



How diseases spread



Key words

- Biology
- Diseases
- Virus and Bacteria
- Transmission

The science behind

In this experiment, you will learn how germs spread through a population but also how they spread in poor hygiene settings.

Basic hygiene

Viruses are tiny micro-organisms, visible only through an electron microscope, consisting of genetic material (DNA or RNA) enclosed in a protein envelope (capsid) and often also in an outer membrane of phospholipids (a type of fat) and proteins, called the pericapsid. Viruses cannot reproduce (replicate) on their own. Still, they can only do so within the cells of the body's tissues, causing them to be destroyed or, for some particular viruses, transformed into cancer cells. The resistance of viruses in the environment is meager, although some viruses (e.g. some respiratory viruses) can survive for a long time.

Bacteria are single-celled living beings. They appear in different forms, live in colonies, and reproduce independently. Some species survive in extreme conditions, even in hot and humid environments. An important fact is that many bacteria are essential for our health. An example of 'friendly' bacteria is the microbiome, which aids digestion and stimulates the immune response.

Bacteria and viruses can be **transmitted** through **touch**. How does it happen?



A cold can be contracted by shaking the hand of a person who has a cold and has just used their hand to wipe their dripping nose. The mucus from the nose is full of cold virus particles, such as rhinovirus, which causes one-third of colds in adults. Once the cold virus particles are on the second person's hands, they are contaminated, and the virus can be transferred into the nose through the fingers.

- Hand washing techniques

Handwashing should take between 40 and 60 seconds to be effective and thorough.

Bring the water to a pleasant temperature and **moisten** your hands.

Apply the right amount of soap and **spread it** over the entire width of the palm.

Rub the palm of one hand against the back of the other, interlacing the fingers and vice versa.

Rub palm against palm, interlacing the **fingers**.

Rub the back of the fingers against the **opposite palm**.

Rub the thumb while holding it in the palm of the opposite hand and vice versa.

Rub the fingertips into the opposite palm and vice versa.

Rinse.

Dry the hands well with paper, also passing it between the fingers.

Using the same paper, close the tap.

Spread of virus

- Experiment on how virus can spread from one organism to another

Viruses spread from organism to organism mainly through the tiny droplets produced when a person is carrying the virus coughs or sneezes. These droplets, which we may or may not see, can fly and land on a surface. Some may land **directly** on another person's mouth, nose or eye, while others may land on a **hard surface** such as a telephone, door handle or worktop.



The residence time of the particles on the surface varies depending on the surface and the viral filament. For some viruses, it is a few hours; for others, it can last up to nine days. If a healthy person touches one of these surfaces and then touches his nose, mouth or eyes before washing his hands, he has transmitted the virus to himself. If the person carrying the virus coughs or sneezes and does not disinfect the area, the virus can be transferred again, and the cycle continues.

- Comparison to diseases such as malaria, measles, etc.

Chickenpox and **measles** are both infectious diseases but are caused by different viruses. Symptoms of chickenpox include a rash that first appears on the chest, face and back but can spread to the rest of the body, fever, headache, tiredness or fatigue and reduced appetite. Symptoms of measles include a rash that first appears at the hairline or on the forehead and then spreads downwards to other parts of the body, fever, dry cough, cold, sore throat, and reddened eyes. In chickenpox, **contagion** occurs through the **inhalation of respiratory droplets** that are generated when a sufferer coughs or sneezes. The disease can also spread **through contact with contaminated surfaces** or fluid drained from the blisters. Like chickenpox, measles can spread when a sufferer coughs or sneezes and **through contact with a surface or object that has been contaminated.**

- How contagion works

The modes of contagion are varied: viruses can infect by **air, food, sexual intercourse or through vectors** (mainly insects such as mosquitoes).

Respiratory viruses, such as influenza or the common cold, are spread through droplets of saliva or secretions produced by coughing and sneezing (droplets) from infected persons. Other viruses can infect by **parenteral transmission** or through contact between mucous membranes or blood and other body fluids, such as hepatitis B, C and HIV. **Viruses with oro-faecal transmission** are contracted by ingesting food, water or other material contaminated with faecal material (e.g., polio or rotavirus). Then some viral agents are almost purely food-borne, such as hepatitis A and hepatitis E. **Pets** can also transmit viruses: the most famous case is probably rabies. In any case, the presence of a general weakening of the organism or immunodepression can facilitate virus infections and worsen their course.



Every day life

Covid 19 guidelines and recommendations

- Usage of masks, hydroalcoholic gels, etc.

Wearing **masks** and using **sanitizing gel** can contain the proliferation of Covid-19. In particular, face masks should be worn regardless of symptoms, as asymptomatic people are responsible for many infections. Remembering to wear the mask correctly and use the sanitizing gel is essential. One must consider that the Coronavirus is transmitted precisely by air from one person to another. Hence, the mask proves to be decisive in avoiding coming into contact with the small particles suspended in the air. As for sanitizing gels, these are a valid alternative in all those situations in which one does not have the possibility of washing one's hands with soap and water. However, a necessary clarification must be made. Even if a gel contains a high percentage of alcohol to combat viruses and bacteria, it must be used correctly to ensure disinfectant strength. It is best to use the product on **well-dried skin**, free of lesions and wounds. Then, you have to scrub your hands for about 30 seconds, in the same way as you do when using soap under running water.

- Contagion

The virus is mainly transmitted through **close contact**, exposure to **droplets**, i.e., the particles we emit when we **speak** or, to a considerably greater extent, when we **shout, sing, sneeze** or **cough**. Therefore, to protect oneself from the spread, in addition to using protective equipment, it is necessary to maintain a **distance of at least one metre** from other people. The spread of the virus can also occur through **contact with droplet-contaminated surfaces** if you bring your **hands to your face**, perhaps touching your mouth or nose after contact has occurred. Depending on the **material of the surface** it is on, Covid 19 can survive from a few hours to several days. This is why it is essential to **wash and sanitize hands** often.



Other infectious diseases

- Malaria, Ebola etc.

Malaria is a dangerous infectious disease caused by a **parasite** and is prevalent mainly in hot, tropical areas, which can also occur (very rarely) in temperate climate zones. It is still one of the leading causes of death globally, although it is now practically absent in Western countries. On the other hand, travelling to tropical developing countries, there is a real risk of being infected, which occurs through the **bite of a mosquito**. Typical symptoms of malaria include **chills, flu-like symptoms, fever, vomiting, diarrhoea** and **jaundice**.

When a mosquito bites an infected person, the microscopic parasites responsible for the disease are taken along with the blood. Then, about a week later, when the next meal is eaten, these parasites are mixed with the mosquito's saliva, and injected during the bite. Once the parasites have entered the bloodstream, they reach the liver and multiply. Within a few days, thousands of **parasites** are released from the liver into the blood, where they destroy **red blood cells**. Some of them remain in the liver and continue to multiply, releasing more parasites into the blood in a few days. This process is repeated several times.

Ebola is the name of a particularly aggressive virus capable of causing a potentially fatal haemorrhagic fever. It is a severe and often fatal disease that can spread from human to human through **direct contact with the blood** or **secretions of an infected patient**. Symptoms of Ebola virus disease can appear anywhere from 2 to 21 days after exposure to the virus and include fever, headache, muscle aches, diarrhoea, vomiting and lack of appetite. The first symptoms with which the infection manifests itself are superimposable to other more common diseases, which makes early diagnosis difficult, usually confirmed through specific laboratory tests.