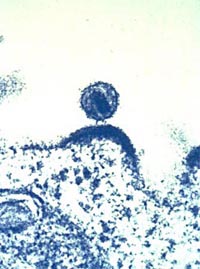
**How AIDS Works**

by [Kevin Bonsor](http://science.howstuffworks.com/life/aids.htm/author-bonsor.htm)

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**HIV, the virus that causes AIDS, is shown budding out of a human immune cell.**

Photo courtesy National Institute of Allergy and Infectious Diseases

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* [DiscoveryHealth.com: HIV/AIDS](http://health.discovery.com/centers/sex/sexpedia/hivnaids.html)

**How AIDS Works**

AIDS (Acquired Immune Deficiency Syndrome) is one of the worst pandemics the world has ever known. HIV (Human Immunodeficiency Virus), the [virus](http://science.howstuffworks.com/life/cellular-microscopic/virus-human.htm) that causes AIDS, was first discovered in 1981 in a remote area of central Africa. It has since swept across the globe, infecting millions in a relatively short period of time. AIDS has killed more than 28 million people that we know of, with up to 3.6 million people dying in 2005 alone [Source: [Avert](http://www.avert.org/worldstats.htm)]. While many cases go unreported, the prevalence of the disease is increasing. By comparison:

* The [flu](http://science.howstuffworks.com/life/cellular-microscopic/flu.htm) pandemic of 1918 killed approximately 20 million people worldwide.
* [World War II](http://www.britannica.com/eb/article?eu) killed approximately 40 million people.

Clearly the AIDS pandemic has had, and will continue to have, a significant and global impact.

In this article, we will show you how the HIV virus attacks the immune system and how it causes AIDS. We will also clear up some of the myths about AIDS and how HIV is transmitted.

The thought of contracting HIV is frightening. And there is good reason for that fear -- the disease is presently incurable, it has a high mortality rate, it spreads quickly and there is no vaccine to protect against it. In today's world, that combination is rare. For example, **small pox** is often fatal, but the disease has been completely contained through vaccinations. **Tuberculosis** is often fatal but can usually be cured with antibiotics if caught early.

AIDS has been able to infect and kill so many people because of its unique makeup. Let's look at some of the features that make this disease so unusual:

* HIV spreads by intimate contact with an infected person. Forms of intimate contact that can transmit AIDS include [sexual activity](http://health.howstuffworks.com/pregnancy-and-parenting/pregnancy/conception/human-reproduction.htm) and any sort of situation that allows [blood](http://health.howstuffworks.com/human-body/systems/circulatory/blood.htm) from one person to enter another. Especially when you compare it with the many viruses that spread through the air, it would seem like the intimacy involved in the transmission of AIDS would be a limiting factor. However…
* A person can carry and transmit the HIV virus for many years before any symptoms show themselves. A person can be contagious for a decade or more before any visible signs of disease become apparent. In a decade, a promiscuous HIV carrier can potentially infect dozens of people, who each can infect dozens of people, and so on.
* HIV invades the [cells](http://science.howstuffworks.com/life/cellular-microscopic/cell.htm) of our [immune system](http://health.howstuffworks.com/human-body/systems/immune/immune-system.htm) and reprograms the cells to become HIV-producing factories. Slowly, the number of immune cells in the body dwindles and AIDS develops. Once AIDS manifests, a person is susceptible to many different infections, because the immune system has been weakened so much by the HIV it can no longer fight back effectively. HIV has also shown the ability to mutate, which makes treating the virus nearly impossible.

The last feature in this list is the one that is truly unique. HIV invades and destroys the immune system -- the system that would normally protect the body from a virus. HIV corrupts and disables the system that should be guarding against HIV.

Next, we'll see how HIV can (and **can't**) be transmitted.

**HIV AND MOSQUITOES**

One of the most prevalent myths about HIV transmission is that [mosquitos](http://animals.howstuffworks.com/insects/mosquito.htm) or other bloodsucking insects can infect you. There is no scientific evidence to support this claim. To see why mosquitoes don't aid in the transmission of HIV, we can look at the insect's biting behavior.

When mosquitoes bite someone, they do not inject its own blood or the blood of an animal or person it has bitten into the next person it bites. The mosquito does inject saliva, which acts as a lubricant so that it can feed more effectively. Yellow fever and [malaria](http://science.howstuffworks.com/malaria) can be transmitted through the saliva, but HIV does not reproduce in insects, and therefore doesn't survive in the mosquito long enough to be transmitted in the saliva.

Additionally, mosquitoes don't normally travel from one person to another after ingesting blood. The insects need time to digest the blood meal before moving on.

To learn more about mosquitoes, check out [How Mosquitoes Work](http://animals.howstuffworks.com/insects/mosquito.htm).

RELATED ARTICLES

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**How HIV Is Transmitted**

In the United States, given the current distribution of HIV in the population, there is better than a one in 1,000 chance of contracting HIV during an unprotected heterosexual encounter, according to the [Centers for Disease Control and Prevention](http://www.cdc.gov/) (CDC). In some locations, the chances are even higher. Unprotected sex is the most common way of transmitting HIV. Your chances for infection increase with each new partner. Here is a list of ways in which HIV can be transmitted:

* **Sexual contact**
* **Sharing contaminated intravenous needles**
* **Breastfeeding** (mother to baby)
* **Infected mother to fetus during pregnancy or birth**
* **Blood transfusions** (Rare in countries where [blood](http://health.howstuffworks.com/human-body/systems/circulatory/blood.htm) is screened for HIV antibodies.)

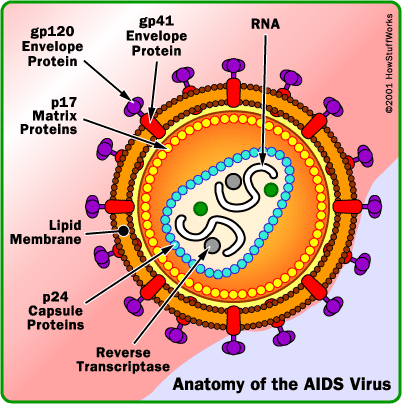
There is also a slight chance of transmission through open-mouth kissing and biting. However, there have been very few cases of HIV being transmitted through either method. In fact, the CDC has investigated only one case in which HIV infection was attributed to open-mouth kissing.

HIV does not transmit through the air or surface contact like cold and flu viruses do. HIV is a fragile virus and doesn't survive well outside the human body. This fragility makes the possibility of environmental transmission very remote. Outside of a host cell, HIV doesn't survive for very long. In laboratory studies, the CDC has shown that once the fluid (blood, sweat, tears, et cetera) containing the HIV virus dries, the risk of environmental transmission is nearly zero.

There is a lot of misinformation about how HIV can be transmitted. So, here is a list of ways in which HIV is**not** transmitted:

* **Saliva, tears and**[**sweat**](http://health.howstuffworks.com/skin-care/information/anatomy/sweat.htm) - Saliva and tears contain only small amounts of HIV, and scientists haven't detected any HIV in the sweat of an infected person.
* **Insects** - Studies show no evidence of HIV transmission through bloodsucking insects. This is true even in areas where there are many cases of AIDS and large populations of mosquitoes.
* **Using the same**[**toilet**](http://home.howstuffworks.com/toilet.htm)**seat**
* **Swimming in the same**[**pool**](http://home.howstuffworks.com/swimming-pool.htm)
* **Touching, hugging or shaking hands**
* **Eating in the same restaurant**
* **Sitting next to someone**

Next, we'll look at what happens once the HIV virus enters the body, and how it attacks the immune system.



RELATED ARTICLES

* [How the Immune System Works](http://health.howstuffworks.com/human-body/systems/immune/immune-system.htm)
* [Prevent Harmful Infections](http://health.howstuffworks.com/wellness/preventive-care/how-to-prevent-viral-infections.htm)
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**The HIV Life Cycle**

Like all [viruses](http://science.howstuffworks.com/life/cellular-microscopic/virus-human.htm), HIV treads the fine line that separates living things from nonliving things. Viruses lack the chemical machinery that human cells utilize to support life. So, HIV requires a host cell to stay alive and replicate. To replicate, the virus creates new virus particles inside a host cell and those particles carry the virus to new cells. Fortunately the virus particles are fragile.

Viruses, like HIV, don't have cell walls or a nucleus. Basically, viruses are made up of genetic instructions wrapped inside a protective shell. An HIV virus particle, called a **virion**, is spherical in shape and has a diameter of about one 10,000th of a millimeter.

HIV infects one particular type of immune system cell. This cell is called the CD4+T cell, also know as a T-helper cell (see [How the Immune System Works](http://health.howstuffworks.com/human-body/systems/immune/immune-system.htm) for details on T cells). Once infected, the T-helper cell turns into a HIV-replicating cell. T-helper cells play a vital role in the body's immune response. There are typically 1 million T-cells per one milliliter of blood. HIV will slowly reduce the number of T-cells until the person develops AIDS.

To understand how HIV infects the body, let's first look at the virus's basic structure. Here are the basic parts of the HIV virus:

* **Viral envelope** - This is the outer coat of the virus. It is composed of two layers of fatty molecules, called **lipids**. Embedded in the viral envelope are proteins from the host cell. There are also about 72 copies of **Env protein**, which protrudes from the envelope surface. Env consists of a cap made of three or four molecules called **glycoprotein** (gp) 120, and a stem consisting of three to four **gp41** molecules.
* **p17 protein** - The HIV matrix protein that lies between the envelope and core
* **Viral core** - Inside the envelope is the core, which contains 2,000 copies of the viral protein, **p24**. These proteins surround two single strands of HIV RNA, each containing a copy of the virus's nine genes. Three of these genes -- gag, pol and env -- contain information needed to make structural proteins for new virions.

HIV is a **retrovirus**, which means it has genes composed of **ribonucleic acid** (RNA) molecules. Like all viruses, HIV replicates inside host cells. It's considered a retrovirus because it uses an enzyme, **reverse transcriptase**, to convert RNA into DNA.

Next, we'll see what happens when the HIV virus enters the body.

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**What HIV Does**

Once the HIV virus enters the body, it heads for the lymphoid tissues, where it finds T-helper cells. Let's look at how the HIV virus infects immune system cells and replicates:

1. **Binding** - The HIV attaches to the immune cell when the gp120 protein of the HIV virus binds with the CD4 protein of the T-helper cell. The viral core enters the T-helper cell and the virion's protein membrane fuses with the cell membrane.
2. **Reverse transcription** - The viral enzyme, reverse transcriptase, copies the virus's RNA into DNA.
3. **Integration** - The newly created DNA is carried into the cell's nucleus by the enzyme, **viral integrase**, and it binds with cell's DNA. HIV DNA is called a**provirus**.
4. **Transcription** - The viral DNA in the nucleus separates and creates **messenger RNA** (mRNA), using the cell's own enzymes. The mRNA contains the instructions for making new viral proteins.
5. **Translation** - The mRNA is carried back out of the nucleus by the cell's enzymes. The virus then uses the cell's natural protein-making mechanisms to make long chains of viral proteins and enzymes.
6. **Assembly** - RNA and viral enzymes gather at the edge of the cell. An enzyme, called **protease**, cuts the polypeptides into viral proteins.
7. **Budding** - New HIV virus particles pinch out from the cell membrane and break away with a piece of the cell membrane surrounding them. This is how enveloped viruses leave the cell. In this way, the host cell is not destroyed.

The newly replicated virions will infect other T-helper cells and cause the person's T-helper cell count to slowly dwindle. The lack of T-helper cells compromises the immune system. When a person's T-helper cell count drops below 200,000 cells per one milliliter of blood, he or she is considered to have AIDS. The development of AIDS takes about two to 15 years, but about half of all people with HIV will develop AIDS within 10 years after becoming infected, according to the CDC.

No one dies from AIDS or HIV specifically. Instead, an AIDS-infected person dies from infections, because his or her immune system has been dissipated. An AIDS patient could die from the common cold as easily as he or she could from [cancer](http://health.howstuffworks.com/diseases-conditions/cancer/facts/cancer.htm). The person's body cannot fight off the infection, and he or she eventually dies.

**HIV/AIDS HISTORY**

* **1926-46** - HIV possibly spreads from monkeys to humans. No one knows for sure.
* **1959** - A man dies in Congo in what many researchers say is the first proven AIDS death.
* **1981** - The Centers for Disease Control and Prevention (CDC) notices high rate of otherwise rare cancer
* **1982** - The term AIDS is used for the first time, and CDC defines it.
* **1983/84** - American and French scientists each claim discovery of the virus that will later be called HIV.
* **1985** - The FDA approves the first HIV antibody test for blood supplies.
* **1987** - AZT is the first anti-HIV drug approved by the FDA.
* **1991** - Basketball star Magic Johnson announces that he is HIV-positive.
* **1996** - FDA approves first protease inhibitors.
* **1999** - An estimated 650,000 to 900,000 Americans living with HIV/AIDS.
* **2002** - AIDS global death toll reaches nearly 28.1 million.

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* [Prevent Harmful Infections](http://health.howstuffworks.com/wellness/preventive-care/how-to-prevent-viral-infections.htm)
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**World Impact**

To understand the devastation of AIDS, you have to understand the high mortality rate of people who develop the disease. If you counted every person in the city of Chicago, which is about 3 million, you would get an idea of how many people died worldwide from AIDS each year for the past few years. Basically, that means that each year AIDS kills the same number of people that populate the third largest city in the United States.

Between 36.7 and 45.3 million people are infected with the HIV virus worldwide as of November 2005, with as many as 25.8 million of those cases in sub-Saharan Africa. Additionally, another 4.9 million new HIV infections occurred in 2005, which represents almost 14,000 new cases per day. The regions with the greatest number of people living HIV/AIDS, according to the **World Health Organization**, include:

* **Sub-Saharan Africa** - 25.8 million
* **South and Southeast Asia** - 7.4 million
* **Latin America** - 1.8 million
* **North America** - 1.2 million
* **Eastern Europe/Central Asia** - 1.6 million [[Avert](http://www.avert.org/worldstats.htm)]

AIDS is clearly one of the worst health crises facing the world today. Without any truly effective treatment, most health experts are putting an emphasis on prevention to stop the spread of HIV. To learn more about HIV and AIDS, check out the links in the next section.