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LETTERS

AIDS and the Polio Vaccine

As a scientist, I did not intend to debate Tom Curtis when he presented his hypothesis about the origin of AIDS in *Rolling Stone* (*1*). The publication of his letter in *Science* (29 May, p. 1260), however, transferred the debate from the lay press to a highly respected scientific journal. I would now like to state my views, based on facts, in order to counter and thereby repudiate Curtis' hypothesis about the origin of AIDS.

Polio epidemics were raging throughout the world in the late 1940s. At that time, the late Tom W. Norton and I developed a concept to try to attenuate the poliovirus through its passage in unnatural nonprimate hosts and through cloning of the virus for selection of variants avirulent for monkeys injected intracerebrally. It was a difficult task but we finally succeeded (*2*), between 1949 and 1952, in attenuating the three types of poliovirus and using them for vaccination in preliminary trials in the United States.

Curtis has theorized (*2*) that the "African epidemic was spawned by a contaminated polio vaccine administered from 1957 to 1960 to at least 325,000 people in Rwanda, Burundi and the former Belgian Congo." He has stated that the area of vaccination of children in Ruzizi Valley in 1958 corresponds "roughly to another map . . . the one identifying the regions of highest HIV [human immunodeficiency virus] infection in equatorial Africa" (*1*). This is completely wrong. Ruzizi Valley, where 215,504 subjects were vaccinated in 1958, is located in the northwestern part of the Republic of Burundi, not in the Kivu district of Zaire, an area where Curtis placed "the lion's share of their [Koprowski and his associates] samples" (*1*). Curtis refers to the "high prevalence of antibodies" to the AIDS virus without symptoms of disease in the Kivu district. The finding of a high rate of HIV among healthy populations (*3*) could be ascribed to the well-recognized fact that ELISA (enzyme-linked immunosorbent assay) tests of the first generation developed at that time show a high rate of nonspecific positive reactions. This was taken into consideration in the second report of the same investigators (*4*), who say that "reactivity in both ELISA and Western Blot analysis may be non-specific in healthy Africans" (*4*). Thus, the high prevalence (12 to 24%) of HIV in the rural Kivu population had to be scaled considerably downward, particularly in the light of recent reports that out of 675 blood donors from Kivu only 25 (3.7%) (*5*) were seropositive for AIDS antibodies.

Since 1985 many epidemiologic studies have been carried out in the rural populations of northeast Zaire, Burundi (Ruzizi Valley), and Rwanda. The results of these studies confirm the previously published low rate of HIV infection in these areas [0.7% for rural Burundi (*6*), 1.3% for rural Rwanda (*7*), and 3.7% (*5*) for rural Zaire]. It is thus misleading for Curtis to say that Ruzizi Valley and the surrounding rural area of Zaire are heavily infected by AIDS. If the AIDS virus had been administered to children in Burundi in 1958 through polio vaccine immunizations, would not a much higher percentage of infected adults than 0.7% be observed in the rural areas? Yet it is the urban area in which the population is heavily (25 to 30%) infected with HIV, and it would seem that the spread in Africa occurs from urban areas to rural areas, not vice versa.

If one were to say that, since we gave polio vaccinations to the population in Léopoldville (now Kinshasa), capital of the former Belgian Congo, we could have started the AIDS epidemic there, we can point out that the same pool of virus material was used for the vaccination of children in Léopoldville and of children in Poland (*8*). Inasmuch as the prevalence of AIDS in Kinshasa today is 25 to 30% and Poland has the lowest incidence of AIDS in Europe, one would have to undertake super-speculative acrobatics to incriminate the vaccine as the source of the AIDS in Africa. Even the supposedly early cases of AIDS in Africa were clinically diagnosed several thousand kilometers away from the Kivu region (*9*). And the first proved case of AIDS was in a British sailor who died in 1959 and who showed symptoms of the disease throughout 1958, before any mass vaccination for polio was started (*10*).

After the original batch of the type II polio vaccine was produced in cotton rat brain (*11*), all other batches were produced in kidney tissue obtained from rhesus monkeys (*Macaca mulatta*) captured either in India or the Philippines (*12*). India's ban on the shipment of their monkeys outside India did not affect delivery from the Philippines. Curtis' speculation that we could

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have used in our production kidney tissue from other species of monkeys that might have harbored a simian immunodeficiency virus (SIV) or an HIV virus has no basis in fact. Importers of rhesus monkeys were carefully scrutinized by the U.S. government, and they could not supply tissue from animals coming from mixed sources. In addition, even if one speculates that green monkey tissue could somehow have been mixed up with rhesus monkey tissue, it has been shown that neither embryonic nor kidney tissue removed from SIV-infected African green monkeys contains SIV (*11*, *12*).

Curtis attempts to make a case by saying "the Koprowski Congo preparation" may have been contaminated with an "unidentified cell-killing virus" found by Albert Sabin (*13*). First, Sabin did not test the Congo vaccine, but rather a seed lot of virus. Second, the same material in which he detected the presence of an unknown agent was retested in our laboratory and in two other labs, and no extraneous virus was found (*14*). Finally, it was reported at the Second International Conference on Live Polio Vaccines in 1960 that many monkey kidney vaccines infected with different strains of poliovirus, including strains developed by Sabin, contained "vaccuolating agents" cytopathic for tissue culture and contained foamy viruses. Such viruses were also isolated from polio noninfected cultures of both rhesus and cynomologous monkeys (*15*). I have presented cogent arguments (*16*) that the presence of these viruses does not disqualify the polio vaccine for worldwide use. I have, however, said that when a permanent culture of a human diploid cell strain free of all extraneous contaminants becomes available, it should be used for the production of poliovirus vaccine (*12*). The desire to replace the monkey kidney vaccine did not arise from concern about its safety. As a scientist, I felt that cells of human diploid culture kept permanently in a culture that could be kept at a limited passage level in vitro and thoroughly scrutinized for lack of extraneous contaminants should be recommended for vaccine production. Lots of vaccines produced in human diploid cells have been used for immunization in Switzerland (*17*) and in Croatia (*18*).

Among the 7,239,000 children vaccinated in Poland (*19*), 34,000 in Switzerland (*20*), and 1,500,000 (one-fourth of the entire population) in Croatia (*21*), careful follow-up observation has proved the vaccine to be safe and unassociated with any major illness. Even after the vaccination of 76,000 children in Léopoldville (*8*), it was possible to observe the vaccinees long enough to establish the protective effect of the vaccine at the time of an epidemic of poliomyelitis (*23*). Again, there was no doubt about the safety of the vaccine because there were no untoward reactions that could be attributed to an extraneous agent (*23*).

Curtis does not distinguish between lots of vaccines and seed lots of virus. There is no vaccine stored at the Wistar Institute, but there are a few vials of tissue culture supernatants available that may represent seed lots used for production of vaccines in the years 1957 to 1959. Curtis (*2*) suggests testing these samples "by multiple PCR [polymerase chain reaction] and other tests in independent labs by investigators of unquestioned integrity and stature *outside the United States* [italics mine]—preferably in England and Switzerland." Any competent AIDS research lab could qualify to test these samples provided positive and negative controls are included in the assay. If the seed lot is found free of exogenous retroviruses (which is highly probable), contentious individuals could still argue that this does not represent what might have been present in the large lot of vaccine.

The argument for the safety of polio vaccination lies in the absence of any AIDS-related disease among the hundreds of millions of people vaccinated throughout the world; the fact that AIDS is rampant in subequatorial Africa can only be attributed to the polio vaccine by the wildest of lay speculation (*24*).

Tremendous efforts were made by scientists to save children from paralytic polio. The current anxiety among parents of children who have been or are going to be vaccinated against polio followed dissemination by the lay press of unproved theories of the origin of AIDS. This was unnecessary and harmful, particularly since the vaccine was tested thoroughly before any vaccination was done; the vaccine was and continues to be safe.

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REFERENCES AND NOTES

1. T. Curtis, *Rolling Stone*, no. 626 (19 March 1992).
2. _____, *Washington Post*, 5 April 1992, sect. C, p. 3.
3. R. J. Biggar *et al.*, *Brit. Med. J.* **290**, 808 (1985).
4. _____, *Lancet* ii, 520 (1985).

5. P. R. Fischer *et al.*, *Vth International Congress of AIDS in Africa, Kinshasa, Zaire, October 1990*, abstr., p. 197.
6. *Programme national de sero-prevalence de l'infection par le virus de l'immuno-deficience humaine (VIH) on Burundi. Juillet 1989–Fevrier 1990* (Ministre de la Santé Publique, Bujumbura, Republique du Burundi, 1990), p. 12.
7. Rwanda Sero-Prevalence Study Group, *Lancet* i, 941 (1989).
8. S. A. Plotkin *et al.*, *Bull. WHO* **22**, 215 (1960).
9. J. Sommet *et al.*, *Scand. J. Infect. Dis.* **19**, 511 (1987).
10. G. Williams *et al.*, *Lancet* ii, 951 (1960).
11. H. Koprowski, G. A. Jervis, T. W. Norton, *Am. J. Hyg.* **55**, 108 (1952).
12. H. Koprowski, *J. Am. Med. Assoc.* **178**, 1151 (1961).
13. Y. Ohta *et al.*, *AIDS* **3**, 183 (1989).
14. R. Kurth, personal communication.
15. A. Sabin, *Brit. Med. J.* i, 663 (14 March 1959).
16. H. Koprowski, *ibid.*, p. 1349 (23 May 1959).
17. B. H. Sweet and M. R. Hilleman, *Second International Conference on Live Poliovirus Vaccines, Washington, DC* (Pan American Sanitary Bureau, Washington, DC, 1960), pp. 79–89.
18. H. Koprowski, *J. Am. Med. Assoc.* **173**, 972 (1960).
19 F. Buser *et al.*, *Proc. Symp. Charact. Uses Hum. Diploid Cell Strain* (1963), p. 38.
20. D. Ikic *et al.*, *ibid.*, p. 405.
21. F. Przesmycki and J. Kostrzewski, paper presented at a meeting of the European Association against Poliomyelitis, Oxford, England, 17 to 20 September 1961 (abstr., p. 79).
22. G. Ritzel *et al.*, *Schweiz. Med. Wochenschr.* **91**, 616 (1991).
23. D. Ikic *et al.*, *Bull. WHO* **28**, 217 (1963).
24. S. A. Plotkin *et al.*, *ibid.* **24**, 785 (1961).
25. Curtis states that he is not "the author of the theory" of the origin of AIDS. He says that the idea came to him from Blaine F. Elswood, whose paper written with R. B. Stickler "has been accepted by *Research in Virology*." This paper is still not published.

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Fetal Tissue Banned . . . and Used

In his editorial "Fetal tissue research" (26 June, p. 1741), Daniel E. Koshland, Jr., says that research on the use of fetal tissue "could lead to the development of cell lines or drugs that could be the basis of large-scale therapy." In fact, normal human fetal cell strains have been used in precisely this way in the United States since 1962. Thirty years ago my colleagues and I reported that a poliomyelitis vaccine produced in such cells was both safe and efficacious (*1*). Our human fetal cell strain, WI-38, and similar strains derived from surgical abortions, are used in the United States for the production of vaccines against poliomyelitis, rubella, adenoviruses, and rabies. When he recently vetoed the bill that would have sanctioned the use of human fetal tissue in transplantation research, President Bush might well have pondered this: it is quite likely that, like tens of millions of other Americans, he has received vaccinations produced in human fetal cells.

Seventeen years ago, the WI-38 cell strain was said by federal government officials to be so valuable (they called it a "national resource") that they claimed title to it and confiscated the cells from my laboratory. After 7 years of litigation, my lawsuit against the government was settled out of court in my favor (*2*). Title to the self-duplicating systems that soon became the heart of the emerging biotechnology industry was agreed to be vested in the discoverer (*3*). Thus, the government returned to me most, but not all, of the ampules of WI-38 cells. Throughout the Reagan and Bush administrations the government has funded the distribution of its WI-38 cells for profit—a use of surgically aborted human fetal tissue that they publicly trumpet to be so abhorrent.

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REFERENCES

1. L. Hayflick, S. A. Plotkin, T. W. Norton, H. Koprowski, *Am. J. Hyg.* **75**, 240 (1962).
2. B. L. Strehler *et al.*, *Science* **215**, 240 (1982); L. Hayflick, *Exp. Gerontol.* **24**, 355 (1989).
3. L. Hayflick *Proc. Int. Assoc. Biol. Stand.* **70**, 11 (1989); *Adv. Cell Cult.* **3**, 303 (1984).

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The Rowland Institute

The profile by Ivan Amato of the Rowland Institute for Science (News & Comment, 19 June, p. 1625) suggests that Edwin H. Land never explained the origin of the name. The institute is surely named in honor of Henry Augustus Rowland (1848–1901), first Professor of Physics at Johns Hopkins University. Rowland was a founder of scientific optics. At the Rowland Wood Symposium at Johns Hopkins University, brilliantly organized in 1975 by William G. Fastie and Aihud Pevsner, Land indicated that as a youngster he had written to a professor at Hopkins (undoubtedly R. W. Wood) and received strong and continuing encouragement of his interest in optics.

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In Amato's article, "The Rowland Institute for Science: Land's last experiment," an institute investigator, Steven Block, is quoted as saying that "this place would not have worked if it were somewhere in the middle of Kansas." We *live* in the middle of Kansas, and we disagree. Unfortunately, some think that Dorothy and Toto remain the only inhabitants of the state and overlook the fact that a few others, accomplished business people and scientists among them, have taken up residence happily amidst the amber waves of grain. Although its "intellectual fellowship" may use telecommunications instead of mass transit, Kansas has much more to offer the Rowland Institute and the scientific community as a whole than an occasional tornado.

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Response: Henry has a good instinct, but staff members at the Rowland Institute for Science consider Land's admiration for Henry A. Rowland as only a possible source of the Institute's name. Another theory is that Land combined the word "row," which might have referred to his son-in-law's love for rowing, and land, for obvious reasons. "Land absolutely wouldn't tell," says Institute scientist Steven Block.

As for the Conrads' objection to Block's colloquialism that happens to reduce Kansas to an intellectual backwater, I hear ya. I'm from New Joisey, which even Kansans have been known to mistakenly think of as a turnpike with vast acreages of blacktop on either side—**Ivan Amato**

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Biological Motors

The recent Research News article by Michelle Hoffman about biological motors (26 June, p. 1758) includes a section on chromosome movement that gives me more credit than I deserve or desire. I was not the first to provide evidence that chromosomes might be self-propelled, as implied in the article. Mitchison and Gorbsky and co-workers (*1*) are the true pioneers. My remark that "No one had taken [the] suggestion [of self-propulsion] seriously before" was a celebration of these collective efforts, not of my one experiment.

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REFERENCES

1. T. Mitchison, L. Evans, E. Schultze, M. Kirschner, *Cell* **45**, 515 (1986); G. J. Gorbsky, P. J. Sammak, G. G. Borisy, *J. Cell Biol.* **104**, 9 (1987); *ibid.* **106**, 1185 (1988).