

HIV and Helper T Cells

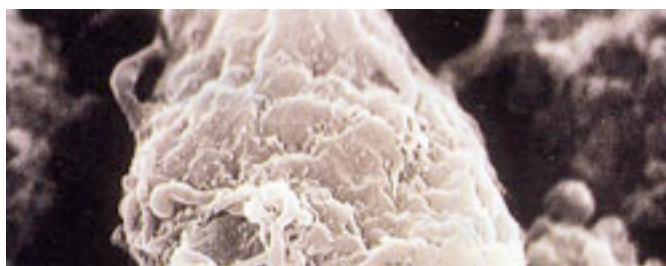
The virus that causes AIDS (Acquired Immunity Deficiency Syndrome), HIV, is a retrovirus—an RNA virus that carries with it the enzyme reverse transcriptase, which makes a cDNA copy of the viral chromosome and inserts the cDNA into the host genetic material. The virus attacks those cells that have specific receptors (called CD4 receptors) to which the virus can bind. Such receptors are found in abundance on **T4 lymphocytes** (one subclass of **helper T cells**), but are also located on certain cells in the digestive tract, brain, and skin. Once the virus enters the cell its genetic material is integrated into the host DNA and remains hidden, evading the body's immune defense. The viral DNA is replicated along with the host DNA whenever the cells divide. This latent period can last for weeks, months, or years until its virulent phase is triggered. From careful studies most researchers now conclude that the average time from infection until symptoms occur is eight years. During this period the individual is infected with the virus and is capable of transmitting it to others, but does not have any symptoms of the disease and, unless the person is tested, may not even know that he or she is infected.

The disease is so devastating because it severely compromises the ability of the immune system to defend the body against invading pathogens. The preferred host cells for the virus, the T4 helper cells, play a central role in coordinating the immune response. From the videotape you learned that it is the helper T-cells that activate the cytotoxic T cells, macrophages, and B cells, recruiting them to enter the battle against invading pathogens. They also produce a number of chemicals that stimulate the proliferation of other T cells.

Initially, the immune system responds normally to HIV, with B cells releasing suitable antibodies, helper T cells amplifying the response, and macrophages consuming free viruses. But the virus lives on in infected cells. When infected, the T4 helper cells simply cannot carry out their role—some of them die, and those that remain do not work very well. The population of helper T cells remains normal for about a year, but then begins to drop,

reaching, on average, about 25 percent of normal three years after infection. To make matters worse, the suppressor T cells inhibit the activity of what T4 cells there are. That is not the end of the misery for an AIDS patient, however. The macrophages are massively stimulated and produce large amounts of interleukin-1. IL-1 leads to symptoms of infection: high fever, loss of appetite, chills, sweating, fatigue, malaise; in short, AIDS victims feel wretched most of the time, and are incapable of doing much of anything. But the death of helper T4 cells or the disruption of their normal function is not the direct cause of AIDS fatalities; instead, victims succumb to subsequent, normally minor infections that rage unchecked, the immune system being unable to successfully mount a proper defense because the helper T cells responsible for activating the appropriate immune defenses are either missing or no longer effective.

Present estimates indicate that 1.5 to two million Americans may be infected with the virus. Recent surveys on college campuses in the United States have disclosed a disturbingly high incidence of HIV-infected college students. Nearly one in 300 college students is thought to be infected—an incidence that is nearly as high as that of prisoners (whose infection rate is one in 250)! It is fortunate that the virus is fragile and not easily contracted. AIDS is far less contagious than measles, polio, malaria, cholera, tuberculosis—all diseases that kill more people per year than AIDS. (Two million children die each year of measles alone.) There is no evidence that the virus can be spread by ordinary casual contact. How then to protect yourself from this terrible disease? The best protection is abstinence or to maintain a monogamous relationship with an uninfected individual. Condoms used in conjunction with spermicides offer some defense but they are about as effective in preventing HIV transfer as they are in preventing pregnancy, which means about 90 percent effective. Intravenous drug use with shared needles and unprotected (i.e., without a condom) anal intercourse should be avoided in all cases.





HIV viruses budding from a cultured lymphocyte.

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