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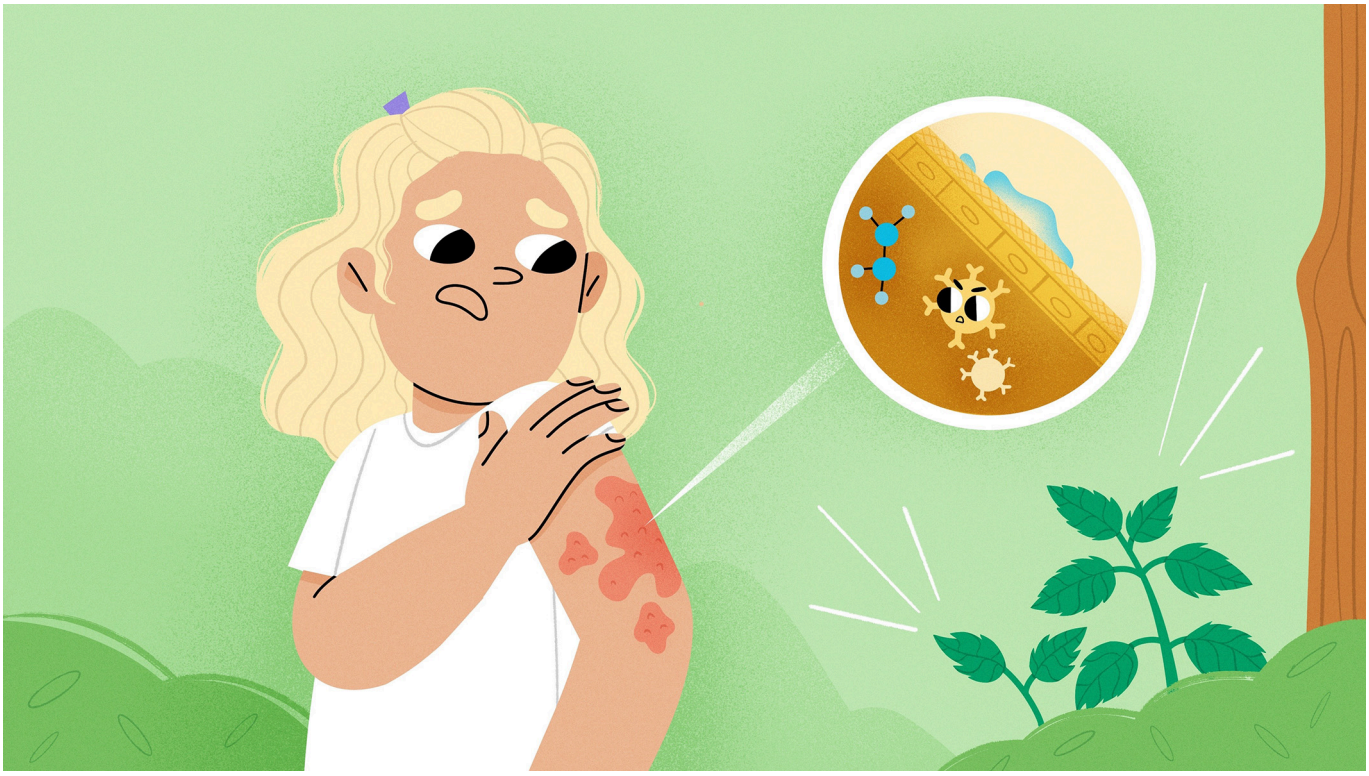

HOW CAN PLANTS HARM YOUR SKIN?

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YOUNG REVIEWERS:

DOMINIK
AGE: 13

YALE PATHWAYS TO SCIENCE/ OPEN LABS
AGES: 11–14

Have you ever gotten a rash after playing outside? Certain plant-based substances can irritate your skin. In the U.S., poison ivy is the most common cause of these rashes. Recognizing these plants can help you prevent rashes while enjoying the outdoors. Symptoms include itching, redness, swelling, and blisters, usually appearing 24–48 h after touching the plants. The rash can last up to 3 weeks. This article will help you learn how to identify plants that can irritate the skin and explain how skin inflammation happens. Treatment involves washing the skin, avoiding scratching to prevent infection, and using creams to alleviate symptoms. Prevention strategies include wearing protective clothing and using creams that block poison. Other plant-related skin issues can arise from thorns, other itch-inducing substances, and reactions to sunlight after contact with certain plants. Proper identification of harmful plants and taking precautions can ensure a safe outdoor experience.

CAN PLANTS "HARM" YOUR SKIN?

Have you ever returned from spending time outdoors to discover itchy red welts on your skin? You could have brushed against toxic plants that can irritate your skin. This skin irritation is called **plant dermatitis** [1]. Your skin can react when you touch certain plant parts, such as leaves, stems, or pollen. There are around 350,000 plants that can trigger skin irritation. Poison ivy and poison oak are common plants that can lead to skin rashes.

PLANT DERMATITIS

A skin rash caused by contact with a plant or plant parts.

WHAT IS POISON IVY, AND WHERE CAN YOU FIND IT?

A common saying can help you to identify poison ivy: "Leaves of three, let them be". You had better stay away if you see a plant with groups of three shiny leaves! You might find it creeping as a bush or climbing like a vine in the woods and along hiking trails. Be cautious of its irritating relatives, poison oak and poison sumac, which also cause skin rashes. Poison oak also has groups of three leaves, but the leaves tend to have rounder tips. Poison sumac has 7–13 leaves arranged in pairs, like a small tree. Poison ivy and poison oak are found in every U.S. state except Alaska and Hawaii, but do not let that scare you away from outdoor adventures. You can avoid getting itchy rashes if you watch out for those tricky plants next time you are on a forest treasure hunt!

WHAT ARE THE SIGNS AND SYMPTOMS OF POISON IVY?

If you accidentally contact poison ivy, you may experience redness, itching, and swelling, and bumps or blisters may form on your skin. Patterns like lines or spots may also show up on the skin. Some people might see dark spots or streaks with slight redness. Reactions vary from person to person—while some people may have severe responses that last for weeks, others may not react at all. Typically, most poison ivy rashes heal on their own in about 2–3 weeks, without treatment. However, excessive scratching can lead to bacterial infections that can worsen the rash.

URUSHIOL

A clear, odorless oil in plants like poison ivy, poison oak, and poison sumac. It is the cause of the itching sensation.

IMMUNE SYSTEM

An intricate system of cells (such as Langerhans cells and T cells), tissues, and organs that safeguard the body against infections and various diseases.

HOW DOES POISON IVY CAUSE SKIN RASH?

Poison ivy causes itching due to a sticky oil called **urushiol**. This colorless oil is found in the leaves, stems, roots, and even the tiny fruits of poison ivy, oak, and sumac. You may be caught off guard if you accidentally contact it while exploring in the woods. Your body recognizes this oil as harmful, prompting your **immune system** to respond. This reaction results in the itching, burning sensations, redness, swelling, and sometimes blisters on the skin.

When you first touch poison ivy, your skin does not react immediately. This delay happens because your body has not met urushiol in the past and needs time to learn about it. This time is called **sensitization**. Once the urushiol sneaks into your skin, it is too small to cause a reaction immediately. It must first change its shape through a chemical reaction. Then, a particular protein in your skin bonds with it to create a joint molecule. Langerhans cells, a type of white blood cell resembling an octopus, patrol the outer layer of your skin as protectors. If one of their arms captures the joint molecule and identifies it as a threat, it then shows the captured invader to specialized T cells, another type of white blood cell. These T cells become memory T cells, which can remember what the joint molecule looks like for an extended period (Figure 1A) [2].

SENSITIZATION

When the immune system learns to recognize a foreign invader. It remembers the invader, so next time, your body can respond faster and more effectively.

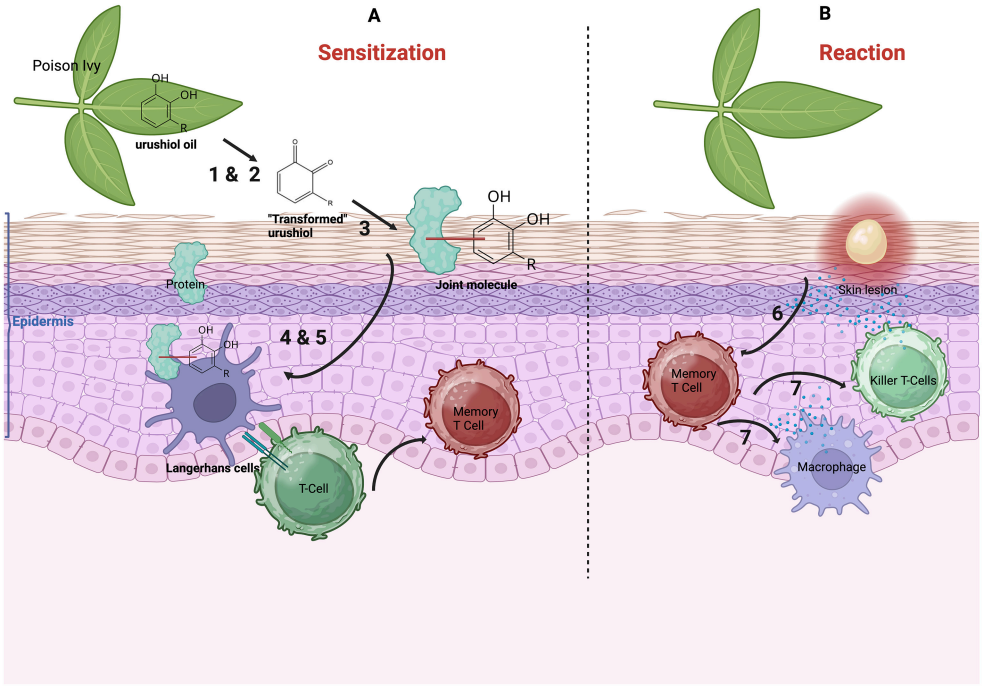


Figure 1

Poison ivy can cause a skin rash through two main steps. **(A)** During sensitization: 1. Urushiol from poison ivy penetrates the skin. 2. Inside the skin, urushiol changes its shape. 3. This form attaches to a protein in the skin, forming a joint molecule. 4. The joint molecule is captured by Langerhans cells, which 5. bring the invader to T-cells, which form memory T-cells. **(B)** 6. If you touch poison ivy again, the memory cells quickly recognize the urushiol. 7. Then they activate more T-cells and other immune cells called macrophages. These cells and the substances they release (blue dots) cause inflammation and rash (Created with BioRender.com).

Then, when you contact poison ivy again, the memory T cells quickly recognize the urushiol. You can think of T cells as the commanders of the immune system. They assist in directing other immune cells and summoning their help by releasing chemical signals (Figure 1B). This entire response results in skin irritation, which is called **delayed hypersensitivity** because it takes some time—typically 24–48 h after exposure.

DELAYED HYPERSENSITIVITY

When your immune system, especially T cells, reacts to something your skin has touched. This reaction takes time—usually about 24 h before you notice it.

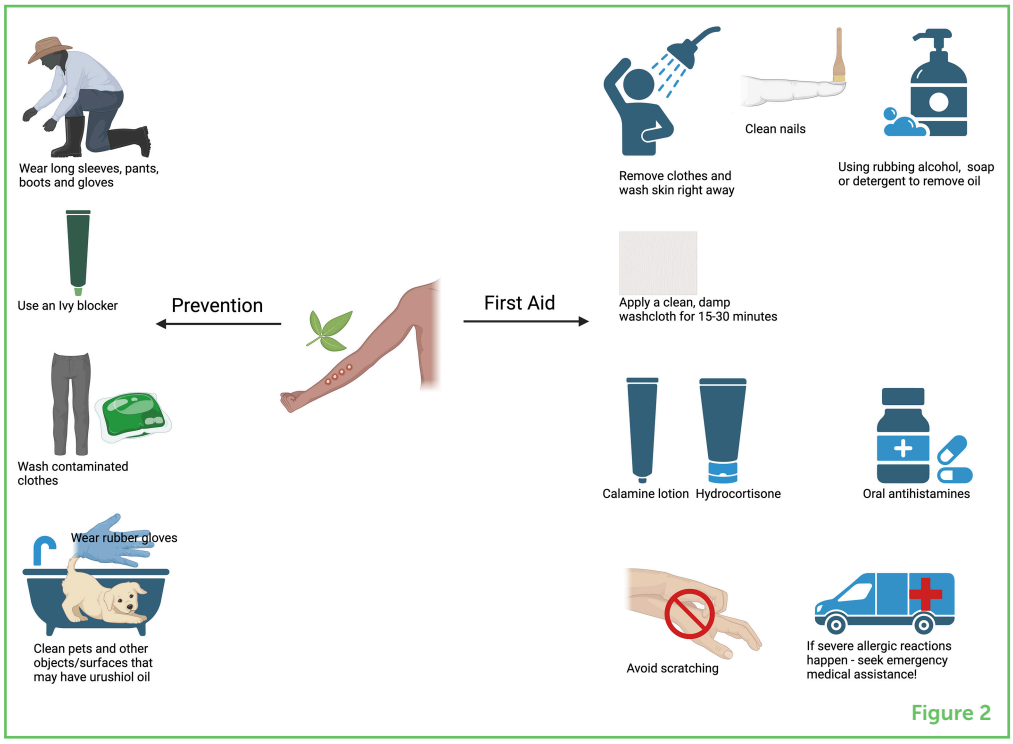
WHAT IS THE FIRST AID FOR POISON IVY RASH?

Poison ivy rash is not contagious and does not spread from one area to another. However, if the oil from poison ivy gets on clothes or objects, it can spread to other skin areas. To treat poison ivy rash, remove any

clothes worn when exposed to poison ivy and wash the skin right away (Figure 2). Rinse the area with lots of water. Use rubbing alcohol, degreasing soap, or regular soap to remove the oil before it soaks into the skin. A small brush can help clean under your nails where the oil might hide. To ease the discomfort, consider using a clean, damp washcloth for 15–30 min to relieve itching and swelling. Calamine lotion, well-known for its pink color, also effectively reduces itchiness and pain, while hydrocortisone cream helps with inflammation [3]. Oral antihistamines, like Benadryl, can further assist with itching. In the case of a severe allergic reaction, for example, if breathing becomes difficult, seek emergency assistance immediately. Avoid scratching the rash, as this can worsen the condition and lead to bacterial infections requiring additional treatment.

Figure 2

First aid and prevention of poison ivy rash (Created with BioRender.com).



HOW CAN YOU AVOID ITCHY ENCOUNTERS?

To safely enjoy nature and prevent rashes, several precautions can be taken. Wear long sleeves, long pants, boots, and gloves to protect your skin (Figure 2). Before heading out for hiking or camping, apply an ivy blocker, available in most pharmacies, which is a lotion that can protect the skin like a shield. After your outdoor activities, wash your clothes in the washing machine and clean any tools you used. If you have pets, remember that the oil can cling to their fur, even though most pets do not develop symptoms. When washing your pets, wear rubber gloves to prevent the oil from spreading. Following these steps can help keep you safe from plants that may cause rashes.

OTHER WAYS PLANTS CAN HARM YOUR SKIN

Besides itchy rashes, plants can affect your skin in other ways [4]. Some species have sharp features, such as spines and thorns, that can scratch or irritate the skin. If these scratches become infected, they can lead to more severe problems. For example, if a thorn penetrates the skin, bacteria may spread and cause infections in nearby joints. In addition to the plants we have already discussed, other plants can produce substances that can irritate the skin. A notable example is "itching powder", often used in pranks, which comes from the plant *Mucuna pruriens*. Its seed pods have tiny hairs containing a protein called mucunain, which causes intense itching upon skin contact. Another reaction caused by plants is known as **phytophotodermatitis**. This condition occurs when the skin contacts specific plants and is then exposed to sunlight, leading to painful blisters. As these blisters heal, the skin may darken, a phenomenon known as **hyperpigmentation**. This occurs because the skin produces additional **melanin**, the pigment responsible for skin color, triggered by certain light-sensitive compounds in the plants.

PHYTOPHOTO-DERMATITIS

A type of plant dermatitis that arises when certain chemicals in plants contact the skin and the skin is then exposed to sunlight, potentially causing painful, hyperpigmented blisters.

HYPER-PIGMENTATION

A condition in which areas of the skin become darker compared to other areas.

MELANIN

A substance that gives your skin color and helps protect it from harmful sunlight.

CONCLUSIONS

Some plants, including poison ivy, oak, and sumac, can cause skin problems known as plant dermatitis. The itchy rash comes from an oil called urushiol, which is found in these plants. You might not react immediately when you touch poison ivy because your body needs time to process it. After the initial contact, future touches may cause a reaction, leading to red, swollen, and blistered skin within 24–48 h. To treat this, wash the affected skin, use creams for relief, and do not scratch, to avoid infections. To prevent contact, wear protective clothing and use barriers to avoid the oil. Recognizing these plants can help you enjoy the outdoors without worrying about the "leaves of three".

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CONFLICT OF INTEREST: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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YOUNG REVIEWERS

DOMINIK, AGE: 13

My name is Dominik, and I am currently in 8th grade. I am curious and passionate about science. In my free time, I enjoy figure skating, skiing, and fishing.

YALE PATHWAYS TO SCIENCE/OPEN LABS, AGES: 11-14

The Yale Pathways to Science/Open Labs reviewers are a lively team of seven young science enthusiasts. The reviewers love math, science, art, and writing at school, but their interests span far beyond the classroom. They are talented musicians (guitarists, violinists, drummers), active athletes (figure skaters, skiers, gymnasts), and avid readers!

AUTHORS

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Yu is a fourth-year medical student at the Morehouse School of Medicine. She earned her Bachelor of Science in biological science in China before moving to the United States to pursue a Ph.D. in biochemistry at Auburn University in Alabama. After completing her Ph.D., Yu spent 2 years at Virginia Tech, making history as the first individual to discover the methanofuran biosynthesis pathway. In 2021, she embarked on her journey to become a medical doctor. As a mother of a 6-year-old, she enjoys playing music and reading books with her daughter. Her motivation to pursue a career in dermatology stems from her daughter's struggles with atopic dermatitis since birth. Yu wrote this article after her daughter experienced contact dermatitis while gardening with her grandmother in the front yard.

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Jillian is an assistant professor of dermatology at the University of Massachusetts Medical School. She earned her B.S. in molecular and cellular biology from Johns Hopkins University and her Ph.D. in immunology and pathology from Boston University School of Medicine. Her laboratory studies the role of the immune system in skin diseases. She is the faculty advisor for the Dermatology Interest Group Journal Club at UMass. Jillian is passionate about teaching and mentoring students in the classroom and the laboratory, and discovering new treatments for patients through her research. She enjoys spending time with her kids, baking, and gardening. *jillian.richmond@umassmed.edu