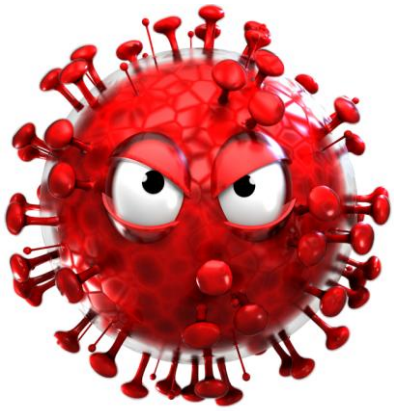
ISBN-10: 0-936571-13-6

" PULLS NO PUNCHES...AN EXCELLENT JOB "

– ***The New England Journal of Medicine***

Understanding and Preventing AIDS



HAC

A Book For Everyone

by Chris Jennings

"This book pulls no punches ... an excellent job in assembling an up-to-date, readable book for adolescents and members of the general public . . . ***Understanding and Preventing AIDS*** belongs in the school library."

- The New England Journal of Medicine

"Above all, it has the kind of practical information, laid out in a highly readable, straightforward, understandable terms, that is largely absent from every other book on AIDS."

- The Pioneer Valley Advocate

"Thank you so much for sending along the second edition of Understanding and Preventing AIDS. I know your book has been helpful in the past and I'm sure it will have continued success in the future."

- C. Everett Koop, MD, U.S. Surgeon General

"Thank you."

- Several AIDS Patients

Disclaimer

This book is intended for educational use only. Information regarding AIDS is subject to change. Any suggestions or information provided in this book should not be construed as medical advice nor do they offer any guarantee against contracting HIV infection.

ISBN-10: 0-936571-13-6
ISBN-13: 978-0-936571-13-3

eBook Version 1.1

Line Art by Sue Lee

Health Alert Communications
P.O. Box 65
Hudson, NH 03051
(617) 497-4190
www.healthalert.net

Table of Contents

List of Figures

Introduction

AIDS stands for "acquired immune deficiency syndrome." A "syndrome" is a group of clinical symptoms that make up a disease or an abnormal condition. ("Clinical" means seen in the doctor's office, not discovered by laboratory tests.) In a syndrome, not all symptoms have to appear in anyone patient. Syndromes may be caused by many different things, but in AIDS the syndrome is caused by a deficiency (defect) in the body's immune system. The immune system defends the body against disease.

The diseases of the AIDS syndrome are caused by germs we encounter every day. In fact, some of these germs permanently live, in small numbers, inside the human body. When the immune (defense) system weakens, these germs have the opportunity to multiply freely, so the diseases these germs cause are called "opportunistic diseases."

AIDS first claimed national attention in 1981 when five homosexual men in Los Angeles were simultaneously hospitalized due to *Pneumocystis carinii* pneumonia (PCP). At that time, PCP normally occurred in kidney transplant patients whose immune systems had been chemically suppressed (blocked). PCP was usually cured by antibiotic drugs. The PCP is these men, however, resisted drug therapy.

As more cases of mysterious immune-deficiency diseases came into being among more and more homosexual men, doctors guessed that it was an acquired disease; a disease that could be passed from one person to another. The mysterious disease was given its name, AIDS, before its cause was discovered.

Initially, doctors and scientists were baffled. Theories of what caused AIDS changed over time. First, some scientists thought some factor in homosexual lifestyle caused AIDS. Eventually, this line of thought led to the "immune-overload theory." In this theory, the immune system was thought to collapse from overwork (being exposed to too many diseases). Many of the first people to catch AIDS practiced a number of habits known to increase the likelihood of

catching diseases; namely, having sexual contact with large numbers of people, using large quantities of legal and illegal drugs, and having irregular sleeping and eating habits.

The immune-overload theory was rejected as scientists found evidence that AIDS was caused by an infectious agent (germ). First, doctors found that sexual partners of AIDS patients were coming down with AIDS. Second, it was discovered that intravenous (IV) drug abusers, who use medical needles to inject drugs into their bodies and often share these needles with other people, were also coming down with AIDS.

In retrospect, it is now known that AIDS was present in the U.S. population before 1981. Prior to 1981, several doctors, epidemiologists (scientists who study the spread of disease in populations), and members of the homosexual community had recognized the presence of a disease alternately called "the gay cancer," the "gay plague," or GRID (Gay-Related Immunodeficiency Disease).

Finally, in May 1983, Dr. Luc Montagnier of the Pasteur Institute in Paris obtained a virus from an AIDS patient that he believed was the cause of AIDS. Few other scientists believed Dr. Montagnier. Lacking the resource to continue studying the virus, Dr. Montagnier placed his samples on ice. Then, in May 1984, Dr. Robert Gallo at the National Cancer Institute (NCI) isolated a virus he believed to cause AIDS. Evidently, they were both right, and a legal battle ensued over the rights of discovery; resolved by both parties sharing equally. Eventually this virus was named the Human Immunodeficiency Virus (HIV). The acronym HIV is used throughout this book.

A Virus - The Invader

A virus is a tiny organism (any living thing is an organism). The average Human Immunodeficiency Virus (HIV), the virus deemed responsible for AIDS, is about 0.000031 inches (120 Angstroms) long. Several thousand of them could fit into the period at the end of this sentence.

Viruses are hard to find. An electron microscope, a large and expensive device, is required to "see" them. But before using a microscope, one must first know where to look. Chemical tests of body tissues usually reveal viral chemical activity and, thus, the site of viral infection.

Viruses are responsible for many diseases, such as the common cold, the flu, and some childhood illnesses such as mumps and chickenpox. Smallpox, yellow fever, and certain other deadly diseases are also caused by viruses. In some animals, viruses have been found to cause cancers, such as leukemia in cats. Some cancers in humans may also be caused by viruses.

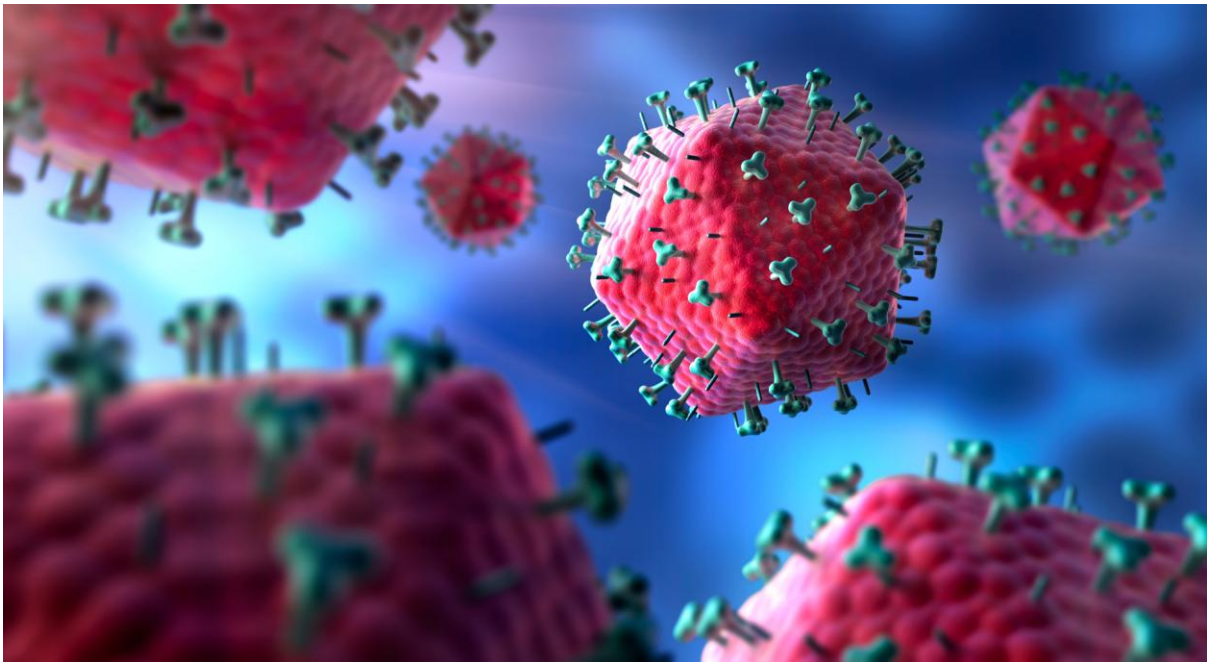


Figure 1 An artist's conception of free-floating HIV virions

Viruses are not cells. Cells are the structural units of most living things. Some organisms, like the amoeba, are one-celled organisms. Others, like humans, are multi-celled organisms.

Cells contain fluid and specialized structures. Cells reproduce by dividing in half — one cell divides to make two identical cells. Unlike cells, viruses contain no fluid nor do they perform any life processes, such as growth or reproduction, on their own. Instead, viruses infect (live in) the cells of other organisms. By some definitions of life, viruses are not really alive.

Viruses are parasites. A parasite is an organism that lives on or in another organism called the host. A parasite uses the host's chemicals and nutrients to live and reproduce. Being so small and able to use their hosts' nutrients, viruses survive as very simple physical structures. Usually, a virus consists of a strand or strands of DNA (deoxyribonucleic acid) or a strand or strands of RNA (ribonucleic acid), coated by a layer of protein. Most known viruses that infect humans have DNA cores. The Human Immunodeficiency Virus (HIV), however, has an RNA core.

In most living things - animals, plants, microorganisms, and most known viruses complete instructions for building and running the organism are contained in DNA. DNA is often called the "master molecule," or the "molecule of life." DNA is composed of four chemical building blocks, called *nucleotides,* which are like letters of the alphabet. Strung together into different combinations, they form a biological equivalent of words, sentences, and books.

Within human cells, DNA makes RNA. A chemical structure in human cells "reads" a string of DNA and "writes" a strand of RNA using a similar chemical alphabet. This process is called *transcription,* another word for "writing." After DNA transcribes (writes) the RNA, the DNA stays in the center of the cell while RNA travels around the cell, building and running the cell, and making other chemicals that do most of the work.

The nucleotide alphabet is basically the same in all living things. A virus uses its host's "alphabetical" chemicals to write copies of itself. To do this, the virus "hijacks" the host cell.

A typical DNA virus first latches onto the outside of a host cell; then it injects its DNA strand into the host cell, leaving its protein coat outside. The viral DNA travels to the center of the host cell and splices itself into the host's DNA strand or strands. The viral DNA takes over

cell operation. The hijacked cell begins to make replicas (copies) of the viral DNA and proteins for the coat of the virus. The hijacked cell becomes a virus-making factory. This whole process is called *viral replication*.

Within a limited number of known viruses RNA – not DNA – is the carrier of information. The Human Immunodeficiency Virus (HIV), deemed responsible for AIDS, is an RNA virus. In most RNA viruses, the viral RNA directly hijacks the host cell. However, HIV is different. Once injected into the host cell, HIV's RNA strand writes dual strands of viral DNA (the process opposite of human cells). This backwards writing is called "reverse transcription." These newly written DNA strands then go on to hijack the cell and oversee the production of new RNA replicas. Reverse-writing viruses, like HIV, are called *retroviruses*.

In HIV, an enzyme called *reverse-transcriptase* (RT) performs the reverse-transcription process. Enzymes are chemical workhorses. Human cells do not contain RT because they only write and have no need to reverse-write. Thus, reverse transcriptase is virus-specific and an important target for anti-viral drug therapy.

As a group, retroviruses can live in their hosts for a long period of time without causing any sign of illness. In most animals, retrovirus infections last for life. Retroviruses are not very tough: they die when exposed to heat, are killed by many common disinfectants, and usually do not survive well if the tissue or blood they are in dries up. However, retroviruses have high rates of mutation and, as a result, tend to evolve very quickly into new strains (varieties). HIV seems to share this and other traits with other known retroviruses.

Mutations and HIV

A mutation is a mistake, happening when some nucleotide word or phrase is misspelled. Either a letter or word is left out, or put in the wrong place, or an extra letter or word is added. A mutation is not an intentional act on the part of the organism. Mutants are rarely stronger organisms and many of them simply die.

Suppose this page contained an error in spelling (a “mutation”). What are the chances

that this error would: 1) improve the book, 2) make the book worse, or 3) make no difference? In most instances, a mistake makes the book worse. The same is true for organisms. However, a series of small, almost unnoticeable mistakes may lead to the development of a new strain.

Since a single virus may make hundreds of replicas, a few mistakes here and there make little difference in the replication effort. Even if many mutants die, replicas are cheap to make (because the host cell pays the price). If one or two of a thousand mutants receive better written instructions for survival in their immediate environment, then these organisms may be able to make replicas of themselves which become new strains of virus over time.

For a virus, diversity (having different strains) is an advantage. The new strains may be able to infect (live in) new cells within the host or to infect new host organisms. Many viruses either infect both animals and insects or both plants and insects. Diversity also protects the virus from being wiped out by a host's immune system. Out of several strains, it is possible that at least one strain will resist an attack by the immune system.

HIV Strains

In HIV, a nucleotide segment called the *env* gene mutates rapidly. Written in the *env* section are HIV's building instructions for its protein coat. HIV mutants, if they survive, are likely to have altered protein coats. Since the human immune system recognizes viral invaders by their protein coats, new mutants may be able to hide from the human immune system temporarily, gaining time to replicate and infect more host cells.

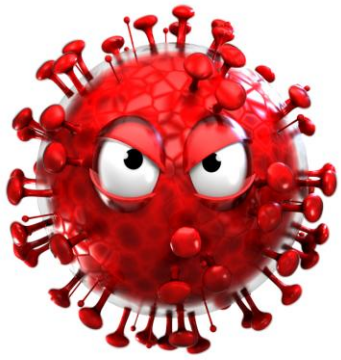
The border line between one strain of HIV and another is indistinct. However, from observation in the laboratory, scientists have demonstrated that different strains exist. For example, some strains replicate faster than others. Or, they replicate better in one or another type of human host cell than other strains. These demonstrably different growth rates may explain why some HIV-infected people rapidly grow sick and die while other HIV-infected people survive longer. (Or, a number of other factors may account for this difference in survivorship.) Still, a person who is already infected with HIV should safeguard against being re-infected by

other strains.

Two strains of HIV are commonly named HIV-l and HIV-2. HIV-1 is the virus first discovered in the U.S., Europe, and Africa. HIV-2 was discovered in West Africa several years later. HIV-2 evidently causes a disease that is called “AIDS-like” but is not as progressive or deadly.

Mistaken identities are common among viruses. For example, HIV was first thought to be a leukemia virus. Upon initial discovery, the American researchers labeled HIV the "human T-cell *leukemia* virus-III, type III" (HTLV-III). Historically, HTLV-I and HTLV-II were rather rare human leukemia viruses found in select African and Japanese populations. HTLV-III (now called HIV) was only the third know human retrovirus. After realizing that HTLV-III was not closely related to HTLV-I and HTVL-II, the scientists changed the *leukemia* in HTLV-III to lymphotropic. HTLV-III then stood for human T-cell *lymphotropic* virus-III, type III.” Lymphotropic means "attracted to lymphocytes."

During epidemics, the population of viruses greatly increases. As a result, the number of mutants produced increases and more new strains develop. These new strains are likely to cause more trouble in the future, either by being undetectable, or by finding new tissues or hosts to infect. The influenza (flu) virus, an RNA virus, is an example of a rapidly mutating virus which causes humans a lot of trouble. Each winter, new strains return to plague us.



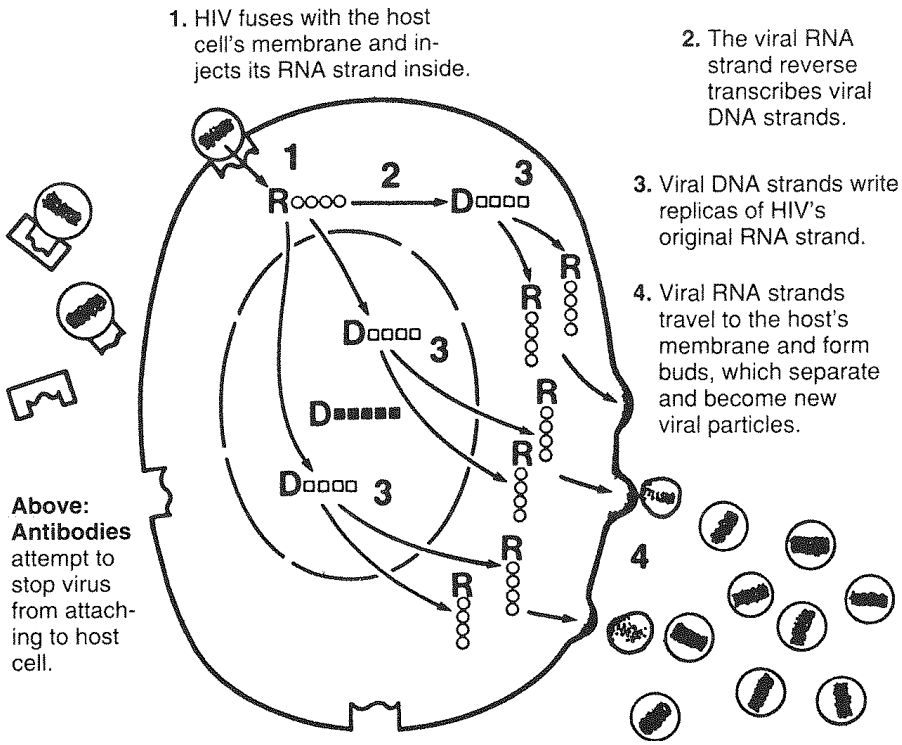
Humans - The Host

Our body's immune system is like a wall which protects us from armies of germs. This wall can be compared to a jigsaw puzzle; many parts fit together to form a solid surface. In the blood, the puzzle's pieces include white blood cells, antibodies, and a number of biologically active chemicals. If a piece is missing, germs rush in through the hole. This is the situation with AIDS.

The T-Cell

The Human Immunodeficiency Virus (HIV) likes to replicate (live) in the group of white blood cells called **lymphocytes** (**T-Cells**). (Lymphocytes are one of five major white blood cell groups.) Among the T-cells, HIV's favorite is the **T4-lymphocyte**, also called the **T4-cell**. You may also find it referred to as the **CD4 cell**. Figure 2 illustrates the life cycle of HIV in the T4-cell.

Figure 2 HIV Life Cycle in Host Cell



Caption: HIV latches onto host cell, injects its RNA inside. The viral RNA creates viral DNA, which hijacks the host cell, turning the host cell into a virus-making factory. The host cell's DNA is represented by solid black.

The T4-cell, also called the "helper/inducer" T-cell, performs a vital job in the immune system. The T4-cell finds germ invaders by circulating through the bloodstream and bumping into them. After recognizing the invading germ, the T4-cell releases a chemical alarm that triggers other parts of the immune system into action. The T-4 cell recognizes viral, fungal (fungus) and parasitic invaders, and triggers only those portions of the immune system that act against these specific invaders.

Once the T 4-cell triggers the alarm, other parts of the immune system come into play. For example, other T-cells, called "effector/killer" cells, release chemicals to kill the invader. Sometimes they succeed. The T4-cell's alarm also tells the **B-cells**, another kind of lymphocyte, to change their structure and to begin manufacturing antibodies. A third type of lymphocyte migrates towards the T4-cell's alarm and engulfs and digests germ invaders. These large, roving lymphocytes are called **macrophages**.

Antibodies

Antibodies are proteins which neutralize (stop) invaders. Antibodies prevent viruses from latching onto host cells. A virus and its antibody fit together like a lock and key. B-cells, another type of lymphocyte, make antibodies. New antibodies must be tailored for each new viral invader. Figure 2 shows how antibodies work.

Any substance or object that triggers the creation of antibodies is called an ***antigen***. The protein coats of viruses are ***antigenic***, meaning they prompt the production of antibodies. After the antibody and virus join together, they are eaten by macrophages.

Macrophages are large white blood cells that engulf and digest germs. The T4-cell's alarm also increases macrophage production.

Certain B-cells, called *memory cells*, remember the shape of the antibodies they have created. If, after being defeated, the same virus gets into the bloodstream again, these cells rapidly begin antibody production. Hopefully, these antibodies stop the invader before it gets a foothold. However, if the virus has changed (mutated), as the flu does in its yearly journey

around the world, the old antibodies cannot stop it. New antibodies must be manufactured to neutralize the mutated virus. While this antibody production is taking place, the viral invader has time to multiply, and the infected person suffers the symptoms of infection.

T-cell Function and HIV

HIV's infection of the T4-cell creates a defect in the body's immune system which eventually causes AIDS.

Once HIV hijacks a T4-cell, the lymphocyte stops functioning normally, although this change is not immediately apparent. Evidently, very little or no viral replication takes place for an indefinite amount of time. HIV's takeover is a quiet event.

When the T4-cell does become active, rather than functioning normally, the T-cell manufactures viral replicas of HIV. An infected T4-cell no longer detects invaders and triggers alarms. Eventually, the infected T4-cells begin to die, gradually decreasing the T4-cell alarm network and allowing opportunistic disease to enter and grow within the body. (Other unknown co-factors may contribute to T4-cell failure and death.)

T4-cells trigger immune system alarms when they encounter fungi, viruses, and parasites. The opportunistic diseases associated with HIV infection are caused by fungi, viruses and parasites, many of which we encounter daily. Some of these organisms live permanently in our bodies, although they are usually held in check by the immune system.

HIV does not attack the anti-viral system on purpose. Viruses have no brains; they can't make decisions. A virus inhabits any host cell that it can successfully infect and replicates within any suitable host organism it encounters.

Antibodies VS. AIDS

B-cells make antibodies in response to the T4-cell's alarm, but mounting the response takes time. The viral infection often runs ahead of the immune system's response for a while, and then the immune system gradually catches up.

This situation is exemplified by influenza (the flu). A person becomes infected and

develops flu symptoms before the body can make antibodies to kill the virus. With the flu, however, the body usually is able to destroy the virus within matter of days.

The situation is different with HIV infection. First, anti-HIV antibodies may not develop for weeks or months after the initial infection. HIV's initial infection may be so slow, or so "quiet," that the body doesn't notice anything wrong for a while.

Also, when the body does notice the infection and produces antibodies against HIV, the antibodies don't seem to work; infected people, rather than getting better, usually continue to sicken.

In several experiments wherein HIV has been isolated from blood, large numbers of anti-HIV antibodies were also present in the blood. This situation indicates that, even though the anti-HIV antibody is present, it has difficulty latching onto the virus and, therefore, provides little protection inside the human body. The surface proteins of HIV are coated a frosting of sugar molecules, which may help HIV cloak its viral proteins from the immune system.

Antibodies cannot enter blood cells. An antibody can only attack viruses in the plasma. Plasma is the fluid part of the blood (blood is composed of fluid, red and white blood cells, antibodies, etc.) Once inside a host cell, HIV has nothing to fear from antibodies. Cells can generate anti-viral chemicals within themselves, but these chemicals seem ineffective against HIV.

Once a virus gets a foothold within a host cell, it is likely to remain there for the rest of the host's life, unless some other anti-viral mechanism within the body or some artificial chemical is able to destroy the virus or the infected cell. HIV-infected cells seem to slip by a number of other immune system safeguards, such as the "natural killer" cells which normally destroy cells infected by viruses.

Other Sites of Infection

The Human Immunodeficiency Virus (HIV) successfully infects and replicates in a number of cells in the human body besides the T4-cell.

Other lymphocytes, such as the T8-cell, are vulnerable to infection. T8-cells help the immune system recognize (and not attack) cells of its own body. Some T8-cells die during HIV infection, and as a result, some AIDS patients have an auto-immune response, meaning that parts of the immune system attack their own body.

HIV also infects macrophages, but it does not kill them. Consequently, the macrophage is like a *Trojan horse* which hides the invader and carries it to protected places, including the brain — where HIV-infected macrophages presumably disrupt the function of brain cells — and the bone marrow, the site of T-cell and B-cell generation.

HIV may also infect the cells of the retina, a part of the eye. HIV also seems to infect (at least in the laboratory) cells of the rectum and colon. The colon is basically the large intestine. The rectum is the lowest part of the large intestine situated directly inside the anus. The ability of HIV to infect colon and rectal cells means HIV may help explain the effectiveness of HIV transmission via anal intercourse relative to other sexual methods of HIV transmission.

HIV also seems to infect lung tissue, but only in children. In adults, HIV seems able to marginally infect the interstitial cells of the lungs, that is, the connective tissue that connects the lungs to the surrounding tissues. Interstitial tissue is not part of the air passageways — HIV remains sealed in the body. Thus, little or no HIV is present in sputum, and little or no HIV is expelled by coughing.

Types of HIV Infections (AIDS)

For the first few years of the AIDS epidemic, it appeared that some HIV-infected people sickened and died quickly while the others stayed healthy indefinitely or slowly progressed into sickness. Now it appears the greater majority of HIV-infected will gradually become very sick and eventually die in absence of drug treatments against HIV infection and/or its consequent opportunistic infections. There are reports of long-term survivors of HIV infection in absence of medical treatment; but, they seem to be the exception rather than the rule.

HIV is a retrovirus and, as a group, retroviruses can live in their hosts for a long period of time without causing any sign of illness. This time period of "silent infection" is known as the incubation period (just as a hen incubates an egg by sitting on it) or the *latency period*. When referring to AIDS, the term *incubation period* means the time from initial infection until the development of "full-blown AIDS," discussed below. There is a misconception that the average incubation time of HIV infection is 10 years. Early in the epidemic, the Centers for Disease Control and Prevention (CDC), a branch of the U.S. Public Health Service, tracked and interviewed a number of the initial patients that came down with AIDS. Based on this interview data, the CDC initially estimated the incubation period of HIV infection to range from 8 to 24 months in adults. The average incubation of HIV infection in a large population of patients over a long period of time has never been established because the epidemic soon grew beyond the CDC's ability track and investigate individual patients. In the early days of the HIV/AIDS epidemic, before effective drug treatments against HIV infection were available, 50% of AIDS patients died within 1 year of developing opportunistic infections.

In the days before effective drug treatments, the incubation period in infants born with HIV-infection was typically several months and infants typically survived less than one year after birth. As the epidemic progressed over time, patients with longer incubation periods came forward. The incubation of people who received blood transfusions might have ranged up to

7 years.

These aforementioned incubation and survival periods represent disease progression and death rates before effective drugs were available for HIV infection and its consequent opportunistic infections. Today, anti-retroviral drugs taken by patients prior to the development of opportunistic infections extend both incubation and survival substantially.

Most symptoms and diseases common to HIV infection are listed in Figure 4, Figure 5, and Figure 6. The presence of these symptoms and diseases varies from one patient to another. These diseases may occur in sequence or simultaneously.

Obviously, many of these symptoms can be caused by a number of common illnesses. These diseases are listed here for the sake of education, not for the purpose of self-diagnosis. In case of any persistent illness, consult your health care provider.

The popular classification system of HIV infections, used here, is a collection of haphazard definitions that evolved as the AIDS epidemic unfolded. These labels are ones of convenience, not ones of scientific or medical accuracy. Medical authorities use different, more complex, classification systems.

Basically, four loosely defined different stages of HIV infection exist: 1) the healthy carrier state, 2) the lymphadenopathy syndrome (LAS), 3) AIDS-related complex (ARC), and 4) AIDS or "frank AIDS," or "full-blown AIDS." These forms or the symptoms of each may overlap the other.

Healthy Carrier State (The Latency Period)

A carrier is someone who is infected with a disease and shows no clinical symptoms, but who is capable of infecting other people with the disease. ("Clinical" means "seen in the doctor's office.") Historically, a healthy carrier was a person who carried the disease pathogen (germ) without getting sick but was capable of infection other people. This is not the circumstance with HIV infection; most people with HIV infection eventually get sick in absence of drug treatment. In the circumstance of HIV/AIDS, this time period may be referred to as the **latency period**.

HIV has been isolated (removed) and cultured ("grown" in a laboratory dish) from healthy people who show no clinical signs of HIV infection.

It is not clear when an HIV-infected person becomes infectious. It is now recognized that some people infected with HIV have a “flu-like” reaction one or two weeks after initial infection (typically not recognized as HIV infection at the time). Since these patients have flu-like reactions, it seems likely they have *viremia* (the presence of viruses in the bloodstream) and, consequently, may be infectious. Thus, in theory, some people may be able to transmit HIV within one or two weeks of infection. At this time, the only safe practice is to assume that anyone carrying the virus is capable of transmitting it to others.

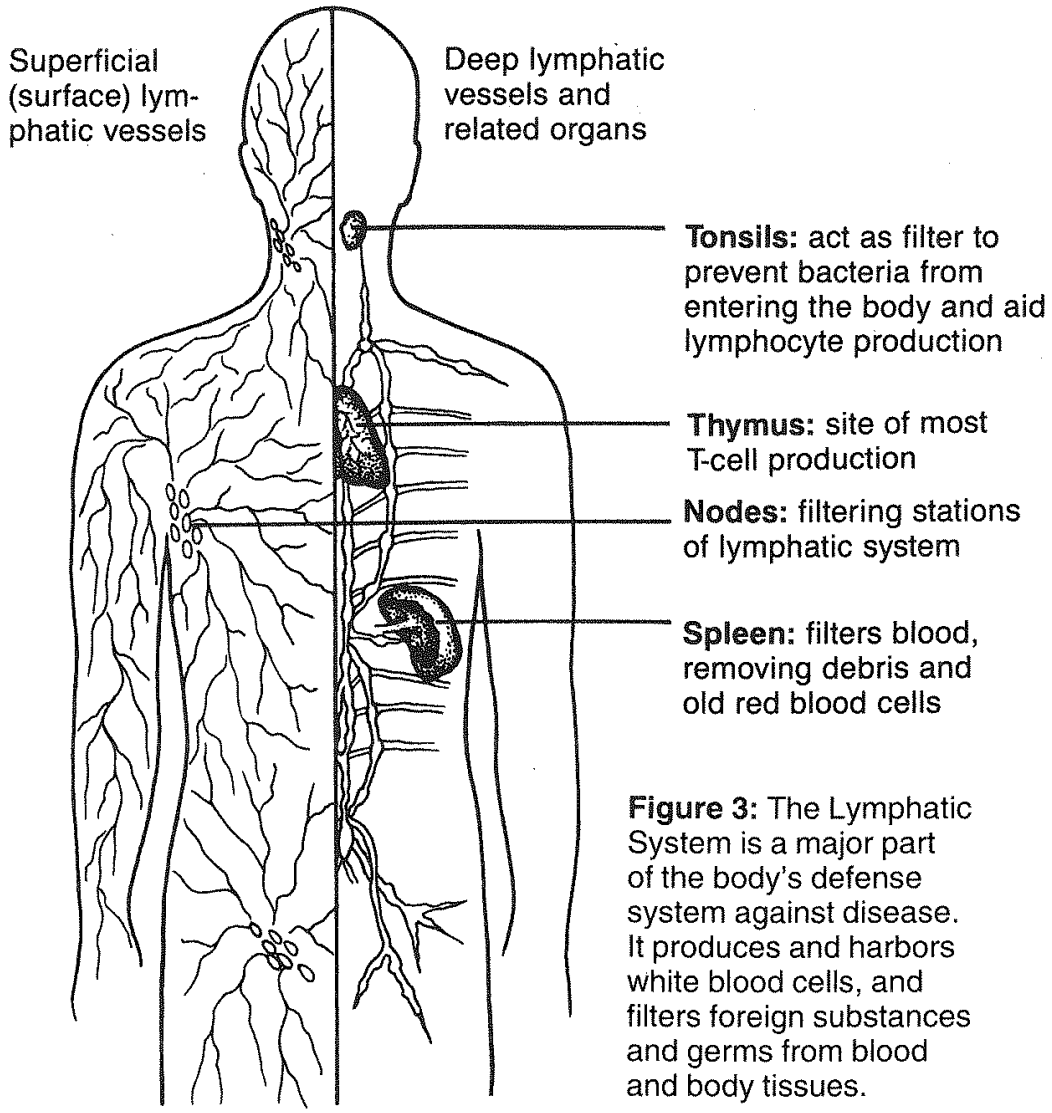
Lymphadenopathy Syndrome (LAS)

Lymphadenopathy Syndrome (LAS) is a mild form of HIV infection, generally characterized by some of the symptoms in Figure 4.

Lymphadenopathy means "disease of the lymphatic system." The lymphatic system is the human body's second fluid system which contains a clear fluid called *lymph* (see Figure 3). The lymphatic system aids the blood system by draining fluid out of the body's tissues. The lymphatic system is not a closed loop like the bloodstream, meaning it does not flow in a circle, and it has no pump like the heart. Nevertheless, lymph flows from smaller vessels into larger lymph ducts in the upper chest. In doing so, lymphatic fluid passes through a series of filtering stations called lymph nodes, or lymph glands. Lymph nodes filter bacteria (one-celled organisms), foreign substances, and dead white blood cells out of the lymph.

The lymphatic system is a vital part of the body's immune system. Lymph nodes store and mature lymphocytes and other white blood cells and also serve as sites of antibody production. T-cells and macrophages can migrate back and forth between the blood system and the lymphatic system, perhaps exposing newly generating T-cells to HIV during their formative stages.

Figure 3 The Lymphatic System



Caption: The Lymphatic System is a major part of the body's defense system against disease. It produces and harbors white blood cells, and filters foreign substances and germs from blood and body tissues.

One of the key signs of lymphadenopathy is swollen lymph glands. Of course, any infection, such as the flu, causes the lymph nodes to swell; but, nodal swelling due to normal infections passes quickly. With HIV infection, this nodal swelling may persist for months, with no other signs of a temporary infectious disease. Consequently, lymphadenopathy is sometimes called persistent generalized lymphadenopathy (PGL).

AIDS-Related Complex (ARC)

AIDS-Related Complex is a more advanced level of HIV infection. Symptoms generally include the symptoms of lymphadenopathy, plus abnormal body conditions revealed by laboratory tests, and/or the presence of one or more opportunistic infections.

A person with ARC has a discomforting illness. His or her everyday activity may be restricted and he or she is probably manifesting bouts of illness that require short-term or long-term medical treatment in and out of the hospital.

Figure 4 Symptoms of Lymphadenopathy Syndrome (LAS)

- Unexplained fever
- Swollen glands
- Night sweats and chills
- Gradual loss of weight
- Sore throat
- Difficulty in swallowing
- Fatigue/Lethargy
- Apathy
- Diarrhea
- Impotence

Figure 5 Symptoms and Conditions of ARC and AIDS

Anergy: lack of skin allergic response Anemia: lack of red blood cells

Autoimmune Disorders: immune system attacks own body

Candidiasis/Oral Thrush: (see Figure 6)

Hyperplasia: excessive growth of normal cells in organ

Kidney Dysfunction: kidneys fail or function poorly

Leukopenia: decreased number of leukocytes (white blood cells that engulf germs)

Lymphomas: lymphatic system cancers

Lymphopenia: decreased number of lymphocytes

Nerve Damage: possible blindness, deafness, paralysis

Oral Thrush: caused by Epstein-Barr Virus (Figure 6)

Wasting: severe weight loss, perhaps death, from diarrhea and malnutrition

Acquired Immune Deficiency Syndrome (AIDS)

AIDS is the "full-blown" syndrome, also called "frank" AIDS. In medical classification systems, AIDS is technically the final, terminal (progressing to death) state of HIV infection. Patients suffering from AIDS often have any number of the opportunistic diseases listed in Figure 6. Other opportunistic infections may also be present. These diseases are either viral, fungal, or protozoal in nature. These diseases develop because of the widespread failure of the immune system. Other infections and medical conditions unrelated to HIV infection may co-exist in any patient.

Drug treatments are available for many opportunistic infections; but, without the support of the immune system, the drugs fail to cure the disease fully or are unable to keep the disease from returning. These opportunistic infections, curable under other circumstances, cause the death of most AIDS patients *in absence of effective drug treatment*. Currently, a regimen of multiple anti-retroviral drugs is utilized to slow the progression of HIV infection; thereby, preserving the patient's T4-cell population, and staving off the development of opportunistic infections. The cost of this drug-enabled survival is a regimen of anti-retroviral drugs that require strict discipline in adherence to the drug regimen using drugs that tend to have rather unpleasant side effects. The anti-retroviral drugs do not kill HIV. Rather, they slow or block viral replication (making viral copies). If the drug treatment is ever stopped, it is likely that HIV will begin replicating again. While there have been several news reports of individual cures and long-term survivors, these cases are news because they are so rare. There is no outright, reliable cure for HIV infection.

Figure 6 Diseases Common to AIDS
***Pneumocystis carinii* pneumonia (PCP).** Caused by fungus-like single- celled parasite, *Pneumocystis carinii*, common world-wide. Infects lungs. Previous to AIDS, found in kidney transplant patients whose immune system had been chemically suppressed. Occurs in 60% to 80% of AIDS patients. Initially responsible for 30% to 50% of deaths among AIDS patients, now brought under better control due to chemical prophylaxis, that is, chemically treating the patient before symptoms occur.
Kaposi's sarcoma (KS). Malignant skin cancer. Appear first as pink, purple or brown lesions (wounds), usually on arms and/or legs; then spreading around body. In AIDS patients, may spread to gastrointestinal tract, lungs, other internal organs. Initially occurred in 46% of homo-sexual AIDS patients, in only 3.8% of heterosexual IV drug abuser AIDS patients. Onset is statistically associated, in homosexual males, with oral-anal sex and fecal (feces) contact-possible infectious agent involved.
Toxoplasmosis. Caused by *Toxoplasmosa gondii*. Infects blood and many tissues. Common to humans, many domestic and wild animals. Humans may catch from droppings of cats and undercooked meat, especially mutton. In AIDS patients, tendency to infect tissues of central nervous system (brain and nerves). Also causes pneumonia and hepatitis inflammation/dysfunction of the liver). Many minor, non-life-threatening outbreaks occur in day-care centers. In AIDS patients, can be a major cause of mortality.
Candidiasis. Caused by species of *Candida*, a fungus common to skin, mouth, vagina, gastrointestinal tract of humans. In AIDS patients, usually takes oral form: white spots or patches on lateral sides of tongue, perhaps inside mouth on mucous membranes of cheeks; commonly lodges under nail beds and skin around armpits, groin, and rectum. Sometimes affects lungs. Frequently, first clinical (as seen in doctor's office) sign of HIV infection.
Cryptococcosis. Caused by *Cryptococcus neoformans*, a fungus found in pigeon manure. Common among humans and other mammals, especially cats. Causes pneumonia in rare instances, most often causes meningitis (inflammation of the spinal cord and brain membranes). Also causes endocarditis (inflammation of lining of heart); and skin ulcers. Some increasing success with drug therapy.
Herpes infections. Caused by herpes simplex viruses 1 (cold sores on lips) and 2 (sores on genitals). In HIV-infected patients, herpes simplex infections form chronic ulcers, often affecting face and sometimes the eyes; anal area often affected in homosexual males. Herpes infections are commonly found in people who are not infected with HIV; forming a c1uster(s) of small, painful blisters, often, but not necessarily, on face.
Herpes zoster infection. Caused by another herpes virus. Also known as shingles or chickenpox. Herpes zoster viruses may remain latent (inactive) for years (perhaps left over from childhood), but may be reactivated by HIV infection, causing inflammation of the spinal and cranial ganglia (nerve roots). In AIDS patients, can be disseminated (widespread) throughout the body. Often an initial clinical symptom in HIV-infected individuals. Herpes zoster is common among people not infected with HIV.

Figure 6 Diseases Common to HIV/AIDS (*continued)*
Mycobacterium infection. Caused by *Mycobacterium avium-intracellulare*, a bacterium commonly found in human saliva. Causes type of tuberculosis in humans, producing lesions in lungs. Disseminated, it causes problems in the intestines, blood, liver, and spleen.
Epstein-Barr infection. Caused by the Epstein-Barr virus (EBV), suspected cause of mononucleosis and some lymphomas (cancers of the lymph tissue). Implicated in number of auto-immune conditions (body's immune system attacking itself, as sometimes occurs in advanced HIV infection.) Thought to disrupt T-cell function. In HIV-infected, causes oral hairy leukoplakia, fuzzy white spots on the tongue which do not rub off as does "hairy tongue" caused by smoking. Possibly remains dormant until HIV infection occurs.
Cytomegalovirus (CMV) infection. Normally present in salivary glands of humans. Often widely scattered throughout the body in patients with advanced HIV infection. Causes problems in eyes, colon, lungs, liver, and adrenal glands. Suspected in promoting appearance of Kaposi's sarcoma. After PCP prophylaxis became effective, CMV infection became the major cause of mortality among AIDS patients. Cytomegalovirus is frequently spread in day-care centers, where it has been shown to survive on toys and Plexiglas for 30 minutes.
Cryptosporidiosis. An enteritis (inflammation/swelling of intestines) caused by *Cryptosporidia muris* and/or *Cryptosporidia difficile;* a one-celled parasite common to domestic and wild animals. Many minor, non-life-threatening outbreaks occur in day-care centers. In AIDS patients, may be major cause of mortality.
Tuberculosis (TB). Caused by *Mycobacterium tuberculosis*, a bacterium and a non-opportunistic infection found in non-HIV-infected people. Infects lungs, disseminated in some AIDS patients. A major killer in the past, social hygiene education and effective medical treatment eliminated TB from most of the Western world, except among populations lacking adequate access to medical care. Statistically associated with AIDS (found in some AIDS patients), it may reflect socio-economic status rather than being an opportunistic infection due to AIDS. Infection may occur prior to HIV infection as a damaged immune system is not required to catch TB.

Catching AIDS

In 1979, when the Human Immunodeficiency Virus (HIV) was rare, in order to become infected, a large number of sexual contacts was generally required. HIV is no longer rare in the U.S. population. According to current scientific guesstimates, 1.2 million U.S. citizens are currently infected with the HIV virus. If this figure is correct, then one out of approximately every 250 people in the United States is infected.

AIDS is not evenly distributed throughout the United States. Pockets of high concentration exist among specific sub-populations and in certain geographical locations. Thus, again assuming that the 1.2 million guesstimate is correct, some areas of the United States many have only one infected individual out of thousands, while other areas may have one infected individual out of dozens.

Unfortunately, up to now, most estimates of the number of HIV-infected people have been overblown. As early as 1983, some scientists, and consequently the media, trumpeted estimates of 1 to 3 million. At the time, these estimates were exaggerated. Now, however, the AIDS epidemic is 30 years old, and scientists have tabulated over 1.1 million total registered AIDS cases. This figure of 1.1 million AIDS cases includes 617,000 AIDS patients who died. Consequently, the current estimate of 1.2 million people living with AIDS carries more weight.

The Mechanics of Transmission

In order for a person to catch AIDS (HIV infection), the Human Immunodeficiency Virus (HIV) must travel from the inside of one person to the inside of another person, arriving with its RNA strand(s) intact. Then the virus or its intact RNA strand must get into the new host's bloodstream and then successfully find and enter a T-cell. Once inside a host cell, HIV can prepare for replication. After replication, replica viruses infect other host cells, probably attaching to new host cells when the infected host cell collides with other cells in the bloodstream.

Generally, more than one virus enters the body at one time. Most likely, a person encounters dozens, hundreds, or thousands of viruses (or virus-infected cells) during exposure. The more viruses present, the better the chance of one or more viruses succeeding in finding a host cell and replicating.

Viruses are not able to enter the body through intact skin. Therefore viruses must enter the body through an open wound(s) or one of a number of possible body openings. Most of these body openings contain mucous membranes. Mucous membranes are thin tissues which protect many openings and passages in the human body. These membranes secrete mucus which contains anti-germ chemicals and keeps the surrounding tissues moist. There are mucous membranes in the mouth, inside the eyelids, in the nose and air passages leading to the lungs, in the stomach, along the digestive tract, in the vagina, in the anus, and inside the "eye" of the penis. Many viruses, if placed on the surface of a mucous membrane, can travel through the membrane and enter the tiny blood vessels inside.

The mucous membranes of the eyes and mouth are often doorways into our bodies for highly infectious viruses such as the flu. You can catch the flu from a person in the following manner: the person coughs in his or her hand, you shake hands soon afterward, and then your hand carries the virus to your eye or mouth.

The flu is highly infectious because the flu virus lives in the lungs, throat, and sinuses. Therefore, a high concentration of flu viruses is present in the sputum of an infected person. (*Sputum* is the substance expelled by coughing or by clearing the throat. *Concentration* is the number of viruses per unit of volume.) Coughing forces many viruses out of the lungs and into the air or onto the sick person's hand or handkerchief. The flu virus easily crosses the mucous membrane.

The danger with AIDS is very different. With AIDS, the major infection sites are the bloodstream and the central nervous system. While HIV-carrying macrophages (roving white blood cells that engulf invaders, but are susceptible to HIV infection) are found in the connective

tissues of the lung and in oral mucous membranes, the number of viruses present in these sites does not seem great. Thus, HIV is present in low concentrations, if at all, in saliva and sputum. So coughing should not expel a large quantity of HIV, if any. Apparently, HIV can cross the mucous membrane, but not as readily as the flu virus, and large concentrations of HIV are probably necessary.

Where the Virus is Found in Humans

In an infected person, HIV is found in any body fluid or substance which contains lymphocytes (T4-cell and company). Substances containing lymphocytes include: blood, semen, vaginal and cervical secretions, mother's milk, saliva, tears, urine, and feces.

The presence of HIV within a substance does not necessarily mean the substance is capable of transmitting HIV infection. All of these substances are capable, in theory, of transmitting disease; but in reality, the most dangerous substances seem to be blood, semen, and cervical and vaginal secretions, and perhaps feces. Despite a lot of looking, no one has been able to find a clear cut case of saliva causing transmission, although kissing theoretically could. See *Kissing* in the Possible Methods of Transmitting HIV.

The concentration of HIV in these substances is very important when it comes to infectivity. (Concentration is *the number of viruses per unit of volume*.) If a substance contains a high concentration, that is, a lot of viruses, then it is more likely HIV can be transmitted by the substance. Below a certain concentration of viruses, the substance can not effectively transmit HIV infection.

The importance of concentration is illustrated by the situation with sperm and pregnancy. If a male's semen contains fewer than 20 million sperm cells per milliliter (cubic centimeter), than it is unlikely that the male will be able to impregnate a female. Similarly, if the concentration of a virus is too low in sputum or any other substance, then it is unlikely to transmit infection.

Blood. Blood contains a high concentration of HIV in an infected person. HIV has been

obtained from the blood of "full-blown" AIDS patients, ARC patients, and healthy HIV-infected individuals. Blood is a highly contagious substance.

Semen. Semen is the fluid discharged from a male's penis during sexual excitation (orgasm). The squirting of this fluid is called ejaculation. Semen is composed primarily of fluid and sperm cells (spermatozoa), but also contains a relatively high concentration of lymphocytes (T-cells). There appears to be high concentration of HIV in the semen of HIV-infected men. Semen is an infectious substance; it can transmit HIV infection.

HIV is also present in pre-ejaculate fluid. Pre-ejaculate fluid oozes from the tip of the penis after prolonged sexual excitation, but before ejaculation. Therefore, pre-ejaculate fluid should be considered potentially infectious.

Vaginal and Cervical Secretions. HIV is found in the vaginal and cervical secretions of females. Vaginal refers to the vagina. Cervical refers to the cervix. The cervix is located deep within the vagina and is the doorway to the uterus (womb).

The concentration of HIV in these substances seems to be not as high as the concentration of HIV in semen and blood, but, these substances are infectious and can transmit HIV infection.

Urine and Feces. Urine is the body's fluid waste. Feces are the body's solid waste. HIV is present in urine. Feces seems to contain HIV, and statistical studies conducted among homosexual males suggests that exposure to feces can transmit HIV.

Mother's Milk. HIV is present in mother's milk. In at least one case, it is suspected that a baby contracted AIDS from its mother this way.

Saliva. Though HIV is sometimes present in saliva, it apparently exists at very low concentrations. HIV can be in saliva because saliva contains T-cells and macrophages, which rove around the surfaces of the mouth's mucous membrane. The concentration of HIV in saliva seems to be very low compared to blood and semen.

In theory, saliva can transmit HIV infection but, so far, it doesn't seem to have happened

in real life. Kissing is discussed in more detail in Possible Methods of Transmitting HIV.

Tears. HIV can be obtained from tears, but the concentration seems very small. Also, HIV does not seem to appear consistently in tears. Tears are not likely to transmit HIV infection.

HIV Survival Outside the Host

If HIV is contained in any of the aforementioned substances (blood, semen, vaginal and cervical secretions, urine, feces, mother's milk, saliva, tears), the HIV in these substances is capable of remaining infectious until these substances dry up. Therefore, depending on circumstances, HIV might survive for a matter of minutes or hours. If any of these substances stay moist, viruses contained in them can survive much longer. For example, in saline and blood solutions (10% blood, 90% saline), HIV can survive at room temperature for 2 weeks. (Saline is sterile water containing salts balanced with those of the human blood.) In refrigerated blood, such as blood used for transfusions, HIV can survive indefinitely.

See the instructions on how to handle these substances in the Preventing HIV Infection.

Possible Methods of Transmitting HIV

Most known cases of HIV infection have been transmitted through sexual contact, transfusions of blood and blood products, sharing contaminated intravenous (IV) needles, and passage of the virus from mother to unborn child.

Being exposed to a virus does not mean that a person is going to catch the virus. Exposure does not necessarily mean transmission. For example, when a person with the flu sneezes in the face of another person, the sneeze recipient mayor may not contract the flu. Any number of factors contribute to this situation.

Proven or suspected methods of HIV transmission are discussed here. Prevention methods are discussed in the Preventing HIV Infection.

Anal Intercourse. Anal intercourse seems to be the most effective sexual method of sexually transmitting HIV infection. This statement is true whether the sexual partners are heterosexual ("straight") or homosexual ("gay").

Anal intercourse involves inserting one person's penis into the anus of another person. From the body's viewpoint, anal intercourse is not a great idea. The anus is biologically designed for the excretion of feces. Evidently, medical disorders can arise from frequent and/or rough anal intercourse.

During anal intercourse, the receptive partner is the partner at greatest risk of catching HIV. The receptive partner is the person whose anus is being penetrated. This high risk for receptive partner exists whether the receptive partner is male or female.

Previously, it was thought that anal intercourse transmitted HIV infection because, during anal intercourse, the penis opened bleeding wounds inside the receptive partner's anus. These bleeding wounds were thought to be the doorway by which HIV directly entered the bloodstream to infect T4-cells.

However, it appears that the presence of bleeding wounds in the anus is not necessary for HIV transmission to take place. Macrophages are present, roving over the surfaces of the anus. HIV may infect these macrophages directly. Also, HIV is probably able to cross the mucous membrane and enter the tiny blood vessels inside. No damage to the wall of the anus may be necessary for HIV transmission to take place. According to a statistical study, rectal douching after anal intercourse increases the risk of HIV infection.

"Fisting" is the insertion of the fingers, or the entire hand into the anus. It might be considered a form of anal intercourse. According to a statistical study, fisting carries a slight risk for the insertive partner. There is little risk for the receptive partner. The risk to the insertive partner probably comes from contact with feces or with blood from the anus. People's hands often have small, invisible wounds around the cuticles of the fingernails; these may provide doorways into the body for the virus. Or, there could be an anus-to-hand-to-mouth transmission of the virus. This increased risk for the insertive partner could be a statistical quirk.

Vaginal Intercourse. In vaginal intercourse, a male's penis is inserted into a female's vagina. HIV can be passed from males to females and from females to males during vaginal

intercourse. Vaginal intercourse does not seem to be as effective a method of transmitting HIV as anal intercourse, but have no doubt, it can and does happen.

Apparently, HIV transmission from males to females occurs more effectively than from females to males. This greater risk seems to be true for most sexually transmitted diseases: the female is at greater risk. ("Receptive partner" can be substituted for "female" in case of homosexual sex). The exposure of a male's penis to the female (or receptive partner) is relatively short, but the male deposits potentially contaminated semen into the vagina. Usually the semen remains in the female (or receptive partner) long after intercourse is over. The longer a person is exposed to germs, the more likely he or she is to catch the disease.

Male to female: If the male is infected, he deposits HIV-infected semen inside the female's vagina. Again, previously it was thought that inside a female's vagina, small wounds and bleeding may occur during sex or for a number of reasons, providing a doorway for HIV into the bloodstream. Bleeding wounds inside the vagina are probably not necessary.

Certain conditions may make a woman's vagina more susceptible to infection. For example, cervicitis (inflammation of the cervix) is a common condition in females, which makes the surface of the cervix and the vagina more likely to bleed. Cervicitis may be caused by IUD contraceptives devices and by sexually transmitted diseases such as gonorrhea, syphilis, and *Chlamydia* infection.

Females probably do not have an increased risk for catching HIV during menstruation. Menstrual bleeding is actually the shedding of the tissues of the uterus (womb). Menstrual blood flows from the uterus, through the cervix, and into the vagina. There is no vaginal wound for entry by HIV.

Again, it should be noted, that the current consensus is that wounds may not be necessary, since HIV may directly infect macrophages, which rove the mucous membrane surfaces. Also, HIV may be able to directly cross the mucous membrane and enter the blood vessels therein.

The vaginal secretions contain anti-germ chemicals. The vagina, being designed to accept foreign objects, has substantial immune defenses. This may help explain why vaginal intercourse apparently does not transmit HIV infection as effectively as anal intercourse.

Female to male: Males can catch HIV from infected females. It may be possible for HIV infection to come from menstrual blood or from contact with a female's vaginal or cervical secretions.

The concentration of HIV in vaginal or cervical secretions does not seem very high (compared with blood and semen). Nevertheless, the concentration is sufficient for HIV transmission to take place. Small amounts of blood may also be present in the vagina due to rough sexual intercourse or to other vaginal conditions.

In males, the doorway for HIV into the body may be very small wounds on the head of the penis, the mucous membranes lining the urethra (the "eye" of the penis is the opening of the urethra), or the glands which intersect the urethra at the base of the penis. The condition of the cells lining the urethra may be important in male susceptibility to infection. The health of the cells may be affected by STDs (sexually transmitted diseases) or other irritants.

Oral Sex. Oral sex is defined here as the contact of one person's mouth with the penis, vagina, or anus of another person. In theory, HIV transmission can occur during oral sex. If such HIV transmission did occur, most likely HIV would pass from the penis, vagina, or anus to the mouth – the viral carrier being semen, cervical and vaginal secretions, feces or blood.

Once inside the mouth, HIV may penetrate the mucous membranes of the mouth, or enter the bloodstream via a number of possible doorways, including any small wound such as cold sores, bleeding gums (inflicted by toothbrush or dental floss, or rough kissing), and self-inflicted bites. Macrophages, which are susceptible to HIV infection, are also present.

It is possible, with some germs, for infection to pass from one person's mouth to the other person's penis, vagina, or anus. With HIV, this event is possible in theory, but seems unlikely owing to HIV's low concentration in saliva.

Blood is always a special consideration. Blood is a highly infectious substance. Blood might be present in the either partner's mouth, the male's urethra, the female's vagina, in a male's or female's anus – such blood might be present because of pre-existing wounds or infection, or from recent rough sexual intercourse. Blood might be in the female's vagina during menstruation.

There are no proven cases of individual people catching HIV from oral sex, but several suspected cases have come into light. Several homosexual males claim to have had only penis-to-mouth oral sex, including ejaculation, with their HIV-infected partner and to have become infected themselves. These cases are not confirmed. Several statistical studies suggest certain types of oral sex may be able to transmit HIV. Increased statistical risk was found in homosexual males who had histories of swallowing semen, or having oral-anal contact. However, statistical studies are based on groups of people, and individual specifics are rarely pinpointed. The people studied usually engaged in other sexual practices, not only oral sex alone. Therefore, although a statistical risk could be assigned to oral sexual activity, on an individual basis, one could never know whether any specific incident of HIV transmission occurred during oral sex or by some other sexual practice.

Kissing. In theory, kissing in which saliva is exchanged can transmit HIV infection, but in reality, there are no proven cases. Several possible cases have arisen, but were subsequently disproved.

Saliva contains such low concentrations of the virus that infection via saliva is unlikely. Saliva contains germ-killing chemicals which seem effective against HIV. Another factor that must be considered, however, is blood in the mouth. If a person is infected, his or her blood contains a high concentration of the virus and blood is far more infectious than saliva alone. The presence of blood in the mouth is a common event and not obvious. Blood in the mouth may originate from bites, abrasions, flossing, and bleeding gums. Kissing, if done roughly, can also create bleeding points in the mucous membranes of the gums and cheeks.

In many instances of HIV-infected homosexual males who continually wet-kissed

(exchanged saliva) with their non-infected partners, no HIV transmission seems to have taken place.

However, many infected individuals at high-risk for infection are being told that kissing is 100% safe. The risk of catching HIV infection from wet kissing is close to zero, but it is not zero.

Lesbian Sex. There exists at least one case where a lesbian (female who prefers female sexual partners) passed HIV infection to her female sex partner. The two females engaged in oral sex and insertion of the fingers into the vagina and anus.

Urination. Contact with urine of a sexual partner is not advised because HIV has been isolated in urine and may be transmitted through microscopic lesions in the skin.

Artificial Objects. In theory, viruses and other germs can travel from one host to host via artificial objects. If any artificial object comes in contact with contaminated body substances, it should be sterilized or disinfected before being inserted into any other body opening or another person.

Blood Transfusions. HIV seems to be present in most of the components of human blood; namely, red and white blood cells, platelets (which help blood clotting and scab formation), and plasma. People receiving blood transfusions have caught HIV infection from whole blood and from blood components, including platelets, red blood cells, plasma, and clotting factor concentrates manufactured for hemophiliacs. Neither pasteurized (heat-treated) albumin gamma-globulin nor other immunoglobulins (blood proteins isolated and transfused into ill patients) have been reported to transmit HIV.

In 1985, a blood-screening test became available to blood testing centers. Though not 100% accurate, this test enables them to screen all blood donations for HIV. By current accounts, the blood test, which detects HIV antibodies, is close to perfect but it is not perfect. (Generally, manufacturers claim something to the effect that the tests are 99.9% sensitive, meaning they detect 999 out of 1000 positive samples, and miss one positive result.)

Also, in newly infected individuals, there is a "window" after HIV infection, but before the development of antibodies, when this test is useless. On limited evidence, this window persists for up to 3–6 months after initial infection. Thus it is possible that HIV-infected blood could be collected during this window.

Despite these problems, the annual number of transfusion-related and HIV infections should be close to zero. However, the likelihood of catching HIV from a heterologous blood transfusion (blood from a person other than yourself) will remain an extremely remote possibility.

Household and Medical Instruments. Shaving razors and toothbrushes, both of which may come into contact with blood, may possibly transmit HIV from one person to another. Bleeding would probably have to occur in both people.

Intravenous needles (inserted into a vein) and hypodermic needles (needles inserted under the skin - usually into a muscle) and syringes (the plastic container attached to the needles) are all transmitters of HIV. You have no need to fear becoming infected from any new needle used in a doctor's office. Needles and most syringes used by doctors and hospitals are destroyed immediately after one use. Reusable injection guns, used in medical settings, have transmitted another blood borne disease, Hepatitis B. Therefore, improper use of these devices could theoretically transmit HIV.

The risk of medical needle use stems from reusing a needle, or sharing needles with another person. HIV is transmitted via the small amount of blood that remains in the needle or syringe after use.

Needle sharing habits are common among IV drug abusers. IV drug abusers commonly include people who inject heroin and/or cocaine into their veins. IV drug abusers also include individuals using steroids for body building who share IV needles with their friends. They may be using either intravenous or hypodermic needles. It is the practice of sharing contaminated needles and syringes, not the use of any particular drug, which holds the risk of HIV infection.

Health care workers have contracted HIV infections by accidentally sticking themselves with needles contaminated with HIV-infected blood or bodily substances.

Organ Transplants. In an HIV-infected person, all organs and tissues contain HIV-infected blood. If any HIV-infected organs or tissues are transplanted into another person, the recipient has a risk of catching HIV infection. Recipients of liver, kidney, and skin grafts have caught HIV infections from their donor organs or tissues.

Pregnancy. HIV can cross the placental blood barrier, a barrier formed by chemical action to protect the unborn baby from disease. (The placenta is a sac enclosing the baby in the womb.) A baby in the womb can thus become infected with AIDS.

Not all babies born to HIV-infected mothers catch HIV infection. Approximately one-half to one-third of babies born to HIV-infected mothers catch AIDS.

Artificial Insemination. Artificial insemination is the use of medical instruments to deliver a male's sperm into a female's vagina and uterus. This process is generally performed when the male member of a heterosexual couple is not able to effectively generate sperm, or if a female wishes to have a baby but does not wish to have sexual intercourse with a male.

A number of females have been exposed to HIV by artificial insemination. Little follow-up information is available. Other sexually transmitted diseases have reportedly been transmitted by artificial insemination, including gonorrhea and *Chlamydia*.

Infected Health Care Workers. On rare occasions, health care workers infected with blood-borne diseases have transmitted them to their patients. Such health care workers tend to be primarily dentists or surgeons.

Generally, with blood-borne diseases such as AIDS, transmission occurs only during invasive medical procedures, that is, medical procedures in which the health care worker's hands, and medical instruments, are inserted inside the body of the patient.

The risk stems from the health care worker cutting himself or herself and bleeding into the patient. Usually, the infections appear in clusters, with one health care worker infecting several patients before the situation is discovered.

Blood spills/Contact with Bodily Secretions and Feces. Exposure to blood, either on the hands or in the eyes and mouth, has been responsible for HIV infection among health-care workers. (Invisible lesions, wounds, are often present around the cuticles of the fingernails.)

There are a couple of cases in which HIV may have been transmitted with contact by feces and/or bodily secretions. In one instance, a mother caring for an HIV-infected infant (transfusion recipient) became infected. She frequently did not wear gloves and did not wash her hands immediately after frequent contact with the baby's feces, blood, saliva, and nasal secretions.

Blood-Letting Instruments. In theory, any instrument which penetrates the skin or contacts blood could transmit HIV infection. Such devices include circumcision knives, acupuncture needles, tattooing needles, any instrument used to make scars or homemade tattoos, ear-piercing needles and equipment, and electrolysis equipment.

Any of these instruments should be sterilized or disinfected before reuse.

Biting. There have been at least two cases of individuals being bitten deeply by HIV-infected individuals. In these two cases, no HIV transmission occurred. A small risk exists since HIV can be present in the saliva and, of course, blood might be present in the mouth in such violent circumstances.

Spitting. In a couple of instances, arresting police officers have been spit upon by infected people. No documented cases of infection from these situations have been found, however, a very small risk exists although it is probably too small to be measured (unless there is

blood in the mouth).

No HIV Transmission Found

Casual Contact. There is a great fear of catching AIDS through casual contact, such as shaking hands, being in the same room with an HIV-infected person, touching doorknobs, or sharing bathroom facilities. The fear is far, far greater than the risk. Diseases which are spread by casual contact invariably are spread via saliva or sputum, and exist in saliva or sputum in very high concentrations. HIV exists, if at all, in saliva and sputum in very low concentrations.

After 30 years of documenting the AIDS epidemic, there are no known cases of AIDS or HIV infection being transmitted by casual social contact, not even among people living in the same household. In some instances, household members even shared toothbrushes with HIV-infected housemates without contracting HIV.

No medical or health care workers have contracted HIV from casual contact.

Sweat. According to current scientific detection standards, HIV does not exist in sweat. Using the most precise techniques of detection available, neither RNA nor DNA from HIV can be detected in sweat. Accordingly, sweat cells cannot transmit HIV.

Insects. No known cases of HIV transmission by insects exist. In the highly publicized case of possible mosquito transmission in Belle Glade, Florida, the follow-up studies that evaluated the situation did not support the theory of mosquito transmission. The scientists tested the blood of Belle Glade residents infected with HIV to see if they all had the same sets of antibodies common to germs carried by mosquitos. If these individuals had received HIV from mosquitoes, then most likely they would all share the same set of antibodies caused by mosquito bites. They did not.

Insects are known to transmit both viral and bacterial disease to humans and other mammals. Insects commonly implicated in transmitting disease are mosquitoes, lice, bedbugs, ticks, fleas, and spiders. Insects are known to transmit both viruses and bacteria from animal reservoirs to humans, and probably visa versa.

Insects can be either biological transmitters or mechanical transmitters of disease. In *biological transmitters*, the cells inside the insect become infected by the germ. The insect thus becomes a germ-making factory. This situation occurs with malaria. The germ which causes malaria lives in the salivary gland of certain species of mosquitoes. No known insect becomes infected with HIV, thus no known insect is a biological transmitter of HIV.

Mechanical transmitters transmit germs from one host to another via mouthparts contaminated with infected blood. Mechanical transmission takes place when an insect is interrupted while feeding on one host and completes its meal on a second. There is no evidence that this has occurred with HIV.

In summary, insect transmission of HIV remains a remote theoretical possibility, but may not exist in the real world. If such transmission does exist, it is not epidemiologically important, that is, if HIV had to depend solely on insect transmission, the Human Immunodeficiency Virus would soon be extinct.

Preventing HIV Infection

Ending or controlling the AIDS epidemic requires action on both the personal and societal level. All members of society must participate, not just those in so-called "high-risk" groups. Disease seeks any opportunity to advance, and disregards any human definitions of social organization.

Sexual Hygiene

Hygiene is the practice of following certain health rules. In the age of AIDS, sexual hygiene means avoiding the exchange of bodily fluids and secretions during sexual activity.

Strictly speaking, semen, vaginal and cervical secretions, blood, urine, feces, saliva, tears, and mother's milk from one person should not be placed into the mouth, nose, eyes, ears, vagina, anus, or open wounds (even microscopic) of another person. As mentioned previously, the hands often have microscopic lesions (wounds) around the fingernail cuticles.

This chapter outlines the physical and behavioral barriers used to prevent catching HIV infection sexually, and discusses other important concerns.

Physical Barriers

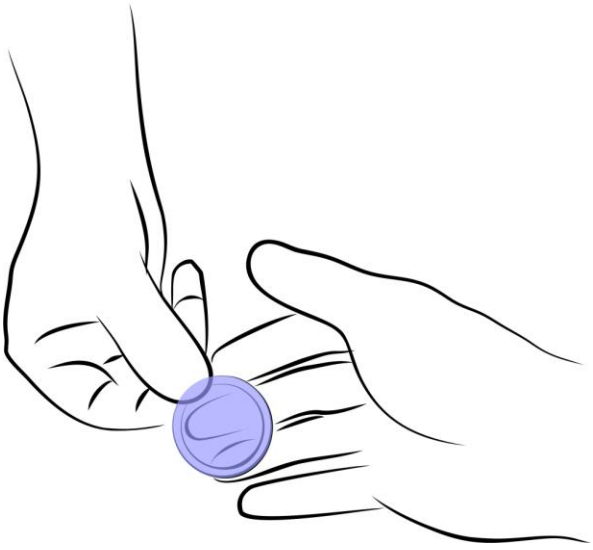
Condoms. Use latex condoms to reduce the risk of catching or transmitting HIV. Condoms should be used for anal, oral, and vaginal intercourse.

Semen is a potentially contaminated substance. If contaminated, it is highly infectious. Neither semen nor pre-ejaculate fluid should come into contact with mucous membrane surfaces. Ideally, semen should not come into contact with a person's hands either, since microscopic lesions (wounds) often exist in the vicinity of the fingernail cuticles. Ideally, latex gloves should be worn to prevent hand-to-semen contact.

Be prepared in advance. Sexual passion often interferes with clear thinking. In order to provide adequate protection, condoms must be used correctly. See Figure 7 regarding condom use, and then practice.

Condoms are a physical barrier against HIV transmission but they are not perfect barriers. Condoms can have invisible pinholes or cracks. Condoms can break open or slip off. When condoms break, it is usually because of the lack of lubrication. Condom lubrication is very important in the preventing of condom breakage. Lubrication should only be applied to the outside of the condom. Any lubricant inside the condom may help it slip off the penis during intercourse. Ideally, spermicide or contraceptive jelly should accompany condom use.

Most condoms are made of latex, basically a form of rubber. Approximately 1 percent of all condoms sold are natural, made of the "skin" of lamb's intestines. The membrane surfaces in intestines are permeable, meaning that some large biological molecules are able to pass through the material. In laboratory experiments, some viruses are able to pass through natural membrane condoms. Thus, natural membrane condoms are not considered adequate for preventing HIV infection.



Condoms vary in size and width, and generally these factors vary slightly from nation to nation. When going on vacation, bring your own condoms along.

In the United States, all commercially manufactured condoms obtain the approval of the Food and Drug Administration (FDA), but there is a wide variety in quality. Researchers suggest avoiding "boutique" brands because quality control techniques may not be on par with those of major condom manufacturers. With the advent of AIDS, many new types of condoms, supposedly designed for anal intercourse, have been marketed. Most claims are not backed by scientific experiment.

Figure 7 Condom Use

When:

- Use a latex condom for oral, anal, vaginal sex. Use one every single time.
- Put on condom as soon as erection occurs or before pre-ejaculatory fluid appear on tip of penis.
- Be prepared in advance; sexual passion often interferes with clear thinking.
- Practice condom use beforehand. Practice makes perfect.

Removing Condom from Package:

- Carefully inspect package for holes, cracks, and damage. Discard condom if package is open. Carefully open to avoid damaging condom. Inspect condom for signs of aging, dryness, or brittleness. Discard if necessary.

Putting on Condom:

- Leave condom rolled up. Note that condom unrolls only one way. If wrong side of condom becomes contaminated with moisture from penis, then discard condom.
- With thumb and finger of one hand, gently squeeze condom tip together. (Squeezing condom tip ensures that no air remains in condom and leaves room for semen.) Place condom over tip of penis, then unroll condom over full length of penis with other hand. When unrolling condom down penis, be sure to expel all air. Unroll condom to base of penis.

Lubrication:

- Lubricate condom. Lack of adequate lubrication is suspected to be the major cause of condom breakage.
- Water-based lubricants, non-allergenic surgical lubricants (such as K-Y jelly), and contraceptive jellies and foams are OK to use. Available in pharmacies and sex specialty shops. Read the label.
- DO NOT use petroleum jelly or any petroleum-based lubricant (they dissolve latex). DO NOT use saliva (may contain germs or blood).
- Avoid over-long exposure of condom to spermicides and contraceptive foams or creams. No problem should develop during the time span of normal use.

Ejaculation:

- Once the inside of the condom becomes wet, the condom can easily slip off and spill its contents into the receptive partner. After male ejaculation, body movement should stop or be reduced to a minimum. At this point, check with hand to make sure condom is securely in place.

Penis Withdrawal from Partner:

- To remove condom from penis, hold onto base of condom when withdrawing penis, else it is likely to slip off, spilling its contents into the receptive partner.
- Removing condom, roll condom up shaft of penis, then slide condom off without spilling contents.

Disposal:

- Care should be taken in the disposal of condoms. Semen is a potentially contaminated substance. Do not place used condoms in places where other people might unintentionally come into contact with them. Most toilet systems can handle condoms. Condoms might be disposed of in a bedside container of 1 part bleach/ 9 parts water solution.

Storage:

- Condoms should be stored at room temperature. Condoms should not be exposed to extremes of hot or cold.
- DO NOT store condoms in sunlight. If the condom package has a window in it, DO NOT store condom package under fluorescent light. DO NOT store condoms in glove boxes of cars - it gets too hot. Coolest place in auto is under front seats. Discard and replace condoms frequently if carried in wallet, or find better place.

Condom Failure Emergency:

- A can of contraceptive foam can be an emergency measure if the receptive partner is exposed to HIV due to condom failure or slippage. Fill vagina with contraceptive foam. Foams containing nonoxynol-9 or benzalkonium chloride have anti-HIV action. Spermicides and contraceptive foams are not FDA approved for use in the anus.

Reuse:

- Never reuse a condom.

Diaphragms. Diaphragms may reduce the risk of transmitting or catching HIV, particularly if cervical bleeding is taking place, but they are no guarantee against catching HIV. While condoms prevent contact between the sexual partners, diaphragms offer no protection for the mucous membrane surfaces within the female's vagina. Diaphragms only prevent semen from entering the cervix, the doorway to the womb. If HIV is present in the semen, the whole vagina is still exposed.

Contraceptive jellies and spermicides. Contraceptive means "preventing pregnancy." Spermicides are chemicals that kill sperm.

Ideally, contraceptive jellies or spermicides should always be used along with condoms. By using both condoms and contraceptive chemicals, pregnancy risk approaches zero. Proper use of both should reduce greatly the risk of catching HIV. The use of contraceptive jellies and spermicides by themselves is NOT EFFECTIVE against pregnancy and probably are NOT EFFECTIVE in preventing HIV transmission.

Some chemicals are known to inactivate HIV. In the United States, nonoxynol-9 and benzalkonium chloride are two chemicals which inactivate (kill) HIV and are available in spermicidal jellies and foams, some condom lubricants, and on the tips of some condoms. Brands differ.

Dams. Dams are sheets of latex intended for use in dental surgery. During sexual activity, dams can be used to cover a person's vagina or anus, so that oral stimulation of these areas can take place without partners exchanging bodily fluids or substances. Care must be taken not to contaminate both sides of the dam, or to transport a dam covered with vaginal fluids to the anus and visa versa.

Latex Gloves. As mentioned previously, the hands often have microscopic lesions

(wounds) around the fingernail cuticles. In theory, if any HIV-contaminated substance comes into contact with the hands, HIV transmission can occur (HIV entering the body via these microscopic openings).

Ideally, latex gloves should be worn if the hands are to come into contact with semen, vaginal and cervical secretions, blood, urine, feces, saliva, tears, or mother's milk. That is, latex gloves should be worn to prevent hand-to-semen contact, hand-to-anus contact, hand-to-vagina contact, etc.

Among homosexual male AIDS patients, a slight statistical risk for hand-to-anal contact has been established.

In at least one instance, HIV transmission has occurred in a medical setting when a nurse's hands came into contact with blood (she did not wash her hands immediately as she should have). In another instance, a mother nursing an HIV-infected infant had frequent and prolonged contact with the baby's blood, feces, saliva, and nasal excretions and did not wash her hands immediately afterwards. The mother became infected.

The most dangerous substances, or course, are blood, semen, vaginal and cervical secretions, and feces. Saliva and tears do not seem capable of transmitting HIV due to their low concentration of HIV.

When to Stop Using Barriers. Ideally, no one should have unprotected sex until everybody involved has been tested for HIV. Such HIV testing should come at least 6 to 12 months after the most recent possible exposure to HIV (sexual or otherwise, like a blood transfusion), so that antibodies have time to develop and can be detected by the blood test. If both partners test negative, then it should be safe to have unprotected sex (testing for other sexually transmitted diseases wouldn't hurt either). Tests are not perfect and the small statistical chance of false-positives and false-negatives do exist.

Behavioral Barriers

Abstinence. Abstinence, not having sex, is the safest sexual behavior. Perhaps the best

advice, particularly for young people, is to save the wonderful thing called sex for someone special with whom you really want to share it.

Abstinence has other benefits: the lack of risk of pregnancy, and the lack of exposure to spermicides and contraceptive jellies (exposure to any chemical carries some degree of health risk), and the avoidance of the emotional ravages of premature sex. As many adults will testify, sexual activity can be emotionally hazardous.

Unfortunately, as a society, we are living a big lie. While many concerned individuals promote abstinence, our visual world is saturated with sexual images that relate success, maturity, and popularity to sexually active behavior.

Also, although touted as the historically successful approach, abstinence has never been fully successful as a way of controlling unwanted pregnancies nor STDs. Perhaps when most people lived in small villages and there were only a few dozen potential sexual mates in the vicinity, and social censure was very strong, then abstinent behavior was a realistic expectation for the majority of individuals. However in the modern Western world, individualism overcomes social censure, and sexuality has become a measure of success. Also, especially for young urban people, the number of potential sexual partners one sees daily, say just walking to work, may number in the hundreds or thousands.

Sex Education. Studies show that biologically explicit sexual education delays the onset of sexual activity in adolescents. For example, Germany has an extensive sex education program in their school systems and the lowest rates of teenage pregnancy. In the United States and many other countries, many people do not receive adequate education regarding sex and reproduction.

Overcoming Reluctance to Use Condoms. Many people simply do not want to use condoms. Both men and women say that condoms interfere with sexual pleasure by reducing sensation, or by interrupting the sexual act.

Embarrassment is also a key issue, beginning with the purchase of the condom and

ending with a reluctance to insist on their use.

The responsibility for purchasing and using condoms and other physical barriers should be shared by sexual partners. Each partner should be instructed how to place the barrier on the other partner and partners should practice doing so. By making eroticism part of this exercise, condom and barrier use can become part of relaxed, satisfying sexual behavior.

Selection of Sex Partner. One form of protection against HIV transmission and other STD transmission is careful selection of sexual partners. Ideally, one should avoid having sex with partners who have sex with numerous people, HIV-infected people, IV drug users (including steroid users), people who have sex with HIV-infected people, people whose HIV status is unknown, and so on.

If you are choosing to share sexual intimacy with a person infected with HIV, then please do so safely and perhaps refer to your medical provider for current thoughts on the subject.

Drug Use. Avoid drug use in situations where sex is likely. All drugs affect judgment, especially alcohol, which lowers inhibitions and is known to increase the expression of high-risk behaviors. Drugs lower one's mental and emotional barriers. Experimentation with drugs and sex should not happen at the same time.

Number of Lifetime Sex Partners. Limit your number of sex partners. A high number of sex partners is the most consistent risk factor associated with catching HIV, according to statistical research done on homosexual males engaging in unprotected sexual activity. The greater the number of sexual encounters, the greater your chances of encountering HIV. However, one exposure to HIV may be enough!

Negotiating Limits. Sexual partners should agree on the limits of sexual activity before such activity begins. Negotiation is a skill which many people need to develop. Negotiation of

sexual activity is a new, necessary skill. It can be as simple as speaking out when you don't feel comfortable.

Other Concerns

IV Needle Precautions. All intravenous (IV) needles and hypodermic needles should be destroyed immediately after (one) use. Anyone who shares IV needles or hypodermic needles with other people is at risk for catching AIDS, whether the needle users are injecting cocaine, heroin, steroids, or other drugs.

In world locales having limited medical resources, IV needles or hypodermic needles may be re-used within medical settings. If you happen to be in a foreign country during the outbreak of some infectious diseases, such as cholera, you may be required to accept injections in order to cross country borders. Sterile needle kits for travelers can be purchased at camping and/or other stores catering to international travelers.

HIV infection and AIDS are not the only dangers associated with re-using IV needles. In people who share and/or re-use IV needles, the following conditions are common: 1) HIV infection; 2) hepatitis B infection; 3) bacterial infections ("staph" and "strep"); 4) endocarditis (the inflammation of membrane lining the heart); 5) tetanus (poisoning by bacterial poisons); and, 6) embolisms, wherein air bubbles introduced by the needle into the bloodstream become lodged in blood vessels, blocking blood flow and perhaps resulting in the death of tissues downstream and/or the death of the person.

If needles are re-used, proper cleaning can help reduce the risk of these conditions occurring. Two cleaning agents are generally available: bleach, and ethanol (drinking alcohol). Isopropyl alcohol (rubbing alcohol) does not seem very effective against HIV in the presence of

blood. **Do not use rubbing alcohol (isopropyl alcohol).**

Bleach is inexpensive and very effective, but it slowly corrodes plastic and metal. Bleach is poisonous to living tissue. Pure bleach spilled on skin can cause burns. To make a cleaning solution of bleach, add 1 part bleach to 9 parts water. "Parts" just means any unit of measure, a part can be a cupful or a bucketful, just keep the "parts" the same.

Ethanol is drinking alcohol. Ethanol is very expensive. Ethanol can be purchased at liquor stores or at chemical supply stores. If purchased at a liquor store, the liquor must be "150 proof" or more. Ethanol does not harm metal but it will eventually damage plastic. Purchased from a chemical supply store, the ethanol will be "denatured" — poison is added to make it undrinkable. Denatured alcohol is still useful for cleaning equipment.

To clean equipment: 1) fill a container with cleaning solution; 2) stick the needle point into the solution and slowly fill the syringe by drawing the plunger back. Keep the needle point below the surface of the liquid; do not let air bubbles into the syringe; 3) Tap the syringe up and down its length to dislodge air bubbles; 4) After filling the syringe, slowly push the plunger all the way to the bottom, expelling all fluid from the syringe; 5) Repeat this several times; 6) Disassemble the equipment and leave them soaking in the solution for at least 10 minutes. Preferably, soak the equipment in alcohol until the next use.

Before using equipment again, fill a glass with water and carefully flush the needle and syringe by pumping water in and out of the equipment. Change the water and wash both the inside and outside of the equipment. Remove all smell of bleach or alcohol.

Discard cleaning solutions after use. Discard any cleaning solutions left out overnight. If the syringe contains blood, stronger mixtures of cleaning solution may be used (add more than 10% bleach).

If time is short, fill a glass with bleach; pump bleach in and out of the syringe several times, then fill the glass with water, and pump some more.

Or, the needles and syringe can be boiled in water for 10 minutes. This heat should kill

HIV, but not the stronger bacteria.

Bloodspills & Spills of Bodily Waste. Any person touching a spill of blood or other body substances, such as vomit, urine, or feces, should wear latex gloves.

To clean up such spills, use a 10 percent bleach solution (I part bleach, 9 parts water). Surround the spill with bleach solution; work inward with the mop, working slowly and carefully to avoid splashes or creating aerosols (airborne particles). Stronger bleach solutions (add more than 10% bleach) should be used if excessive amounts of blood or other substances are present. Afterwards, the mop head should be soaked in 10 percent bleach solution. Agitate (stir up) the mop head carefully to ensure that all mop surfaces are exposed to the cleaning fluid.

Exposure to Human Skin. If a substance contaminated with HIV comes into contact with human skin, immediately wash it off with soap and water.

If an open wound is exposed to an HIV-contaminated substance, it should be immediately flushed with large amounts of hydrogen peroxide or a 10 percent bleach solution (1 part bleach, 9 parts water). DO NOT place hydrogen peroxide on mucous membrane surfaces. DO NOT pour hydrogen peroxide into mouth, vagina, anus, eyes, urethra, etc.

Blood Transfusions. The risk of contracting HIV from a blood transfusion is very small, so small that it is foolish to refuse a blood transfusion if your life depends on it.

While not all medical authorities agree with the procedure, the use of autologous transfusions (a patient receives his or her own blood collected in the weeks before surgery) became more common after the advent of AIDS. Besides preventing possible HIV infection, autologous transfusions prevent many other transfusion-related problems. Most negative reactions associated with transfusions are caused by foreign proteins (antigens) in the donor blood which the patient's immune system attacks as invaders.

Anyone planning elective surgery (surgery by choice) can consult his or her physician regarding autologous transfusions.

Soaps and Detergents Which Kill HIV. In general, any soap, detergent, and or

disinfectant is effective against HIV.

Bleach is the preferred cleaning agent of research labs. Mix 1 part bleach with 9 parts water to make a 10 percent bleach solution. If blood or bodily secretions are plentiful, then use a stronger mixture.

Ethanol (drinking alcohol) at 50 percent solution (100 proof) kills HIV. Isopropyl alcohol (rubbing alcohol) in a 35 percent solution kills HIV in most settings, but not for cleaning IV or hypodermic needles. Most drug store alcohol in the United States is 70 percent. Read the label. (Alcohols are not as effective in killing HIV in the presence of blood. If blood or other substances are plentiful, use stronger mixtures, pure alcohol, or a strong bleach solution.)

Lysol at 0.5 percent solution inactivates HIV. In stores, Lysol is available at 3 percent solution, read the label.

In the hospital, Nonidet P-40 at 1 percent killed HIV. Paraformaldehyes and phenols are effective. Formalin was effective but too slow for common use. Tween-20 was ineffective, but its stronger version was effective.

Dishes. Hot soapy water kills HIV. If dishes are visibly soiled with blood or other bodily substances, they can be soaked in 10 percent bleach solution first.

Bathrooms. Bathroom surfaces are only hazardous (if HIV is present) if visibly soiled with HIV-tainted bodily waste or substances. Again, any contaminated substance would have to encounter a mucous membrane surface or an open wound.

Detecting AIDS

Initial Symptoms

The initial symptoms of HIV-infection are usually vague. Occasionally, HIV-infected people experience an acute reaction following infection.

The majority of HIV-infected people experience a vague constellation of symptoms similar to the symptoms of lymphadenopathy (Figure 4). These symptoms probably emerge over a period of time and may include fever, night sweats and chills, weight loss, diarrhea, sore throat, swollen glands, difficulty in swallowing (dysphagia), fatigue, and depression.

Obviously, many of these minor ailments may be caused by a number of other illnesses. In HIV infection, these symptoms may (or may not) persist for months without apparent reason. In any persistent illness, a doctor should be consulted.

Acute Reaction

Approximately 10 to 30 percent of HIV-infected people experience an acute reaction to HIV infection. **Acute** means that the symptoms begin and end quickly, although they may be severe.

The symptoms of the acute reaction generally are fever, tremors, joint discomfort, headache, swollen glands about the head and neck, and muscle aches. Less frequently reported are pimples or rash, abdominal cramps, diarrhea, and hives. Some researchers describe the acute reaction as being similar to the flu; others call it mononucleosis-like. Historically, the acute reaction appears 3 to 12 weeks after exposure, apparently coinciding with the appearance of anti-HIV antibodies in the blood.

Oral and Facial Signs

The mouth, face, head, and neck are the areas where the first visible signs of HIV infection often appear. In lymphadenopathy, the lymph nodes about the head, face, and neck are often the first to swell. They swell during other infections too, such as for a cold or flu.

In many ARC or AIDS patients, the mouth, face and head are also where the first opportunistic infections occur. The most common are 1) oral candidiasis (white spots or patches on the tongue or the mucous membranes of the cheeks); 2) oral hairy leukoplakia (fuzzy white spots on the tongue caused by a rare mouth fungus which does not rub off in AIDS patients, as does the hairy tongue caused by smoking); and, 3) herpes zoster blisters (large, painful pus-filled pimples which follow the path of a nerve under the skin). Herpes zoster is relatively common among people who are not infected with HIV.

Blood Tests

A person's blood can be tested for the presence of HIV antibodies. Two tests are commonly used in combination: the ELISA and the Western blot. Again, these tests detect the presence of anti-HIV antibodies. They do not directly detect HIV. Isolating and culturing (growing) HIV is too complicated for doctor's offices, hospital laboratories, and similar settings. The antibody tests are easy, accurate, and inexpensive.

ELISA stands for "enzyme-linked immunoabsorbent assay," also called the EIA. The human body makes antibodies versus several components of HIV. If the ELISA finds the evidence of anti-HIV antibodies in the blood, then the person tested is considered seropositive ("blood positive").

Most commercial ELISAs detect that antibody targeted against HIV's protein coat of HIV as well as one or more other antibodies targeted against other components of HIV. Testing kit designs and the antibodies they detect differ between manufacturers and within manufacturers by purpose of use (for example, testing kits designed to detect HIV in patients are designed differently from testing kits used to test blood donations).

The ELISA is very sensitive, meaning it detects small amounts of antibodies. However, it is so sensitive that it can be fooled by proteins or antibodies unrelated to HIV. Consequently, in normal testing procedures, ELISA-positive samples are tested again by the Western blot. The Western blot tests is saved for confirmation because it is difficult (thus expensive) to perform.

The Western blot test is very specific, meaning it is exact in what it "sees." The Western blot eliminates most of the mistakes that ELISA makes from being too sensitive. The Western blot is an interpretative test, that is, an experienced technician must "read" it, thus human errors are possible or the test can be indeterminate.

Accuracy

These blood tests are accurate but not perfect. Both false-positives and false-negatives can and do occur, although statistically they are very rare. In false-positive results, the tests are fooled by proteins that resemble anti-HIV antibodies. ELISA false-positives are statistically related to second and subsequent pregnancies, severe renal (kidney) failure, recent organ transplant, some forms of cancer or rheumatoid arthritis, the flu vaccine, and laboratory errors.

False positives may occur in people with immunosuppression (weakened immune system). People afflicted with alcoholism and drug abuse commonly experience immunosuppression.

False positives have been recorded in patients have "passively acquired" anti-HIV antibodies. Passively acquired means the patients did not generate the antibodies themselves because they were not infected with HIV. Rather the patients “passively” received the antibodies from transfusions of the gammaglobulins and immunoglobulin portions of whole blood that contained anti-HIV antibodies. But HIV itself was not in the transfusion. These blood components contained only anti-HIV antibodies, not the virus itself.

Overall, the predictive value of ELISA is claimed to be better than 99% sensitive at 6 months after exposure. The accuracy of the combined tests, for seropositivity, is greater than 99.9 percent, according to research studies.

Again, these blood tests detect the presence of antibodies in the blood. Antibodies do not develop immediately after infection. Generally, antibody development requires a few days or a few weeks. There is a "window period" between the time of actual infection and the time at which antibodies are detectable in the blood. During this "window," a person could be infected

and test seronegative.

According to the most recent information, involving a small number of cases where the time of HIV infection was actually known, HIV antibodies developed to detectable levels in the blood within 14 weeks. Using this information, and adding additional time for safety's sake, the window period currently is considered to be 3–6 months.

Thus, if a person tests negative for anti-HIV antibodies six months after a known exposure, they are probably not HIV-infected. Prudence suggests that anyone exposed to HIV should be tested at 3 month intervals up to a year after exposure.

What a Positive Blood Test Means

If a person's blood contains antibodies to HIV, this means one of three things:

1) The person was exposed to HIV, their antibodies defeated the virus, and the virus is no longer present in the person's body. This situation seems very unlikely. Historically, the presence of anti-HIV antibodies has indicated the presence of HIV, except in cases of "passively-acquired antibodies (see above).

2) The person is still carrying the HIV virus, but will not develop any AIDS-related disease. However, the person may be a carrier and may be able to transmit HIV infection. This situation is also unlikely. The people who are seropositive and who remain healthy in absence of drug treatment are the exception rather than the rule.

3) The person is carrying HIV and eventually will develop lymphadenopathy, ARC, or AIDS in absence of drug treatment.

Finally, different varieties (strains) of HIV exist. Different strains may have slight differences in their proteins coats. Since antibodies are created to match the protein coat of a virus, anti-HIV antibodies differ from person to person and HIV strain to HIV strain. The ELISA

test in current use detects both HIV-1 and HIV-2. A separate HIV-2 test is also available.

How to Get Tested

If you suspect you are infected, or just wish to know your HIV status, you have several options for obtaining an HIV antibody test. If confidentiality is an issue, please refer to Confidentiality. It is best to find a testing option best suited to your needs.

First, you may simply request a test from your personal doctor. Any doctor can order an HIV test and many insurance programs cover the cost of the test.

Second, a number of public and private agencies have created free and anonymous HIV testing centers. You may find these services on the internet, or call the local AIDS-related organizations to learn more about testing locations, confidentiality, and options.

In the United States, the Centers for Disease Control and Prevention (CDC), a branch of the U.S. Public Health Service, has established a number of free test sites around the country. These sites offer an alternative to local doctors or hospitals, which may be required to report the results to insurance companies or to their state government.

These alternative test sites are not evenly distributed around the country. They are located in areas where AIDS is most common. Sometimes alternative test sites are set up by community request. Free or inexpensive AIDS testing centers have also been set up by state governments and private organizations. Ideally, a person being tested receives education and psychological counseling both before and after antibody testing.

Testing centers differ in quality, confidentiality, the amount of time it takes to get an appointment (ranging from no appointment necessary up to months), and the time it takes to get a test result (2 days to 3 weeks). It may be wise to call and question the testing center about their procedures before arranging an appointment.

To locate the testing center nearest to you, contact your city, county, or state Health Department; or your local AIDS-service organization.

Alternately, you can call CDC INFO at: 800-232-4636 (7 days a week, 24 hours a day,

English, Spanish). They can inform you testing sites in your area and also provide other information and literature. CDC also offers an online option for locating your local HIV testing centers. Simply go to their web page and enter your zip code: http://hivtest.cdc.gov/

Confidentiality

When something is kept confidential, it is kept secret. People who are seropositive may wish to keep their antibody status secret because many people have lost their jobs, their apartments, and their friends after their seropositive status became known. Also, seropositive people or even people at high risk for being HIV-infected may not be able to obtain health insurance.

Tests performed by medical doctors and hospitals are not necessarily confidential. In some areas, doctors, hospitals, and medical-testing laboratories are required by law to report seropositive people to local health authorities. In addition, any tests performed in these settings are recorded, either on paper or in a computer. Generally, these records can be obtained by court subpoena.

The laws protecting patient confidentiality vary from state to state. Your city or state health department or local AIDS-service organization should have information on local laws.

Find Your Local HIV Testing Sites

CDC INFO at: 800-232-4636

National HIV and STD Testing Resources: http://hivtest.cdc.gov/

The Hope for a Vaccine

A vaccine is a substance which causes a person's body to produce antibodies against a disease without causing the disease. In the body, antibodies against viruses are formed by T-cell recognition of viral protein coats. So the coat of a virus or the proteins of the viral coat are used to make a vaccine.

To create a vaccine, scientists isolate and grow a large quantity of the virus, then find a way to destroy its DNA or RNA center without destroying the entire protein coat. Then the protein coat, or parts of it, is injected into a person's body. Other components of the virus might be used as well. The person's immune system reacts to the presence of the viral proteins and creates antibodies. The ability to make these antibodies remains with the person for years, or in some cases, for a lifetime. Currently, genetically engineered bacteria are also being used to create viral proteins.

If the vaccinated person ever encounters a living form of the same virus, and the virus gets into his or her bloodstream, antibody production begins immediately. In theory, the antibodies will neutralize the virus before the virus can do any harm.

Vaccines do have risks. Sometimes not all the DNA or RNA of the original virus is destroyed, and strands, once infected into the body, are able to get into a host cell and begin replication. The result: the vaccinated person gets the disease. This event is rare but it happens. Also, some people have negative reactions to the vaccine, ranging from mild conditions, like a rash, to severe ones, like shock.

Thus, vaccines are risky for the first people to try them. The potential benefit must exceed the risk. Not all vaccines are given to everybody; some vaccines, such as the recently developed hepatitis B (HBV) vaccine, are given only to certain individuals at high risk for HBV infection; such as, health care workers, who are often exposed to HIV-infected blood; sexually active homosexual males, who are at risk of catching hepatitis B sexually; and hemodialysis

patients, who are potentially exposed to blood spills and contaminated dialysis equipment.

As far as retrovirus HIV is concerned, several problems present themselves in the development of a vaccine. First, there has never been a 100% effective vaccine for a retrovirus. With our current knowledge or biology and chemistry, it is theoretically possible to create a vaccine; but remember, in biology, there are no guarantees. Everyone thinks of the Salk polio vaccine when they think of vaccines, but a repeat of this success is never guaranteed.

Second, different strains of HIV have slightly different protein coats, and thus the antibodies produced against one strain of virus may not work against another strain. Ideally, a vaccine would be based on some antigenic part of the viral protein coat that remains the same for all strains of HIV.

Finally, anti-HIV antibodies seem to have no effect in HIV-infected individuals. So vaccines, even if they successfully produce antibodies, may not work. No one truly knows when and if a vaccine for HIV will be successfully developed. It would not be wise, at this time, to rely upon the development of a vaccine to solve the AIDS problem. A vaccine will not help anyone who has already been exposed to HIV, so everyone must protect themselves against exposure.

"This book pulls no punches … an excellent job in assembling an up-to-date, readable book for adolescents and members of the general public … Understanding and Preventing AIDS belongs in the school library."

The New England Journal of Medicine

A Harvard Biologist explains in simple language:

- How AIDS is Transmitted Sexually
- How AIDS is Transmitted Non-Sexually
- How to Get Tested – 24 Hour AIDS Hotline
- How Long the HIV can Survive Outside the Body
- When to Worry about Kitchens and Bathrooms
- Soaps and Detergents which Kill HIV
- The Truth about the AIDS Vaccine
- Correct Condom Use
- AIDS Prevention

Chris Jennings excels at writing scientific books that fulfill the needs of professionals while rendering the science accessible and easy to read. This booklet adopted for staff education by Massachusetts General Hospital, the hospital affiliated with Harvard Medical School, Walter Reed Army Medical Institute, other world-renowned hospitals; innumerable city and state health agencies; adopted as a textbook at colleges, nursing schools, and public health schools, and sold in medical bookstores.

HAC Health Alert Communications

www.healthalert.net

ISBN-10: 0-936571-13-6