

Genetic Therapy and the Future of HIV
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What is HIV?

With the worldwide spread of HIV, the old adage that knowledge is power rings more true than ever. Everyone has heard of HIV, but few among us know more about it than the facts that a) it is a sexually transmitted disease, and b) it is deadly. The time has come to shed some light on a few unknown but important facts. First of all, HIV is not AIDS, it is the precursor to AIDS. HIV stand for Human Immunodeficiency Virus, which in turn can eventually cause Acquired Immune Deficiency Syndrome, or AIDS. This means that the organism that gives rise to one of the most virulent and transmissible diseases known to man shares much of its structure and function with the organism that causes the flu. The jury is still out on whether or not a virus constitutes a living organism or merely an antigen, but what we know is that a typical virus is made of only a handful of parts, most importantly the capsid, which is a protein coat that houses DNA (or RNA in retroviruses, more on those in a moment) and spindle, which contracts to inject the genetic material of the virus into a host cell, since the virus is incapable of sexual or asexual reproduction. This DNA/RNA combines with or takes over the host DNA and changes the internal machinery of the cell to that of, for lack of a better term, a virus factory. The host cell uses all its resources to replicate the functional virus until the cell ruptures, releasing hundreds or thousands of new viruses to begin the process again. HIV is classified as a retrovirus, which means that instead of taking over the host cell right away, its genetic material is integrated into that of the host cell. The host cell then functions normally for a period of time before the virus' genetic material is activated through a process we do not yet fully understand. This explains the latency period between contraction of HIV and AIDS diagnosis, which can be anywhere from six months to thirty years. Currently there is no cure for AIDS, and while quality of life can remain at

normal or near normal levels for any given length of time, the mortality rate for AIDS is one hundred percent. Gene therapy has the potential to change this incurable, fatal disease into nothing more than a distant memory.

What is Gene Therapy?

Gene therapy is defined as "The insertion of genes into an individual's cells and tissues to treat a disease."⁽¹⁾ While the process sounds simple, the manipulation of genetic code has only recently made the transition from science fiction to science fact. In the case of HIV, the virus' genetic material is altered with an "antisense codon." What this means is that the stop sequence for the viral RNA is changed to a null codon, effectively short-circuiting the virus' ability to reproduce. The virus is then allowed to infect cells of the body, where the virulent RNA is replaced with the modified RNA, rendering the viral genetic material inoperable. This effectively puts a halt to the reproductive cycle. Genetic therapy is on the razor's edge of today's technology, and it shows more promise for treating previously incurable diseases and afflictions than almost any other medical alternative. Gene therapy's promise is to one day provide treatments that are tailor-made for each individual, with guaranteed effectiveness and zero side effects. AIDS is one of the diseases currently at the forefront of genetic research, and significant progress has been made thus far; in one experiment 15 persons who were AIDS positive and failed to respond to at least two current antiviral drugs were injected with T-cells that had been taken from their bodies, purified, and re-infected with a genetic alteration of the HIV Virus. According to the BBC, "Viral loads of the patients... decreased during a trial lasting nine months," "T-cell counts remained steady or increased in four of every five patients," and "Researchers were able to detect the modified cells in patients for months, and in some cases years after the infusion."⁽²⁾

Back to Reality

Unfortunately, as many critics will be exceedingly quick to point out, gene therapy is still in its infancy, and as such, it is still extremely costly per capita. The processing and introduction of new genetic material into the body is still not an exact science, and many of the long term effects will not be known for some time. Try telling that to the next HIV positive patient who walks into a hospital. Gene therapy offers one of the last, best hopes for not only those who live around the corner, but the millions of people who suffer from this modern day pandemic, and as such, a promise should be made to those millions to continue to search for a cure. HIV and AIDS, along with numerous other genetic and hereditary diseases have placed countless lives on the line. As medical professionals, it is up to us to win the battle, and we have just added a new weapon to our arsenal.

1. Wikipedia - the free online encyclopedia

http://en.wikipedia.org/wiki/Gene_therapy

2. BBC news on the internet

<http://news.bbc.co.uk/2/hi/health/6120042.stm>