DNA Vaccines And HIV / AIDS

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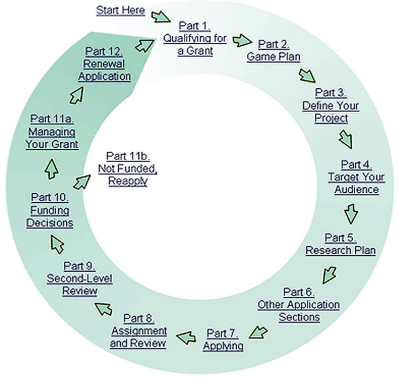
Great Problems Seminar:
Heal The World

Problem Statement

HIV / AIDS affects over 33 million people worldwide, with the greatest number of victims located in developing countries. Conventional drugs only ease symptoms and do not cure the disease. A DNA vaccination that knocks down the CCR-5 gene could offer a solution to the disease.

Over 33 Million People Live with HIV/AIDS Worldwide

HIV is a retrovirus that infects T-cells which are central in adaptive immunity. It enters a cell by attaching to the CD4 receptor and the CXCR4 or CCR5 co-receptor. The HIV infection causes the body to lose cell immunity. The current treatment for HIV/AIDS, a triple cocktail which combines protease and reverse transcriptase inhibitors, costs about $10,000-$15,000 a year. However, the protease inhibitors increase the risk of cardiovascular disease and sudden heart failure in middle-aged HIV/AIDS patients.



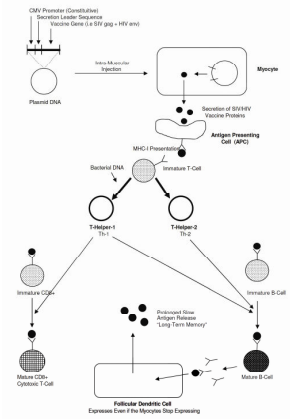
Creating the Vaccine: Funding

While the cost of delivering a DNA vaccine to a patient is cheap, the initial discovery cost of the vaccine is in the millions.
In 2000, contemporary pharmaceutical companies estimated the cost of creating a new drug was $403 million.
Two potential HIV / AIDS vaccine trials were scheduled, estimated to cost $140 million and $63 million dollars. In order to create a vaccine, additional funding would be needed from outside sources:

- The Bill and Melinda Gates Foundation
- Private foundations
- Universities and research centers
- National Institute for Health (NIH):
  - Estimated budget in 2008 is $2,905,219,000 with $596,195,000 allocated for AIDS/HIV research.

DNA Vaccines

A DNA vaccine works by directly injecting DNA into the body, either the muscle or skin. Carrying the genetic information required, it begins producing antigens inside a host cell which will lead to a cell-mediated immune response. The plasmid DNA vaccine carries the genetic code for a piece of pathogen antigen and transcribes it to the nucleus. The mRNA is translated into protein and then into peptides. The cytotoxic CD 8+ lymphocytes bind to the peptides and induce the cell-mediated immune response.



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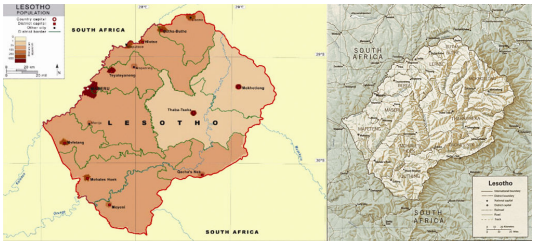
Trial Areas: Lesotho and the United States

United States
- Developed nation
- Unstable economic and politics minimized
- Focus can be made on effectiveness of vaccine

Lesotho
- 270,000 people infected with AIDS (23.2% of population)
- Relatively small area (11.720 sq miles)
- Presence of Riders for Health
- Variety of variables stereotypical of developing nations



Assessment:

Data	Reason
Name	• Determine if patients completed treatment and retuned for follow ups
Housing Location	• Environmental factors that contribute to spread of disease • Area in need of alternative distribution method
Blood Test Results	• Check HIV virus level
Dietary Habits	• Nutrition Level
Clinical Visitation Dates	• Followed inoculation regiments (grace periods between treatments)
Age	• Determine most susceptible population to target • Most treatment responsive age
Gender	• Check for gender specific side effects
Economic Status (Income)	• Determine most susceptible population to target • Determine price range affordable
Family History (if Available)	• Determine potential genetic diseases • Other diseases that could be attributed to death if occurs
Patient Health History	• Determine progression of HIV/AIDS in system
Allergies	• Cease distribution to patient to avoid hyperimmune response
Prescriptions	• Determine if certain medications heighten vaccination response • Determine if certain medications increase health risks