

# PHARMACOLOGY

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# TOLERANCE, DEPENDENCE, ADDICTION

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- It is important to understand the meaning of the terms *tolerance*, *dependence*, and *addiction* when discussing substance abuse and the use of prescription medications such as opioid painkillers. Unfortunately, both professionals and lay people often misuse these terms, leading to the mistaken belief that tolerance, dependence, and addiction are just different names for the same thing. However, knowing the distinction between these terms can lead to a better understanding of the dangers of drug abuse.
- The most important distinction between these concepts is that tolerance and dependence refer to the physical consequences of drug use. In contrast, addiction is a descriptive term that refers to a need to engage in harmful behavior such as drug use.

# TOLERANCE

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- **Tolerance is defined as a person's diminished response to a drug that is the result of repeated use <sup>1</sup>. People can develop tolerance to both illicit drugs and prescription medications. As stated above, tolerance is a physical effect of repeated use of a drug, not necessarily a sign of addiction. For example, patients with chronic pain frequently develop tolerance to some effects of prescription pain medications without developing an addiction to them.**

# 3 MAIN TYPES OF TOLRANCE

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- **Acute**, or short-term, tolerance is caused by repeated exposure to a drug over a relatively short period of time. Cocaine abuse often results in acute tolerance. Experiments have shown that after a first dose of cocaine, test subjects experience a euphoric high and an increase in heart rate and blood pressure. However, despite nearly doubling the levels of drug in the blood, a second dose of cocaine 40 minutes later does not result in a dose-dependent increase in the “positive” effects of the drug, including a further increase in heart rate or blood pressure <sup>2</sup>.

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- **Chronic**, or long-term, tolerance develops when an individual's body adapts to constant exposure to a drug over weeks or months. People who regularly abuse prescription opioids build up chronic tolerance to the euphoric effects of these medications, leading many of them to increase the dosage taken or switch to more potent ways of taking these drugs, such as snorting or injecting
  - **Learned** tolerance may result from frequent exposure to certain drugs. For example, people who abuse alcohol for months or years often do not appear intoxicated to others. Experimental studies have shown that drinkers can compensate for the effects of alcohol on their coordination when they practice a task repeatedly while under the influence <sup>3</sup>. However, this tolerance disappears if the task is altered.

# DEPENDENCE

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- **The words *dependence* and *addiction* are often used interchangeably, but there are important differences between the two. In medical terms, dependence specifically refers to a physical condition in which the body has adapted to the presence of a drug. If an individual with drug dependence stops taking that drug suddenly, that person will experience predictable and measurable symptoms, known as a withdrawal syndrome.**

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- Although dependence is often a part of addiction, non-addictive drugs can also produce dependence in patients. A prime example is prednisone, a synthetic form of the steroid hormone cortisol that is used to treat asthma, allergic reactions, Crohn's disease, and many other inflammatory conditions. Prednisone is not known to produce addiction. However, if a patient has taken prednisone for several weeks and then stops suddenly, they are likely to suffer from withdrawal symptoms such as fatigue, weakness, body aches, and joint pain <sup>4</sup>.
  - Dependence is caused by changes in the body as a result of constant exposure to a drug. In the case of prednisone, the body adapts to repeated doses of the drug by decreasing its own cortisol production, which can leave the body without a baseline level of cortisol "support" when prednisone use is stopped—resulting in steroid withdrawal symptoms until the normal balance is re-established.

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- Drug dependence is a medically treatable condition. The goal is to separate the patient from the drug slowly, instead of suddenly, to allow the body to readjust to normal functioning. For patients who have developed dependence as a side effect of taking a needed medication (e.g., an opioid painkiller), a doctor can use the **tapering method** (slowly decreasing the dose of the drug over time) to minimize withdrawal.
  - For individuals who are dependent on illicit or prescription drugs due to abuse rather than medical need, **detoxification (detox) facilities** may also use a controlled taper and/or medications to prevent serious withdrawal symptoms. They may also substitute dangerous drugs with similar—but safer—drugs to manage dependence. For example, people detoxing from heroin are often given a longer-acting opioid like methadone or buprenorphine to alleviate withdrawal symptoms and cravings.

# ADDICTION

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- **According to the National Institute on Drug Abuse (NIDA), addiction is a “chronic, relapsing brain disease that is characterized by compulsive drug seeking and use, despite harmful consequences” <sup>7</sup>. In other words, addiction is an uncontrollable or overwhelming need to use a drug, and this compulsion is long-lasting and can return unexpectedly after a period of improvement.**

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- Addictive drugs stimulate pleasure and motivation pathways in the brain much more strongly than natural rewards. Therefore, repeated exposure to these drugs can fool the brain into prioritizing drug-taking over normal, healthy activities. The effect of addictive drugs on the brain's reward pathways helps explain two important features of addiction:
  - The inability to limit or cease substance use.
  - The irresistible urge to continue seeking and taking the drug despite serious negative consequences.

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- Addiction results from a complex interplay of a number of social, biological and psychological factors, including <sup>7</sup>
  - Genetic makeup.
  - Socioeconomic status.
  - Family environment.
  - Drug accessibility.
  - The treatment of addiction is likewise complex and requires medical attention, behavioral counseling, and long-term support to prevent relapse.