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Cheap Vaccine Can Be Costly

Use of Such Potent Drugs Should Be Viewed As Another Major Medical Procedure

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Science and Man

IN THIS SERIES of articles on the biology of viruses, and its practical application to the public health, I have been placing considerable stress on the gaps in our knowledge of viruses. It is not my intention to discourage important public health programs like polio and measles vaccinations. However, it is possible for a vaccine that prevents a million cases of a major disease to cause serious side effects in 10,000 people.

Because these 10,000 might not have been among those who would have come down with the main disease, medical research has a responsibility to perfect its tools to a higher standard, even while the best ones available are distributed as widely as possible.

Where vaccination is legally compulsory, as it is against smallpox; or virtually so, as against polio, we can observe an interesting question of social policy. When a large fraction of the population is already vaccinated, the chain of infection is broken—with great benefit to unvaccinated people as well. If one individual then refuses vaccination, he no longer exposes himself to very great risk, but is exploiting his fellow citizens who have taken the trouble to be immunized.

Some individuals may have their own reasons to refuse to participate in this kind of social insurance; and if so, it might be perfectly reasonable to impose a special tax as an alternative contribution to the general welfare.

WHAT ARE THE important gaps in our knowledge of viruses? Most important, what happens to a live virus in the human body after it is put there by the vaccination? Infection with measles, for example, usually confers lifelong protection, and this may imply that some tissues remain permanently infected with the virus—or with some parts of its genetic machinery—but this is only speculation.

The most important issue in the virulence of a strain of a virus is its tissue specificity. The terror of poliovirus is that wild strains occasionally leave the gut, which they usually inhabit with no notable harm to the host, and enter the central nervous system. The tame strains used for Sabin vaccine have been selected empirically for having lost this propensity to travel, but we know nothing about the biochemical basis of the viruses' tastes for one tissue versus another.

We are in a very poor position to predict what might happen to reawaken a virus's appetite for brain.

However, we are beginning to understand dimly some of the ways in which virus genes interact with those of host cells, which is obviously fundamental to eventual knowledge of these relationships. We also know that viruses of different strains can interact with one another and produce new strains. This opens the possibility that harmless strains could cross-breed and produce virulent progeny. This kind of result is easily demonstrated in the laboratory.

The conceptual tools to attack these problems come mainly from basic research in molecular biology, much of it seemingly very distant from problems of human disease. For example, the major turning point in our modern understanding of viruses came from the work of Dr. A. D. Hershey of Cold Spring Harbor, Long Island, N.Y.

His work during the past 15 years on genetic exchange in bacterial viruses, and on the role of nucleic acid as the actual agent of infection, laid the groundwork of current manipulation of animal viruses. It is an outstanding example of cogent scientific insight that has influenced every worker in the field, but is almost unknown to the general public.

ALTHOUGH we should be avidly seeking new knowledge, there is a great deal we do know that is not now applied in practical vaccine production. We know how to purify viruses as chemical entities; but most vaccines are crude products harvested directly from infected cultures. For example, there is no regulation that a vaccine be examined under an electron microscope for uniformity of its virus particles, or that it be analyzed for its nucleic acid composition or for the molecular weight of its particles. The routine application of similar techniques would have led to a much earlier detection of the SV-40 contamination of polio vaccines.

Cost is the main excuse for neglect. But cheap vaccines may result in the most horrendous catastrophes. Vaccines are probably the most potent drugs we expose ourselves to. They can convey enormous benefits, but if we are to get the most out of them we must regard each vaccination with the same rigor as any other major medical procedure. We can hardly afford not to.