

Hot Topics in Science

**Ricin:  
The Chemical  
and the Threat**

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The substance, ricin, has long history as a chemical weapon. Since at least World War I, governments have investigated its use on the battlefield. In September 1978, a Bulgarian dissident, Georgi Markov, was assassinated by a pellet of ricin shot into his leg. There also have been multiple incidents of ricin being sent through the mail. Most recently, in April 2013, envelopes containing powdered ricin were sent to President Obama and US Senator, Roger Wicker. Understanding this chemical, how it works, and how it is used can help to minimize its danger.

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Image courtesy of Carl Fürstenberg, Wikimedia Commons User: AzaToth BE SURE TO GIVE IMAGE TITLE, PRESUMABLY IT IS RICIN MOLECULE??

## What is ricin?

- Highly toxic protein.
  - Prevents cells from making new proteins.
  - Leads to cell death.
- Occurs naturally in seeds of the castor bean plant.
- Not infectious (cannot be passed from one person to another).



*Ricinus communis* plant with seed capsules.



Ricin is a highly toxic protein that occurs naturally in beans from the castor plant, *Ricinus communis* L. When chewed and consumed, castor beans can release ricin, which poisons the victim and may even cause death. Ricin also can be derived from waste produced during the processing of castor beans for their oil. However, castor oil itself is not thought to contain ricin. Extracted ricin toxin can be made into a powder, a mist or a pellet. It also can be dissolved in water. In these forms, ricin can be used as a weapon.

Because it is a protein (not a virus or living organism), ricin is not infectious. Individuals exposed to it do not become contagious, and it cannot be spread from person to person the way a cold or the flu can. Once inside the body, however, ricin is able to enter cells, damage the cell membrane, and deactivate ribosomes, thereby preventing them from making new proteins. Ultimately, this leads to cell death.

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## How can someone be exposed to ricin?

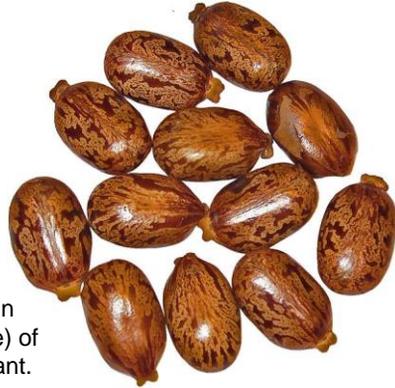
- Ricin is found in the seeds of the castor bean plant and the residue left after oil is pressed from the seeds.
  - The protein, ricin, can be extracted and purified from the seeds or waste.
  - Castor oil does not contain ricin.
- Ricin can enter the body through
  - Inhalation (breathing in a purified form),
  - Ingestion (eating a seed or extract),
  - Direct injection.



Ricin is most dangerous when injected, because the poison enters the blood stream directly and rapidly disperses from there throughout the body. Inhalation also delivers ricin quickly to the bloodstream, but any quantity of toxin not immediately absorbed can be exhaled and/or diluted. Ingested ricin is not absorbed entirely by the gastrointestinal tract, so it is less deadly than ricin that is injected or inhaled.

## What are the symptoms of exposure?

- Low blood pressure
- Pain or tightness in the chest
- Cough
- Nausea or vomiting
- Fever
- Seizures



Ricin is contained in seeds (shown here) of the castor bean plant.



The physiological symptoms of ricin poisoning depend on the method and timing of administration, as well as the dosage. When injected with ricin, victim may begin to experience symptoms, including general weakness and muscle pain. As the illness progresses, a person may experience vomiting, fever and low blood pressure, all potentially culminating in multisystem organ failure and death.

Inhaled ricin is inhaled may cause symptoms within about eight hours, including difficulty breathing, fever, coughing, nausea and tightness in the chest. Low blood pressure and respiratory failure associated with this form of ricin poisoning may be fatal.

Ingested ricin can produce nausea, vomiting, and sometimes, bloody diarrhea within 12 hours. The victim will experience severe dehydration and low blood pressure, and possibly seizures. Fatal liver and/or kidney failure are possible within days.

Because the symptoms of ricin poisoning resemble those of other, more common gastrointestinal and respiratory afflictions, diagnosis requires confirmation of exposure through specialized testing. Multiple, similar cases clustered together can help to determine the source.

Image: *Ricinus communis*, Euphorbiaceae, Castor Oil Plant, seeds. H. Zell, Wikimedia Commons, Creative Commons Attribution-Share Alike 3.0 Unported license.

## Is there a treatment for ricin exposure?

- There is no known antidote. Ricin poisoning can be fatal, even with treatment.
- Treatment options.
  - Prevent ricin from entering the bloodstream.
    - Flush eyes.
    - Oral treatment with activated charcoal (prevents absorption of ricin in stomach)
  - Control the symptoms.
    - Intravenous fluids.
    - Medication for seizures or low blood pressure.



There are no vaccines or antidotes for ricin poisoning. The first step in treatment is to prevent any residual ricin from entering the victim's bloodstream. Depending on the mode of exposure, steps might include flushing the eyes or flushing the stomach with activated charcoal. It is also critical to minimize the physiological effects of the poison. Depending on the route of entry, treatment can include helping the person breathe, providing intravenous fluids, or administering medications to control seizures or low blood pressure.

Outside of incidental ingestion of castor beans, accidental exposure to ricin is unlikely. A deliberate act is required to extract and refine ricin, and use as poison. That is why ricin exposure is usually viewed and investigated within the context of war or terrorism.

As with any unknown or suspicious substance, it is important to take proper precautions and minimize exposure to ricin. For more information about ricin and what to do in the case of a possible exposure, visit The Centers for Disease Control and Prevention at <http://emergency.cdc.gov/agent/ricin/facts.asp> or Baylor College of Medicine at <http://www.bcm.edu/news/item.cfm?newsID=7056>.