HEALTH BASICS

Variola virus

Variola virus is the virus that causes smallpox, which has been eradicated worldwide.

WHAT IT IS
The virus that causes smallpox

WHERE IT COMES UP
Smallpox history, public-health planning, or specialized laboratory work

WHY IT MATTERS
Exposure could cause smallpox and trigger an emergency response

WHAT IT IS NOT
Not a disease; smallpox is the disease

WHO TO ASK
A public health department or infectious disease specialist

HOW IT IS CHECKED
Specialized PCR testing of skin-lesion samples

Overview

Variola virus is the virus that causes smallpox . The virus and the disease are not the same thing: variola is the infectious virus, while smallpox is the illness it can cause.

Variola belongs to the orthopoxvirus family. Other members include the viruses associated with mpox, cowpox, and vaccinia. Vaccinia virus is used in smallpox vaccines; the vaccine does not contain variola virus.

Smallpox was declared eradicated by the World Health Organization in 1980. This means it no longer spreads naturally anywhere in the world. The last known naturally occurring case was reported in 1977.

Officially retained live variola virus is held under strict security at two World Health Organization collaborating centres: one in the United States and one in Russia. It is kept for approved research and public-health preparedness. Variola is not something you should encounter in everyday life, routine healthcare, food, water, or consumer products.

How it works

Variola is a DNA virus, meaning its genetic instructions are stored as DNA. Unlike many DNA viruses, it reproduces in the outer part of an infected cell, called the cytoplasm.

Historically, the virus spread mainly through close, prolonged face-to-face contact with someone who had smallpox. Respiratory droplets and direct contact with infected body fluids or skin lesions could carry the virus. Contaminated bedding and clothing were another possible route. Airborne spread over longer distances was uncommon but could occur in enclosed settings.

After entering the body, the virus reproduced near the point of entry and in nearby lymph nodes. Lymph nodes are small parts of the immune system that help filter germs. The virus then entered the blood and spread to other tissues, including the skin. This process produced the fever and distinctive rash associated with smallpox.

People were contagious while they had active smallpox lesions. They remained contagious until the final scabs had separated and the skin underneath had healed.

Because smallpox has been eradicated, these transmission patterns are mainly relevant to historical research, emergency planning, and the response to a possible laboratory or deliberate release.

Why it matters for your health

Smallpox was a serious infectious disease. Eradication ended natural exposure, so people do not need routine testing for variola virus.

Many people born after routine smallpox vaccination ended have not been vaccinated. Protection in people vaccinated decades ago may also be incomplete. A vaccination scar alone cannot show how much protection someone still has.

Modern smallpox vaccines use vaccinia virus, a related orthopoxvirus that produces immune protection against variola. They do not use variola itself. Vaccination policies differ for members of specialized laboratory teams, military personnel, and emergency responders who may have an occupational risk.

Governments maintain response plans, vaccines, tests, and medicines because an accidental laboratory exposure or deliberate release would have major public-health consequences. These preparations do not mean that variola is circulating in the community.

A routine rash, fever, or respiratory illness is very unlikely to be related to variola. Many common conditions can cause these problems, including chickenpox, mpox, allergic reactions, and other viral infections. Appearance alone is not enough to identify the cause.

What can go wrong

The main concerns connected with variola virus are specific situations, not routine everyday exposure.

Smallpox following a release: An accidental or deliberate release could allow variola to infect people and cause smallpox. A suspected case would require immediate isolation, specialized testing, contact tracing, and a coordinated public-health response.

Occupational laboratory exposure: People working with approved orthopoxvirus materials follow strict safety procedures. A spill, needlestick, equipment failure, or other possible exposure needs immediate reporting through the laboratory's emergency process.

Confusion with another rash illness: Smallpox historically caused fever followed by firm, deep skin lesions. Lesions in the same body area often developed at a similar stage. However, these features cannot safely confirm or exclude smallpox without expert assessment and laboratory testing.

Incorrect or misleading test results: Routine blood tests do not test for variola. Tests for antibodies to orthopoxviruses may react to previous vaccination or exposure to a related virus, so they cannot usually prove a current variola infection. Confirmation requires specialized polymerase chain reaction, or PCR, testing. PCR looks for selected parts of the virus's DNA.

A possible exposure combined with fever or a new unexplained rash is an emergency public-health situation. Do not arrive unannounced at a clinic or emergency department, where other people could be exposed. Limit contact with others and call local emergency services or the public health department for instructions. If someone is having trouble breathing, is unresponsive, or has another immediately life-threatening problem, call emergency services.

A rash without a credible variola exposure usually needs ordinary medical assessment rather than a smallpox emergency response. Seek routine or prompt care based on how unwell you feel and the advice available in your area.

What you can do

For most people, there is nothing specific to do about variola virus. There is no routine screening test to request, and everyday activities do not require special precautions.

If you are reviewing an old medical record, remember that a smallpox vaccination entry refers to a vaccine containing vaccinia virus, not variola. Keep the record if you have it, especially if your work may involve orthopoxviruses or emergency response. A scar is not a reliable substitute for written documentation.

If your job could involve orthopoxvirus materials, ask your occupational health or biosafety service:

Do not try to collect, store, or transport a sample from a suspicious rash yourself. Variola testing is coordinated by public-health authorities and performed in specialized laboratories. Trained staff decide which samples are needed and how to handle them safely.

If you receive a credible warning about a possible variola release or encounter suspicious laboratory material, move away without touching it and follow emergency-service or public-health instructions.

- Which viruses or samples you may handle
- What vaccination or health monitoring applies to your role
- How to report a spill, needlestick, or other possible exposure
- Where specialized testing would be arranged

Common questions

Is variola virus still circulating?

No natural circulation has been identified since smallpox was eradicated. Official stocks remain in two high-security laboratories under international oversight.

Is variola the same as mpox?

No. Variola virus causes smallpox, while monkeypox virus causes mpox. Both are orthopoxviruses, so they share some biological features, but they are different viruses and cause different diseases.

Does the smallpox vaccine contain variola virus?

No. Smallpox vaccines use vaccinia virus, a related virus that trains the immune system to recognize orthopoxviruses. They do not contain the virus that causes smallpox.

Can a routine blood test find variola?

No. Variola testing is not part of routine blood work. Suspected smallpox is investigated through public-health systems, usually with PCR testing of material from skin lesions or scabs.

Can I tell smallpox from a photograph?

No. Photographs and rash patterns may help specialists consider possible causes, but they cannot confirm variola. Several infections and non-infectious conditions can resemble one another.

Should I ask for a smallpox vaccine?

Routine smallpox vaccination ended after eradication in most countries. Vaccination may still be offered to certain laboratory workers or used as part of an emergency response. A public health or occupational health service can explain what applies to a specific exposure or job.

Sources

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