

Poisons are a potent tool for murder in fiction: A toxicologist explains how some dangerous chemicals kill

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People have used poisons [throughout history](#) for a variety of purposes: to hunt animals for food, to treat diseases and to achieve nefarious ends like murder and assassination.

But what is a poison? Do all poisons act in the same way? Does the amount of the poison matter in terms of its toxicity?

[I am a toxicologist](#) who studies how chemicals affect human health, particularly when they cause harmful effects. As a fan of mystery and detective stories, which often feature the use of poisons, I've noticed a few poisons that turn up repeatedly in books, television and movies. How they really work is as fascinating as how they're deployed toward evil ends in fiction.

What is a poison?

The 16th-century [physician–alchemist Paracelsus](#), considered to be the father of toxicology, once wrote: "What is there that is not poison? All things are poison and nothing is without poison. Solely the dose determines that a thing is not a poison." By this adage, any substance can be a poison with the appropriate amount.

Many people intentionally expose themselves to chemicals like ethanol through [alcoholic beverages](#), nicotine through [tobacco products](#) and [botulinum toxin](#) through botox treatments at relatively low doses and suffer minimal adverse effects. However, at [sufficiently high doses](#), these chemicals can be lethal. The body's response often depends on how the chemical interacts with receptors within or on the surface of cells, or how it binds to enzymes used for biological processes. Frequently, higher concentrations of the substance [lead to stronger responses](#).

Despite Paracelsus' dictum, in popular culture the term "poison" is often reserved for [chemical compounds](#) that are not normally encountered in daily life and can lead to detrimental health effects even in relatively small amounts.

Poisons in books, TV and film

Novel writers and television and movie screenwriters have exploited numerous poisons in their works, including those that are chemical elements, such as [arsenic](#) and [polonium](#), and those derived from animals, such as [snake venom](#) and [blowfish poison](#). Many poisons derived from plants have also been used for villainous purposes in fiction.

In the AMC TV series "[Breaking Bad](#)," high school chemistry teacher Walter White uses a compound called ricin to murder the business executive Lydia Rodarte-Quayle. [Ricin is a very potent poison](#) derived from the castor bean *Ricinus communis* and can be especially lethal if inhaled. Once this compound gets inside a cell, it [damages a structure called a ribosome](#) that's responsible for synthesizing proteins essential to the cell's function. Ingesting ricin could result in intestinal bleeding, organ damage and death.

Sometimes, particular organs are much more susceptible to the effects of a poison. Physicians use [digitalis medicines like digoxin](#), which are derived from members of the foxglove family of plants, to treat [congestive heart failure](#) and heart rhythm problems. When administered in sufficiently high doses, however, they can lead to heart failure and death. By interfering with a protein in heart cells called the [sodium-potassium pump](#), they can decrease the rate of electrical impulses in the heart and increase the strength of its contractions. This can result in a dangerous type of irregular heartbeat called ventricular fibrillation and lead to death.

The villain of the James Bond film "[Casino Royale](#)," Le Chiffre, has his girlfriend attempt to kill Bond by poisoning his martini with digitalis. At high doses, digitalis drugs can alter the activity of the autonomic [nervous system](#), which controls unconscious bodily functions like heart pumping.

TV characters are not immune to the dangers of poisonous mushrooms. One particularly potent fungus, *Amanita verna*, is known as the "destroying angel." In the ITV TV series "[Midsomer Murders](#)," puppet show owner and presumed upstanding citizen Evelyn Pope uses this mushroom to fatally poison chef Tristan Goodfellow as part of her murder spree of the inheritors of an estate. This mushroom contains [various chemicals called amatoxins](#) that are thought to inhibit the activity of a specific enzyme critical for the production of [messenger RNA](#), or mRNA, a molecule essential to protein synthesis in cells. Because ingested amatoxins mainly target the liver, these poisons can severely disrupt the liver's ability to repair itself, leading to loss of function that will prove fatal without liver transplantation.

Another highly popular poison in detective and mystery stories is [strychnine](#). In the Agatha Christie story "[The Mysterious Affair at Styles](#)," Alfred Inglethorp and his lover Evelyn Howard use this poison to kill Inglethorp's wife and wealthy country manor owner, Emily Inglethorp.

Strychnine, which comes from seeds of the *Strychnos nux-vomica* tree, [affects the nervous system](#) by blocking a neurotransmitter called glycine in the spinal cord and brainstem. Normally, glycine slows down the activity of neurons and prevents muscle contractions. By blocking glycine, strychnine ingestion can result in excessive activation of neurons and muscles, leading to a series of full-body muscle spasms that can become so intense that they cause respiratory arrest and death.

Many more poisons exist in nature than described here. Aside from potentially enhancing the enjoyment of detective and mystery stories, understanding the mechanisms of how these poisons work can provide an added appreciation for the complexity of the effects foreign chemicals have on the human body.

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