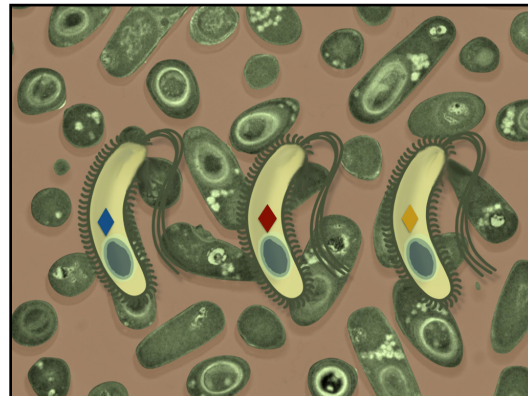


What is *Bacillus thuringiensis* (Bt)?

Bt is a microbe naturally found in soil. It makes proteins that are toxic to immature insects (larvae). There are many types of *Bt*. Each targets different insect groups. Target insects include beetles, [mosquitoes](#), black flies, caterpillars, and moths.

With *Bt* pesticides, routine testing is required to ensure that unwanted toxins and microbes are not present. *Bt* has been registered for use in pesticides by the US Environmental Protection Agency (EPA) since 1961.



What are some products that contain *Bacillus thuringiensis* (Bt)?

Currently, *Bt* strains are found in over 180 registered pesticide products. *Bt* products are used on crops and ornamental plants. Others are used in and around buildings, in aquatic settings, and in aerial applications. These [products](#) are commonly sprays, dusts, granules, and pellets. Some of these products are approved for use in [organic](#) agriculture.

Some crops have been engineered to make the *Bt* toxin. These [plant-incorporated protectants](#) include corn, cotton, and soybeans.

Always [follow label instructions](#) and take steps to minimize exposure. If any exposures occur, be sure to follow the First Aid instructions on the product label carefully. For additional treatment advice, contact the Poison Control Center at 1-800-222-1222. If you wish to [discuss a pesticide problem](#), please call 1-800-858-7378.

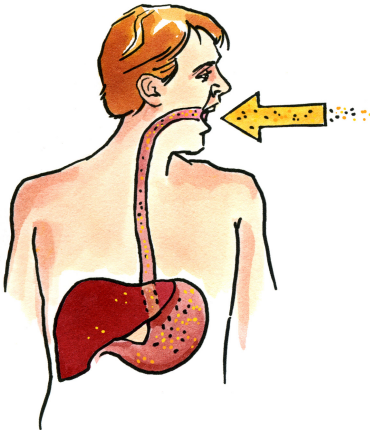


How does *Bacillus thuringiensis* (Bt) work?

Bt makes toxins that target insect larvae when eaten. In their gut, the toxins are activated. The activated toxin breaks down their gut, and the insects die of infection and starvation. Death can occur within a few hours or weeks.

The different types of *Bt* create toxins that can only be activated by the target insect larvae. In contrast, when people eat the same toxins, the toxins are not activated and no harm occurs.

Each type of *Bt* toxin is highly specific to the target insect. For example, the 'kurstaki' type targets caterpillars. The 'isrealensis' type targets immature flies and mosquitoes. Little to no direct toxicity to non-target insects has been observed.



How might I be exposed to *Bacillus thuringiensis* (Bt)?

People are most commonly exposed to *Bt* through their diet, at very low levels. Exposure can also occur if you breathe it in or get it on your skin or eyes. For example, this can occur while [applying sprays or dusts](#) during windy conditions. You may also be exposed after using a product if you don't wash your hands before eating or smoking. Since *Bt* is commonly found in soils, exposures not related to pesticides are also possible.

Pets might be exposed to this product in treated birdbaths or water fountains. You can [limit your exposure](#) and reduce the risk by carefully following the label instructions.

What are some signs and symptoms from a brief exposure to *Bacillus thuringiensis* (Bt)?

Bt is low in toxicity to people and other mammals. Several studies have found no evidence of sickness or infection as a result of exposure. However, some products with *Bt* have caused eye and skin irritation. In one study, rats breathed in very high doses of concentrated *Bt*. Some had runny noses, crusty eyes, and goose bumps. Others were less active or lost weight.

In another study, people were surveyed before and after aerial applications of *Bt*. Most people were not affected. However, some people with hay fever reported certain symptoms. These included difficulty with sleep and concentration, stomach upset, and nose/throat irritation. Seasonal factors, such as pollen, may have contributed to some of the effects.

Scientists also evaluated whether *Bt* can cause allergic reactions. Researchers found that farmworkers exposed for one to four months did not experience any problems related to their airways, nose, or skin. However, further exposure showed evidence of an immune response and the potential for skin allergies to develop.

What happens to *Bacillus thuringiensis* (Bt) when it enters the body?

When eaten, *Bt* is confined to the gut. It does not reproduce, and the toxin is broken down like other proteins in the diet. *Bt* leaves the body within 2 to 3 days.

If breathed in, *Bt* can move to the lungs, blood, lymph, and kidneys. *Bt* is then attacked by the immune system. Levels of *Bt* decrease quickly one day after exposure.

Is *Bacillus thuringiensis* (Bt) likely to contribute to the development of cancer?

No data were found on the carcinogenic effects of *Bt* in humans. However, in one animal study, rats were fed very high doses of *Bt* for 2 years. No evidence of cancer was observed.

Has anyone studied non-cancer effects from long-term exposure to *Bacillus thuringiensis* (Bt)?

In a 2-year study, rats were fed high doses of *Bt* daily. Female rats had lower body weights. However, no evidence of an infection was found.

Bt is only activated in the alkaline environment of the insect gut, compared to the acidic environment of human stomachs. In human stomachs, it is easily digested. As such, no adverse effects are expected after long-term dietary exposure to *Bt*, whether its proteins are sprayed on plants or grown within plant tissues.

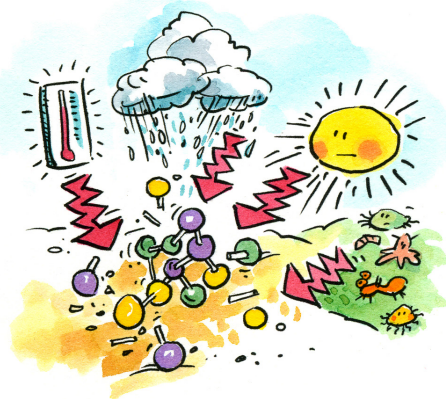
Are children more sensitive to *Bacillus thuringiensis* (Bt) than adults?

[Children may be especially sensitive to pesticides](#) compared to adults. However, there are currently no data showing that children have increased sensitivity specifically to *Bt*.

What happens to *Bacillus thuringiensis* (Bt) in the environment?

Toxins created by *Bt* are rapidly broken down by sunlight and in acidic soil. Other microbes in soil can also break it down. *Bt* does not readily leach in soil. It typically remains in the top several inches of soil. *Bt* remains dormant in most natural soil conditions. However, there has been some reproduction in nutrient rich soils. On the soil surface, dormant *Bt* cells last only a few days. However, below the soil surface, they can last for months or years. The [half-life](#) in unfavorable soil is about 4 months. *Bt* toxins break down much faster. In one study, 12% remained after 15 days.

In water, *Bt* does not readily reproduce. A study found *Bt* toxins in the air were broken down rapidly by sunlight. Forty-one percent (41%) of the toxin remained after 24 hours. On plant surfaces, sunlight breaks down *Bt*; the half-life of *Bt* toxins is 1-4 days.



Can *Bacillus thuringiensis* (Bt) affect birds, fish, or other wildlife?

Bt is practically non-toxic and non-pathogenic to birds, fish, and shrimp. No adverse effect or infection was found in rats given large doses of two different *Bt* strains. There is no evidence that *Bt* can cause a disease outbreak among wild animals.

Little to no direct toxicity to non-target insects and other shelled invertebrates has been observed. *Bt* does not seem to hurt earthworms. However, the **aizawai** strain is highly toxic to honeybees. Other strains have minimal toxicity to honeybees.

Water fleas exposed to the **kurstaki** and **israelensis** strains showed moderate toxicity. The **aizawai** strains are highly toxic to water fleas. However, evidence suggests that toxicity to these non-targets may be related to impurities from the production of *Bt*.

Where can I get more information?

For more detailed information about *Bacillus thuringiensis* (*Bt*) please visit the list of [referenced resources](#) or call the National Pesticide Information Center, between 8:00 AM and 12:00 PM Pacific Time (11:00 AM to 3:00 PM Eastern Time), Monday - Friday, at 1-800-858-7378 or visit us on the web at <http://npic.orst.edu>. NPIC provides objective, science-based answers to questions about pesticides.

Date Reviewed: February 2015

NPIC is a cooperative agreement between Oregon State University and the U.S. Environmental Protection Agency (U.S. EPA, cooperative agreement # X8-83560101). The information in this publication does not in any way replace or supercede the restrictions, precautions, directions, or other information on the pesticide label or any other regulatory requirements, nor does it necessarily reflect the position of the U.S. EPA.