HIV EXAMINER

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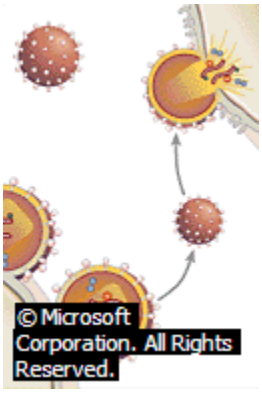
HUMAN IMMUNODEFICIENCY VIRUS

I Introduction



Life Cycle of Human Immunodeficiency Virus

The human immunodeficiency virus (HIV), the cause of acquired immunodeficiency syndrome (AIDS), is genetically programmed to do one thing: highjack the reproductive machinery of a human cell, then trick it into churning out as many copies of the virus as it can before the cell dies. The current best hope for the treatment of AIDS requires that patients take a number of different drugs, each of which interferes with certain steps of the HIV infection process.

Human Immunodeficiency Virus, infectious agent that causes acquired immunodeficiency syndrome (AIDS), a disease that leaves a person vulnerable to life-threatening infections. Scientists have identified two types of this virus. HIV-1 is the primary cause of AIDS worldwide. HIV-2 is found mostly in West Africa.

II STRUCTURE

HIV belongs to the retrovirus family of viruses, whose members share a unique method of replicating themselves when they infect living cells. Retroviruses store their genetic information in molecules of ribonucleic acid (RNA). However, unlike other RNA viruses, retroviruses use RNA as a template (master pattern) for forming deoxyribonucleic acid (DNA), the genetic material that puts viral replication instructions into effect. This process, called reverse transcription, is the exact opposite of the normal flow of genetic information in living things, in which DNA serves as the template for RNA formation (*see* Genetics).

HIV consists of a flexible outer membrane, called the envelope, that surrounds a protein case known as the capsid. The envelope is studded with glycoproteins, chemical receptors that enable the virus to lock onto target cells. Inside the capsid reside two identical strands of RNA. These RNA strands make up the virus's genetic program and store all the instructions needed to replicate HIV once it has infected a host cell. HIV also contains molecules of an enzyme called reverse transcriptase. When HIV infects a cell, reverse transcriptase copies the genetic instructions in the virus's RNA and uses the instructions to build complementary strands of DNA.

III HOW HIV CAUSES INFECTIONS

HIV transmission occurs when a person is exposed to body fluids infected with the virus, such as blood, semen, vaginal secretions, and breast milk. The primary modes of HIV transmission are (1) sexual relations with an infected person (*see* Sexually Transmitted Infections); (2) sharing hypodermic needles or accidental pricking by a needle contaminated with infected blood; and (3) transfer of the virus from an infected mother to her baby during pregnancy, childbirth, or through breast-feeding.

When HIV enters the body, it infects lymphocytes, which are a type of white blood cell in the immune system. HIV uses its glycoproteins to attach itself to receptors on the surface of a lymphocyte. The outer envelope of HIV then fuses with the lymphocyte, enabling the HIV capsid to enter the lymphocyte itself. HIV commandeers the genetic material of the lymphocyte, instructing the cell to replicate more viruses. The newly formed viruses break free from the host, destroying the cell in the process. The new viruses go on to infect and destroy other lymphocytes.

Over a period that may last from a few months to up to 15 years, HIV may destroy enough lymphocytes that the immune system becomes unable to function properly. An infected person develops multiple life-threatening illnesses from infections that normally do not cause illnesses in people with a healthy immune system. Some people who have HIV infection may not develop any of the clinical illnesses that define the full-blown disease of AIDS for ten years or more. Doctors prefer to use the term AIDS for cases where a person has reached the final, life-threatening stage of HIV infection.

IV TREATMENT

No treatment is available that cures AIDS, but a number of drugs have been developed that suppress HIV replication, thereby preventing the destruction of the immune system. Known as antiretroviral therapy, these drugs target different stages in the life cycle of HIV. There are four main classes of drugs used against HIV: nucleoside analogues, non-nucleoside reverse transcriptase inhibitors, protease inhibitors, and fusion inhibitors. Nucleoside analogues and non-nucleoside reverse transcriptase inhibitors use different mechanisms to block the action of the enzyme reverse transcriptase. Protease inhibitors interfere with protease, an enzyme vital to the formation of new HIV. When these drugs block protease, defective HIV forms that is unable to infect new cells. In 2003 the U.S. Food and Drug Administration approved the use of enfuvirtide, sold under the brand name Fuzeon. This drug belongs to a new class of drugs called fusion inhibitors, which prevent the binding or fusion of HIV to lymphocytes.

HTLV, or human T-cell leukemia virus, either of two viruses now known to cause certain forms of human blood-cell cancer (*see* Leukemia). HTLV-I and HTLV-II were first identified in the late 1970s. They cause cancer by attacking the cells known as T lymphocytes (*see* Immune System), causing the cells to proliferate uncontrollably and to invade various tissues. Both HTLVs are viruses of the retrovirus type, distinguished from other viruses because they code their genetic instructions in RNA instead of DNA molecules (*see* Nucleic Acids). Another retrovirus in 1983 and 1984 was linked with cases of acquired immunodeficiency syndrome, or AIDS, and was tentatively labeled HTLV-III by the U.S. research team that isolated the virus. The French research team that isolated an apparently identical virus, however, objected to this classification, and by common agreement the virus that causes AIDS is now known as the human immunodeficiency virus, or HIV.

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