immunizing with a pool of solubilized class I and class II HLA antigens, including those shared with gp120. Such an approach would maximize the number of immunizing determinants and minimize the risk of infecting the prospective vaccinee with blood-borne viruses.

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A Magic Bullet Against AIDS?

A prophylactic vaccine against infection by the human immunodeficiency virus (HIV) is years away at best (*1*) and once developed will face formidable obstacles to successful deployment (*2*). Although many researchers are promoting behavioral interventions to diminish the spread of acquired immune deficiency (AIDS), as noted in the news article by Jon Cohen, the prevailing attitude is that such interventions—the use of condoms or the sterilization of drug injection equipment, for example—are inherently inferior to the "magic bullets" proffered by biomedical science. The veracity of this proposition, however, has received little critical examination.

In order to demonstrate the importance of behavioral risk reduction, one can pose the question, How large a proportion, ϕ, of the sexually active population would need to be *successfully* vaccinated to decrease the rate of HIV reproduction to the same as that attained by the universal (100%) use of condoms? [The reproductive rate (3) is essentially the number of secondary infections arising from each primary infection early in the epidemic.] If each act of sexual intercourse capable of transmitting the virus constitutes an independent Bernoulli trial (4), then ϕ can be approximated by

$$\phi = 1 - \frac{1-(1-\alpha\epsilon)^c}{1-(1-\alpha)^c}$$

where α denotes the infectivity of HIV (that is, the per-contact probability of transmission from an infected to an uninfected partner), ϵ denotes the condom failure rate, and c is the number of sexual encounters during a sexual relationship of average duration.

If one assumes that $c\alpha$ is not too large, then $(1-\alpha)^c \approx 1 - c\alpha$, hence

$$\phi = 1 - \epsilon$$

In other words, if condoms are 90% effective in preventing the transmission of HIV, then 90% of the population would have to be successfully vaccinated for society to get the same benefit (the same reduction in the spread of AIDS) as it would from the conscientious use of condoms (5).

Although precise estimates of the failure rate of condoms with respect to HIV transmission are difficult to obtain (6), it appears that the commonly cited figure of 10% is conservative; recent studies indicate a 2% failure rate when condoms are properly used (7). If condoms are, in fact, about 90% effective, it seems reasonable to question whether *any* vaccine could protect the population against HIV infection as well as the consistent use of condoms; θ is the proportion of the population that is *successfully* vaccinated and is therefore the product of the percentage vaccinated and the efficacy of the vaccine. Thus, unless vaccination of the entire population could be ensured, even a 90% effective vaccine would not equal the protection offered by the consistent use of condoms.

The above analysis is oversimplified and assumes a rather unrealistic rate of condom usage (100%). Nevertheless, the take-home message should be clear: biomedical solutions alone cannot defeat AIDS; only humans can. Thus, our prevention "eggs" should be distributed into several "baskets," including producing better condoms and facilitating their use.

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Transportation Costs and the National Debt

In buying a car, one considers many things, including price, comfort, appearance, and a preference for one make rather than another. A consideration in the mind of many purchasers is miles attainable per gallon of fuel, a number that is clearly posted on the price sticker of each new vehicle. What is really important, however, is cents per mile; in other words, how much does it actually cost to own and operate an automobile?

The answer can be readily obtained from *Motor Vehicles Facts and Figures* (1). In this study, ownership costs are based on a 6-year or 60,000-mile retention cycle. All costs, including those for gas and oil, maintenance, tires, insurance, license, registration, depreciation, and finance charges, are included. In 1992, the national average total cost per mile was 45.77¢, which included 5.2¢ per mile for gas and 0.8¢ per mile for oil change charges. Thus, the net cost for gasoline was about 5¢ per mile or about 10% of the total transportation cost of 45.77¢ per mile. This fuel cost is the lowest in recent history and reflects progress in engine efficiency achieved over the last 20 years (2): for all registered cars, the average miles per gallon was 13.3 in 1973 and 17.1 in 1983; the preliminary data indicate 21.7 for 1991.

The impact of an additional gasoline tax should now be considered. The current congressional proposal, after long and tedious debate, centers at about 5¢ per gallon. The effect of this tax on transportation cost would be 5¢ divided by 21.7 (the current average miles per gallon), which equals a 0.23¢-per-mile increase. Thus, instead of 45.77¢ per mile, the new transportation cost would be 46.0¢ per mile, an increase of only 0.5%. The same 5¢ gasoline tax increase, when based on the 1991 consumption of 120 billion gallons of gasoline (3), would bring in $6 billion per year. Thus, in the major drive