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Abstract

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By the late 1970's an epidemic begun in Central Africa which spread world wide by the mid 1980's. This pandemic is called AIDS (Acquired Immune Deficiency Syndrome) and is caused by an infection with the virus called HIV (Human Immunodeficiency Virus). The names of the disease and of the causative virus were unknown prior to the mid 1980's. Many of the concepts involved in understanding what the infection and disease are about are esoteric and were not known by researchers in the field of immunology until the late 1970's.

This essay will examine the known medical facts concerning the disease and the reasonable inferences which may be drawn at this point as to the probabilities and possibilities of where the disease will go over time. The format will begin with an examination of what the disease is and what the organism is which causes it, followed by a brief discussion of what is known about the epidemic spread of disease. Next will be a discussion as to who has the infection and what the implication is of these data.

The disease called AIDS is a syndrome. The use of the word syndrome implies a lack of understanding of the cause of the phenomenon. That certainly was the case when the first young men in San Francisco and New York began to develop fever, weight loss, and swelling of the lymph nodes, followed by infection by opportunistic organisms and then death. It appeared that these young men had something devastatingly wrong with their immune systems.

Problems with the immune system have been recognized since at least the turn of the century when the cells called macrophages were discovered to play a role in fighting infection. During the twentieth century the various exceedingly complex components of the immune system were discovered. Basically, there appeared to be two types of immune deficiency: genetic and iatrogenic. The genetic deficiency has several types and was the subject of some public note in the early 1960's in the Unites States with the so-called "boy in the bubble." This involved a child who had severe combined immune deficiency and was

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placed into a sterile bubble at birth to protect him from the diseases whch his body could not fight. The other immune deficiency was iatrogenic and was produced by medical treatment, usually employed in treating cancer. Here the white blood cells called lymphocytes, which are also found in abundance in lymph nodes, are easily destroyed by the anticancer drugs and by radiation treatment. In 1981 young men in New York and San Francisco were acquiring immune deficiency and the syndrome was behaving with characteristics of an epidemic. Thus to genetic and iatrogenic was added Acquired Immunodeficiency Syndrome (AIDS).

The way it became known that these young men had immune deficiency was by the fact they acquired opportunistic infections. These are infections by organisms which ordinarily do not produce disease in human beings. The opportunistic identification refers to the organism taking the opportunity to infect a host with markedly weakened immunity. These diseases historically were seen in treated cancer patients whose immunity was compromised for the time of treatment.

The opportunistic organisms are the primary killers of persons with AIDS. They are Pneucmocystis carinil (PCP) a protozoa which produces pneumonia; Toxoplasma ghondii (TG) which produce brain abscesses; Mycobacterium avium intracellularae (MAI) which infects the abdominal lymph nodes and interferes with digestion; and finally, the other common opportunistic organism is a virus called cytomegalovirus (CMV). There are other rarer organisms which are seen but the above list currently represents over 95% of the identified opportunistic infections. Persons with AIDS do not seem to be at a higher risk for infections from organisms which are not opportunistic.

A number of researchers had been working in the study of viruses involved in cancer. Again, dating from the turn of the century, research had been conducted into the viral cause of cancers. There are many cancers of other animals which are clearly caused by viruses. This can be proved by grinding up the cancer, passing it through a filter too small for any cells to pass through, and then injecting that material into another animal who will develop cancer. Such viruses had not been found to cause cancer in humans, in large part, because the technique just described cannot be utilized in most ethical systems. The effort to develop a cure for cancer brought a renewed search for cancer causing viruses. Leading this research was Dr. Gallo of the National Cancer Institute. His work was directed toward the retro-virus family.

Genetic material comes in two distinct chemical forms, this having been discovered in the 1940's and 50's. The forms are ribonucelic acids

(RNA) and desoxyribonucleic acid (DNA). Generally, the nuclear material of animals and plants contained inside the nucleus of the cell is in the form of DNA. When the time comes to make protein the DNA makes a copy of itself in complementary RNA. The process is called transcription and is thought of as similar to making a copy of a recording tape. The only genetic material that retro-viruses have is RNA and when they attach the cell of an animal their genetic coded material is found in the host cell DNA. Thus they read backward, using an exnzyme which they supply called reverse-transcriptase to produce a copy of their genetic material into the host cell. These were the viruses which were known to produce cancer in non human-animals and Dr. Gallo discovered a virus which he called Human T-Lumphotrophic Virus (HTLV) which caused leukemia (a form of cancer) in human beings.

With the first reports of AIDS, Dr. Gallo in the United States, and several people at the Pasteur Institute, began to look for viruses in blood samples of victims. Nearly simultaneously the virus now called HIV was discoverd and found to be present in nearly all persons with the disease AIDS. Subsequent injection of the virus into chimpanzees produced a similar syndrome establishing the cause of the disease to be HIV.

The epidemic has caused a reevaluation of several terms which are not fully understood by anyone and are confunsing to nearly everyone. The first is epidemic. An epidemic is a contagious disease whose numbers of cases is increasing over time. Interestingly, little is known as to why diseases become epidemic. Often risk factors can be identified which are associated with an epidemic. These are not necessarily causal of the epidemic however. Risk factors are identifiable characteristics more frequently seen in the population with the infection than in the rest of the population.

Currently the accepted risk factors are: homosexual intercourse by a male at anytime since 1977; intravenous injection of drugs or abuse at anytime since 1977; having blood or blood products injected since 1977; having emigrated from a country where there is considerable evidence of heterosexual transmission of the disease; having intercourse with any of the above categories of people; or being born of a mother with AIDS or HIV infection.

Risk factors do not prove causation. With a sexually transmitted disease, any factor which is concurrent with promiscuity will be identified as a risk factor. With a disease which is defined by the deficiency of the immune system, factors which have a negative effect on the im-

mune system will show up as risk factors. In the case of IV drug abuse, both are probably true and that confounds an analysis of heterosexual spread.

Making all of this terribly more confusing is the protracted period between infection with the virus and becoming ill. With other sexually transmitted diseases the period between infection and illness is very short. It is three days with gonnorrea and perhaps seven days with syphilis, two well known diseases. With HIV disease the length of time from infection to illness may well be over ten years and the average may not be far from ten years. It is very difficult to establish this with certainty in a disease which was unknown less than the time required to see symptoms.

Because of our technology, we may identify those who are infected with the virus by the use of a blood test for antibodies to the virus. Antibodies are proteins found in the blood which react to the surface of viruses (and other organisms) and are an important part of the immune system, allowing them to be more easily killed by the body. In the case of HIV, the antibodies do not appear to effect the virus. However, they provide a way to measure most of the people who are infected. (The test cannot measure all who are infected as it takes some weeks to develop measurable levels of the antibody after the infection starts). This creates a situation where people know they are infected with the virus, that they are inefectious to their sexual partners or blood recipients, and will probably die of AIDS if they live long enough. Currently it is estimated that 1.5 million people in the United States are thus infected. Most are not aware of it.

The future spread of this disease is at the moment unpredictable with any degree of certainty. There are hopeful signs that the increase may have leveled off and that the disease is already at a plateau. However, it is too early to know for certain.

The persons who were first detected in the United States with this syndrome were homosexual males. In Africa that has not been the case. As of early 1988 it is still somewhat mysterious why the disease is heterosexually predominate in one part of the world and homosexually predominate in the other. Several theories currently exist which try to explain these data. At the moment, the extent of heterosexual spread in the United States is not predictable, however, the risk to sexuallly promiscuous heterosexuals is present. Only the extent is unpredictable.

One thing is known with certainty — transmission of AIDS, except by sexual or transfused blood, is zero or near zero. This is an extremely difficult infection to contract — fairly lucky for the survival of

the species when one considers how far the spread was prior to discovery of the disease.

A brief word about treatment is in order. The virus is not curable. Treatment has been directed at slowing the replication of the virus and that has proved to be of some benefit. That along with improved treatment of the opportunistic infections which usually are the killers of persons with AIDS, had prolonged the lives (and unfortunately the deaths) of its victims. Spectacular improvement should not be expected through the decade.

In conclusion then we are faced with a disease which lasts years before it is called the disease. It is a disease which currently affilicts despised minority groups of sexual orientation and of drug abuse as well as traditional skin color. Current Black to white ratios are 12:1 for non homosexual male victims. The future is not clear as to the course of the disease. How far and how fast the disease spreads is unknown and is in part a function of the learned behavior of people.

Of perhaps more concern is how society shall deal with an infectious disease which has an extremely high incidence in social outcast minority groups. Similar diseases in livestock are controlled by killing all members of the herd if a member becomes infected. Less draconian measures may be tried by various societies but may involve a reduction of individual liberty in the name of protecting the public health. The balance between individual rights and public health in regards to AIDS is heavily weighted in favor of public health because of the extreme non-trivial nature of the infection. Further enthusiasm for more severe liberty curtailment can be expected because of the outcast status of the currently affected minorities.

Our knowledge of AIDS started with iatrogenic immune deficiency which was caused by doctors, who in their enthusiasm for curing cancer, killed the patient's immune system and thus the patient. Society, in an effort to eliminate AIDS, can follow the same path and eliminate the individual rights of their members. Again, as with the spread of the disease, this is a function of learned human behavior of people. As such, it is somewhiat unpredictable in this stage of the epidemic.