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In 1985, over 10, 000 cases of AIDS were reported worldwide (White and Fenner 1986). Just over a decade later, in 1998, the Global AIDS Policy Coalition estimated that 30. 6 million people were infected with HIV worldwide. It has also been projected that by the year 2000, between 40 and 70 million adults will be infected with HIV (New Generation Vaccines 1997). Over 90% of all HIV-1 infected individuals live in developing nations: 50% in Southeast Asia and 40% in sub-Saharan Africa. However, even with all of these alarming statistics and projections, there is hope for the future of humanity. This hope is a potential anti-AIDS vaccine.

An anti-AIDS vaccine is the best bet. Among other factors, the large costs associated with therapeutic drugs do not allow many AIDS patients receive them. This is especially true in the developing nations, constituting over 90% of all HIV infections worldwide (Bloom 1995). Before discussing the development of a potential vaccine, it is imperative to briefly discuss characteristics of HIV itself and also the immune system that these vaccines would target.

HIV, a retrovirus from the Lentivirus subfamily, contains ssRNA nucleic acid. Some of its other characteristics include: an icosahedron capsid, various enzymes (including reverse transcriptase), and envelope with the glycoproteins gp 120, gp 41, and gp160. The genes of HIV-1 can be placed into 3 general categories: structural, regulatory, and accessory genes. The structural genes include gag, pol, and env. The regulatory genes include tat and rev. The accessory genes are nef, vpr, vpu, and vif (Vaccines 1999). There are two major branches to the immune system in primates: a humoral

or adaptive branch and a cell-mediated or innate branch. The cell-mediated immune response operates through MHC I via CD8+ (cytotoxic T cells).

Antibodies are not secreted through this branch of the immune system, and the cell-mediated immune response generally targets viruses and other intracellular antigens. The humoral immune response operates through MHC II via CD4+ (helper T cells). The humoral branch secretes antibodies, which generally target extracellular antigens like bacteria and fungi. There are many obstacles in the way of HIV vaccine development.

First, since HIV often mutates its surface glycoprotein (gp120), it has many strains, and the immune response cannot target all of the possible strains. The genetic diversity among HIV-1 strains is also do to an error-prone reverse transcriptase enzyme, as well as recombination. The second obstacle is the lack of an inexpensive, suitable animal for testing the efficiency of an HIV-1 vaccine. Chimps, baboons, and gibbons can be infected with HIV, however they are endangered and cost between $60, 000 and $100, 000 each. These animals are also unable of assessing a vaccine’s ability to prevent disease, since infected chimps do not develop AIDS (New Generation Vaccines 1997). SCID mice have given optimism to the search for a practical animal model. SCID mice are mice that have been populated with human T cells. When these mice are presented with HIV, the human T cells in the mice become infected.

These mice have already helped researchers find therapeutic levels of AZT and ddI for humans (Kuby 1997). There are several characteristics for an

ideal HIV vaccine. First, the vaccine should be inexpensive. This would enable developing nations to have access to it.

Secondly, the vaccine should be able to evoke a strong response from both the humoral and the cell-mediated immune branches. Finally, the vaccine should be effective against multiple strains of HIV (Vaccine Strategies 1997). There are five potential vaccine candidates that will be discussed: whole inactivated vaccines, live attenuated vaccines, live recombinant vector vaccines, subunit vaccines, and naked DNA vaccines. Initially, whole inactivated vaccines looked as if they protected macaques from SIV infection. However, it was later discovered that the macaque immune response was actually responding to xenoantigens (Vaccines 1999). This vaccine is no longer considered a serious candidate for human vaccines, because of this early failure in chimps and safety concerns. Most vaccines are live attenuated vaccines.

This type of vaccine weakens the pathogen in an attempt to eliminate its virulence while allowing it to still infect the host. Examples of live attenuated vaccines include measles, mumps, rubella, and polio. The virus can infect cells and grow for a limited time before the immune