production of proteins that give memories their staying power. These findings lay the groundwork for new studies in drug relapse.

• Genetic factors weigh in on addiction. Epidemiological studies have established that genetic factors account for 40-60% of risk for alcohol addiction. Most recent studies indicate similar rates of heritability for other drug addictions, including addiction to opiates and cocaine.

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**Medications Used to Treat Drug Addiction**

**Tobacco Addiction**
- Nicotine replacement therapies (e.g., patch, inhaler, gum)
- Bupropion
- Varenicline

**Opioid Addiction**
- Methadone
- Buprenorphine
- Naltrexone

**Alcohol and Drug Addiction**
- Naltrexone
- Disulfiram
- Acamprosate
Treatment Is Effective

Addiction is an illness requiring a continuum of care, like diabetes, asthma or hypertension. Like these diseases, a single course of treatment is unlikely to result in a complete and permanent “cure.” Similar to hypertensive patients, individuals with addiction may require multiple courses of treatment to stabilize their condition. Relapse rates for treatment of alcohol, opioids and cocaine are less than those for hypertension and asthma, and equivalent to those of diabetes—all chronic conditions. In fact compliance rates for treatment of alcohol, opioids and cocaine are greater than compliance rates for hypertension and asthma. 32

- A major review of more than 600 peer reviewed research articles, plus original data analyses, show conclusively that drug addiction treatment is very effective and that it works as well as other established medical treatments for illness such as diabetes, asthma and hypertension. 33 The conclusion that addictions treatment is effective is demonstrated in over 600 published scientific papers. 34

- According to research that tracks individuals in treatment over extended periods, most people who get into and remain in treatment stop using drugs, decrease their criminal activity, and improve their occupational, social, and psychological functioning. Individual treatment outcomes depend on the extent and nature of the patient’s problems, the appropriateness of treatment and services used to address the problems. 35

- Overall treatment of addiction is as successful as treatment of other chronic diseases, such as diabetes, hypertension and asthma. Drug treatment reduces drug use by 40% to 60% and significantly decreases criminal activity during and after treatment. 36

- Individuals progress through drug addiction treatment at various speeds, so there is no predetermined length of treatment. However, research has shown unequivocally that good outcomes are contingent on adequate lengths of treatment. Generally, for residential or outpatient treatment, participation for less than 90 days is of limited or no effectiveness, and treatment lasting significantly longer often are indicated. For methadone maintenance, 12 months of treatment is the minimum, and some opiate-addicted individuals will continue to benefit from methadone maintenance treatment over a period of years. 37

- For a given level of treatment history and current need, those who get more treatment or treatment sooner are indeed likely to do better. 38

- Treatment and improve the prospects for employment, with gains of up to 40% after a single treatment episode. 39

- The majority (69%) of patients who had medical conditions related to their addiction, and who received both medical care and addictions treatment were abstinent six months after leaving treatment. 40
• In the year after leaving residential rehabilitation or nonresidential counseling, 80-90% of long-stay (at least three months) clients who had been using heroin or cocaine weekly before treatment were no longer doing so. For clients who left earlier, the figure was 50-60%. 

• Treatment follow-up studies report an average full remission rate of one-third and significant reductions in alcohol and other drug use and alcohol and drug-related problems for most clients.

• Addiction is tenacious: People in recovery remain vulnerable to relapse even after years of abstinence. Often, it is memory that reawakens the craving. The dormant desire can return with a vengeance when cued by people, places, or situations once associated with drug use. For this reason, memory has become an important area of study for addiction researchers. Neuroscientists over the last two decades have made important advances in tracing the molecular events that occur in the brain as memories are formed and preserved, delineated what appears to be a key pathway in this process: Reversible changes in DNA regulate the production of proteins that give memories their staying power. The new findings may spur breakthroughs in the study of drug relapse, as well as in a broad range of neurological problems, including age-related memory loss and neurodevelopmental disorders.

• Because detoxification is often the only element covered in many health insurance programs, detoxification is often thought of as an addiction treatment. However, it is not. Medical detoxification is, at best, a first step in beginning treatment and by itself does little to change long-term drug use.
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- Offering lower intensity, continuing treatment to individuals who have completed a more intensive initial phase of rehabilitation would seem to be a clinically effective, as well as cost-effective, approach to the treatment of any chronic disorder such as substance abuse. 45

- Rapid entry into involvement with a recovery support group during treatment services generates better long-term recovery outcomes than delayed linkage (e.g., following treatment or at a period subsequent to treatment). 46

- The longer the participation in recovery support groups in the three years following primary treatment, the greater the probability of remission at 15+ years following treatment. 47

- While some individuals disengage from recovery support groups after a period of recovery initiation and sustain stable remission, those who sustain recovery support group participation are more likely to be in remission at follow-up than those who disengage. 48

- Even among clients who had already received a substantial ‘dose’ of treatment, after controlling for other relevant variables, intensive post-treatment self help dramatically cut the chances of relapsing to weekly cocaine use. 49

- Addictions treatment is significantly associated with a 67% reduction in weekly cocaine use, a 65% reduction in weekly heroin use, a 52% decrease in heavy alcohol use, a 61% reduction in illegal activity, and a 46% decrease in suicidal ideation one year post treatment. Moreover, these outcomes are generally stable for the same clients five years post treatment. 50

- Maintaining therapeutic contact for extended periods of time with individuals with alcohol and other drug disorders appears to promote better long-term outcomes than ‘treatment as usual’. 51

Resources for Key Findings


2-8 Ibid.


Sherman, Carl. National Institutes of Health, NIDA Notes, Volume 24, Number 1 Innovations, 8-10.


