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Publication Details

Martin, B, The politics of a scientific meeting: the Origin-of-AIDS Debate at the Royal Society, Politics & the Life Sciences, 2001, 20(2), 119-130. Published by Beech Tree Publishing. The original journal can be found here.

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The Politics of a Scientific Meeting: the Origin-of-AIDS Debate at the Royal Society

Published in *Politics & the Life Science*, Vol. 20, No. 2, September 2001, pp. 119-130 [appearing in print September 2005]. The version here differs from the published paper in minor ways due to sub-editing. The published version is also available.

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Abstract

The Royal Society of London held a scientific meeting in September 2000 focusing on two theories of the origin of AIDS, one that it occurred through "natural transfer" of immunodeficiency virus from monkeys or chimpanzees to humans and the other that it occurred through iatrogenic transfer via contaminated polio vaccines used in Africa in the late 1950s. This meeting was the culmination of years of public contention over the polio-vaccine theory. Several dimensions of the politics of science are revealed by analysis of this issue, including the power of scientific editors, the use of the mass media, decisions about selection of speakers and organization of the meeting, and epistemological assumptions made by participants.

In London on 11-12 September 2000, the Royal Society - the independent scientific academy in Britain, the counterpart to the U.S. National Academy of Science - hosted a discussion meeting on the "Origins of HIV and the AIDS epidemic." The brochure about the meeting gave this synopsis: "HIV-1 and HIV-2 causing AIDS are new human viruses of animal origin. When, how and why these cross-species infections occurred is the topic of this meeting. Discussion will focus on possible natural and iatrogenic routes of transmission in zoonosis and the subsequent epidemic spread of HIV."

Since 1992, there had been fierce contention between advocates of two contrasting AIDS origin theories. Both sides agreed that AIDS arose when a simian immunodeficiency virus (SIV) from a monkey or chimpanzee was transmitted to and took hold in the human species, becoming the human immunodeficiency virus (HIV). The question of how this occurred divided the two camps.

One theory was that SIV jumped species when a hunter, while butchering a monkey, had gotten monkey blood in a cut or, alternatively, virus transfer occurred through a monkey bite or from eating undercooked monkey meat. This theory, commonly called "natural transfer" or "cut hunter," was held by most researchers in the AIDS field (Hahn et al., 2000). The competing theory was that SIV entered humans through contaminated oral polio vaccines - cultured on monkey kidney cells - given to a million people in central Africa in the late 1950s. Called the polio-vaccine or OPV (oral polio vaccine) theory, it was advanced by a small group of journalists, independent scholars and scientists (Hooper, 2000a).

Many other theories have been proposed for the origin of AIDS, including that it was due to smallpox vaccines or to a biological warfare experiment gone wrong (Hooper, 2000a: 151-69; Lederer, 1987/1988). As well, the idea that AIDS is not a distinct disease at all and that it is not due to HIV has received considerable visibility, especially through the efforts of molecular biologist Peter Duesberg (Duesberg, 1996; Maggiore, 1999; for a critique see Harris, 1995). However, at the Royal Society meeting the two main contenders were the cut-hunter and polio-vaccine theories, and the focus here will be on these two theories.

The Royal Society meeting revealed, in concentrated form, the intense symbiosis of science and politics that had long characterized the origin-of-AIDS issue and which is found in many scientific controversies. The meeting provides a useful window into rhetorical and organizational strategies that can be used by partisans at a scientific meeting, and their limitations. In this article, considerable scrutiny will be given to the meeting itself as well as to the build-up to it.

In the next section, the earlier history of the treatment of the polio-vaccine theory is outlined; this is essential background for understanding the dynamics of the Royal Society meeting. In the following section, the Royal Society meeting is described, including politicking beforehand. In the final section, the numerous political dimensions of the issue are summarized.

The origins debate to 1999

AIDS was first diagnosed as a distinct disease in 1981. Within a couple of years HIV was discovered and since then scientific consensus has been that HIV infection is necessary to cause AIDS. In 1985, SIVs were discovered in African monkeys. Since the SIVs are the closest known relatives to HIVs, it seemed plausible that AIDS was a new disease caused by one or more SIVs entering and becoming transmissible in humans.

With no direct evidence for a specific transmission event, the next best thing is correlation in time and space. Although the first diagnosed cases of AIDS were in the US, it soon transpired that most of the earliest cases of AIDS and HIV-positive blood were in central Africa, especially in what is now called the Congo (formerly Zaire). Monkeys and chimpanzees are found in this part of the continent, and are both hunted and kept as pets, leading to many opportunities for SIVs to enter humans. The natural-transfer theory was that this occurred through one of the many normal simian-human interactions; once in humans, the virus - now called HIV - was spread to other humans through sexual intercourse, shared needles and other known routes.

There are complexities at the molecular level. There are various SIVs, with different ones found in different simian species and, since little testing had taken place, the likelihood of discovering further varieties. There are several genetically distinct types of HIV. HIV-1 Group M is responsible for most of the world's infections. HIV-2, a less virulent strain, is mainly found in western Africa. Years later, HIV-1 Groups O and N, both as genetically distinct from Group M as HIV-2, were discovered.

One problem with the cut-hunter theory is timing. Humans have been butchering monkeys for a couple of million years, so presumably there must have been repeated incidents in which humans were exposed to SIVs. Why did this lead to a pandemic only in the twentieth century? One possible explanation is that AIDS had existed for a long time in remote villages, but only in the past century, with urbanization and improved transport, have the conditions existed for exponential growth. While this is a plausible argument, no evidence was available or was collected to back it up.

Although the natural-transfer theory has been accepted by most scientists, it has remained undeveloped, with few specifics given. No one has provided a definitive account. Natural transfer seems to have been accepted as the default option because all alternatives are rejected as implausible.

Compared to the theory of natural transfer, the polio-vaccine theory had a far more difficult time gaining a hearing. South African biomedical scientists Mike Lecatsas and Jennifer Alexander suggested in a brief communication that polio vaccines might be a route for the introduction of AIDS (Lecatsas and Alexander, 1989). This triggered a hostile response (Schoub, Dommann and Lyons, 1990).

Unbeknownst to Lecatsas and Alexander, the polio-vaccine theory had already been developed in far more detail by Louis Pascal, an independent scholar based in New York City. Pascal circulated his ideas to a range of biologists and AIDS researchers but obtained no more than a single acknowledgment. He also submitted a short paper to *Nature, Lancet* and *New Scientist,* without success. More disturbingly to Pascal, he received no substantive critical comments (Martin, 1993). One of his correspondents passed his work to the *Journal of Medical Ethics,* whose editor asked Pascal to write a different sort of paper. He did so, but the result, at 19,000 words, was far too long for publication (Gillon, 1992). (As someone outside conventional scientific culture, Pascal was not used to playing the publication game and, furthermore, was not willing to bend to editorial requirements.) Around this time a colleague passed Pascal's work to me and I agreed to publish his manuscript in a working paper series if it was rejected by the *Journal of Medical Ethics.* Pascal's paper, the first major statement of the polio-vaccine theory, appeared in December 1991 (Pascal, 1991).

Pascal had combed through medical journals in the 1950s and early 1960s for evidence about polio vaccination campaigns in central Africa - especially what are now Congo, Rwanda and Burundi - in the period 1957-1960. This was the region where most of the earliest cases of AIDS and HIV-positive blood samples had been found. The vaccine was manufactured using a culture of monkey kidney cells, thereby providing a route for SIVs to contaminate the vaccine. SIVs do not cause disease in their natural hosts, so monkeys with SIVs would not have been rejected as ill.

There are two main sorts of polio vaccine, using either killed virus or live virus. The killed-virus vaccine, associated with polio pioneer Jonas Salk, requires several injections. The live-virus vaccine, most commonly associated with Albert Sabin and most widely used worldwide from about 1960, requires just a single oral dose and is thus much cheaper and easier to administer.

However, the late-1950s African polio vaccination campaigns were run by Hilary Koprowski who, though much less well known than Salk and Sabin, is considered the third great polio vaccine pioneer.

Koprowski's live-virus vaccine was squirted into people's mouths. Normally this would not create a direct route to the vaccinee's blood, but this could occur through a sore or cut. Furthermore, SIV infection could occur directly through oral mucosa.

Pascal noted that the timing was right: when he wrote, HIV was thought to have originated just before 1960. Furthermore, Pascal noted that Koprowski's vaccine was given to many infants, whose immune systems are not developed, in doses 15 times as great as for adults (this was done to ensure immunization occurred).

Koprowski's vaccines had also been used elsewhere, for example in Poland. If the vaccine was contaminated, shouldn't AIDS have developed there at an early stage too? Pascal noted that different monkey kidneys would have been used to produce different batches of vaccine. Contamination need only have occurred in some batches. Pascal even identified the batch he thought responsible.

Another suggestive piece of evidence is that early polio vaccines were known to have been contaminated with a different monkey virus, SV40, given to millions of people worldwide (Shah and Nathanson, 1976). This showed that vaccine contamination was more than a hypothetical possibility.

Although Pascal provided no direct evidence that contaminated polio vaccines had led to AIDS, he adduced considerable circumstantial evidence, providing a detailed mechanism (vaccines grown on monkey kidneys), describing favourable conditions (vaccination of infants with undeveloped immune systems), explaining timing and location of early AIDS cases, and citing a precedent (SV40). Furthermore, his hypothesis was open for testing and falsification, for example by finding HIV-positive blood samples before 1957. Arguably, there was more evidence at the time to support the polio-vaccine theory than to support the natural-transfer theory. Yet natural transfer was widely and uncritically accepted while Pascal could not find any scientists to explore the polio-vaccine theory. From a social science point of view, this suggested that the two theories were being treated differently, with an excessive burden of proof placed on the polio-vaccine theory.

Only a few months after Pascal's paper was published, the identical theory was published in the rock magazine *Rolling Stone* (Curtis, 1992a). AIDS activist Blaine Elswood, independently of and more recently than Pascal, had developed the same theory. Elswood alerted journalist

Tom Curtis, who did further investigation and wrote a powerful story. Whereas Pascal's sober articles had been ignored by the scientific community, the engagingly written *Rolling Stone* story triggered a storm of comment in both scientific journals and the mass media.

The Wistar Institute, headed by Koprowski and where his vaccines had been manufactured, set up a committee to look into the issue. It pronounced that the theory was extremely unlikely, since each stage - SIV contamination of polio vaccine, oral transmission, and evolution of any known monkey SIV into HIV-1 - was unlikely. (The committee did not, however, assess the likelihood of natural transfer using a similar approach.) In spite of its skepticism, the committee recommended that as a precaution monkey kidneys no longer be used to produce polio vaccines (Anon., 1992; Basilico et al., 1992). (However, most [polio] vaccines today are still produced on monkey kidneys.)

Curtis's article and, to a lesser extent, Pascal's paper, generated considerable interest in the polio-vaccine theory over the following years. There were some significant contributions, including by Elswood and Stricker (1993, 1994) and by journalist Julian Cribb (1996), who pointed out that there had been massive population movements in central Africa for centuries due to the slave trade, making it harder to argue that AIDS had lain dormant in a remote village for decades before the 1960s. However, by the late 1990s, many commentators believed that the polio-vaccine theory had been discredited. There were two main reasons for this (Martin, 1998).

First, mainstream journals - especially the two most prestigious general science journals, *Nature* and *Science* - were resistant to submissions about the theory. Soon after his *Rolling Stone* article, Curtis was able to get a letter into *Science* (Curtis, 1992c). Koprowski (1992) replied, but *Science* refused to publish Curtis's response (Curtis, 1996) to Koprowski. In 1994, eminent evolutionary biologist W. D. Hamilton - who had won two prizes equivalent to the Nobel Prize - submitted a letter to *Science* responding to Koprowski (Hamilton, 1996), but *Science* refused to publish it, revealing that rejections to submissions about the theory were not restricted to nonscientists. Since *Science* published no reply to Koprowski's letter, this gave the impression that Koprowski's arguments were definitive. Similarly, over the years *Nature* rejected submissions about the theory by half a dozen authors, publishing none (Hooper, 2000a: 852).

The second reason why the polio-vaccine theory was perceived as discredited was legal action. In late 1992, Koprowski sued Tom Curtis and *Rolling Stone* for defamation (Anon., 1993a). The case never reached court, being settled by *Rolling Stone*'s payment of $1 to

Koprowski and publication of a "clarification" (Anon., 1993b). While the published statement made few concessions to Koprowski, its very existence superficially gave the impression of acquiescence to Koprowski's claims (Anon., 1993c). A better interpretation was that the statement was made under legal and financial duress: *Rolling Stone* had already spent half a million dollars in legal fees. Koprowski also sued Associated Press over a different story; again, the case was eventually settled many years later. The impact of Koprowski's legal actions was to discourage media discussion of the polio-vaccine theory. *Rolling Stone* declined to publish a follow-up article it had commissioned from Curtis. Furthermore, Curtis was badly burnt and was, in effect, silenced. If he had wanted to pursue investigation into the polio-vaccine theory, he would have felt obliged to warn every informant that his notes and recordings of their conversation could, in principle, be subpoenaed by Koprowski's lawyers. Michael K. Curtis (1995) has used this case to argue that defamation law should be modified to allow "heightened protection" for critical discussion of complex issues.

With the mainstream scientific journals leaving the impression that Koprowski's arguments were unanswered and with Koprowski's defamation actions having inhibited media discussion, many commentators treated the polio-vaccine theory as having been refuted (Garrett, 1994: 381, 666; Karlen, 1995: 245). This combination of editorial power and legal inhibition produced what can be called a political refutation of the polio-vaccine theory (Martin, 1998). Given this process, it is hard to judge what the outcome would have been if scientific arguments alone had been used to judge the theory.

If anything, the case for the theory was stronger than ever. The Wistar Committee (Basilico et al., 1992: 6) had cited the case of a Manchester sailor who apparently contracted AIDS in 1959 (Corbitt, Bailey and Williams, 1990) as the most crucial piece of evidence against the theory. But a few years later, new testing found the previous findings to be incorrect (Bailey and Corbitt, 1996; Zhu and Ho, 1995). Meanwhile, no new evidence for natural transfer had been found - mainly because few were looking for any.

The River and the Royal Society

The polio-vaccine theory might well have gradually faded away without critical scrutiny except for the work of journalist and writer Edward Hooper. After nine years of investigation into the origin of AIDS, many of them focussing on the polio-vaccine theory, Hooper's mammoth book *The River* was published in September 1999 (Hooper, 2000a). Hooper had combed archives and interviewed hundreds of individuals in several continents, probing the earliest cases of alleged AIDS, tracking the spread of AIDS,

exploring the early development of polio vaccines and scrutinizing all aspects of Koprowski's African polio vaccination campaigns. He added a new claim to the polio-vaccine theory: that chimpanzee kidneys, from chimps held at Koprowski's Lindi Camp in the Congo, might have been used to produce polio vaccines. This was especially significant because a chimp SIV was the prime candidate as the precursor to HIV-1 Group M, responsible for most AIDS cases in the world.

The River was written as a scientific detective story, providing engrossing reading despite its great length. Its publication dramatically raised the profile of the polio-vaccine theory. There were dozens of reviews, including many in major scientific journals (Gilks, 1999; Sharp, 1999; Wain-Hobson, 1999) and in the mass media such as the *New York Times* (Altman, 1999; Epstein, 1999), as well as numerous raves by readers on Amazon.com. While only some reviewers professed to being convinced of the polio-vaccine theory, nearly all agreed that it was worthy of further investigation, with only a small minority being hostile (Moore, 1999).

Since 1991, calls had been made for the Wistar Institute to release any remaining polio vaccine samples from the 1950s for testing (Curtis, 1992b). If SIV or HIV were to be found, this would provide strong support for the polio-vaccine theory. However, for years the Institute did not provide any samples for testing - at least not publicly (Hooper, 2000a: 799). With the publication of *The River*, though, the Wistar announced that it did have some samples for testing, and arranged for this to be done at three independent labs. Publicity thus provided the necessary stimulus for scientific investigation.

One of Hooper's prime allies in his long search was Oxford University biologist W. D. Hamilton, the most prominent scientist supportive of the theory. Riding on the tremendous interest stimulated by *The River*, Hamilton used his position on Britain's prestigious Royal Society to obtain its sponsorship for a discussion meeting about the origin of AIDS, focusing on the polio-vaccine theory.

This was a controversial role for the Society, traditionally seen as very much an establishment voice. Founded in 1660, the Royal Society is Britain's most elite scientific body, with some 1300 fellows and foreign members. Its core activities are publication of five scientific journals and the holding of numerous scientific meetings and lectures; as well, it funds hundreds of post-doctoral researchers, awards a number of medals and prizes, and produces reports and makes statements on issues in science and technology. Independent of the government, the bulk of its income is from donations and bequests. For many years it did not play a major role in public debates, but since the 1990s it has engaged more with contemporary issues, for

example running meetings and making statements on genetically modified organisms and nuclear power. Holding the meeting on the origin of AIDS was perhaps its most daring entry yet into controversial waters.

Hamilton's co-organizers for the meeting were Simon Wain-Hobson of the Pasteur Institute in France and Robin Weiss, Professor of Viral Oncology at University College London. The meeting was scheduled for 11-12 May 2000 at the Royal Society in London.

How was the meeting to be run? One model would have been a private roundtable discussion aimed at clarifying points of agreement and disagreement and pointing to areas for further investigation. This sort of approach would have aimed at open and honest examination of strengths and weaknesses of each theory, possibly with attention to other alternatives. Instead, the plan was for a more traditional conference format, with speakers, discussants and questions from the floor. Given this format and given that the cut-hunter and polio-vaccine theories were the main contenders to be discussed at the meeting, the balance of speakers was crucial. Being seen to be on one side were Hooper, Hamilton and a few scientists such as Gerald M. Myers, head of the HIV Sequence Database at the Los Alamos National Laboratory, whose work added support to the polio-vaccine theory even though he was not committed to it. On the other side were Koprowski, his collaborator Stanley Plotkin, and several other scientists critical of the polio-vaccine theory, including phylogeneticist Bette Korber and microbiologist Beatrice Hahn. Speakers and discussants were invited and the meeting was set to go ahead.

Early in 2000, Hamilton went to Africa to collect chimp feces that could be tested for the presence of SIVs, hoping to find evidence that might support the polio-vaccine theory. On the trip, he contracted malaria and, just after returning to Britain, collapsed in a coma, dying five weeks later.

Meanwhile, Hooper alleged that, behind the scenes, opponents of the polio-vaccine theory were putting pressure on the Royal Society to stop or delay the meeting by pulling out or threatening to do so (Meek, 2000). In late March, the Royal Society announced that the meeting had been postponed until 11-12 September. There was an exchange of claims in letters to newspapers, with Hooper (2000b) alleging that the postponement was due to pressure tactics while the president of the Royal Society stated that there were perfectly good reasons for the decision, including waiting for the results of testing of Wistar samples (Klug, 2000).

Whatever the reasons, the format of the September meeting increased its visibility and raised the stakes for all parties. This time around, leading opponents of the

polio-vaccine theory, including Koprowski, agreed to attend. The meeting was to be open to the public and a press conference was to be held. Behind the scenes, once again, the selection of speakers and discussants was the subject of much discussion, so Hooper informed me in many communications prior to the meeting. Table 1 gives the speakers as listed in the brochure about the meeting.

Table 1. Speakers at the Royal Society Discussion Meeting on "Origins of HIV and the AIDS epidemic," Monday-Tuesday, 11-12 September 2000, as listed in the brochure announcing the meeting.

Session I (Monday morning)	**Chair: Professor Walter Finch**	
9.00	Dr Simon Wain-Hobson	Opening remarks
9.05	Sir Robert May	Bill Hamilton *in memoriam*
		Zoonosis and epidemiology
9.15	Professor Albert Osterhaus	Catastrophes after crossing species barriers
9.50	Dr Kevin M De Cock	Epidemiology and the HIV/AIDS epidemic
10.25	Dr Léopold Zekeng	Update on HIV/SIV infection in Cameroon
		Phylogenetics of HIV and hosts 1
11.30	Professor Beatrice Hahn	AIDS as a zoonosis: characterizing the primate reservoir
12.05	Dr Bette Korber	Timing the ancestor of the HIV-1 pandemic strains
Session II (Monday afternoon)	**Chair: Professor Neal Nathanson**	**Oral polio vaccines**
14.30	Mr Edward Hooper	Experimental oral polio vaccines and AIDS
15.05	Dr Stanley Plotkin	Untruths and consequences
16.40	Dr John Beale	Polio vaccine development and retroviruses
Session III (Tuesday morning)	**Chair: Sir John Skehel**	**Phylogenetics of HIV and hosts 2**

9.00	Professor Paul Sharp	The origins of AIDS viruses: where and when?
9.35	Dr Tom Burr	The origin of AIDS - Darwinian or Lamarckian?
10.10	Dr Pascal Gagneux	What do we know about gene flow in wild chimpanzees?
Session IV (Tuesday afternoon)	**Chair: Dr Hilton Whittle**	**Epidemics and society**
14.00	Sir Robert May	Why epidemics take off
14.35	Dr Preston Marx	Serial human passage of SIV: the role of unsterile injecting emergence of epidemic strains of HIV
15.10	Dr Brian Martin	The burden of proof and the origin of AIDS
16.15	Professor Hilary Koprowski	Hypotheses and facts
16.45	Professor Robin Weiss	Closing remarks

As well as these major speakers, there were 15 listed discussants, each of whom was given five or ten minutes, either squeezed at the end of one of the papers or in groups during hour-long slots at the ends of sessions II and III.

Prior to the meeting, it was possible to guess the positions of quite a number of the speakers. It could be anticipated that those opposed to the polio-vaccine theory and/or supportive of the cut-hunter theory included:

- Hilary Koprowski, developer of the CHAT vaccine;
- Stanley Plotkin, a key and vocal collaborator of Koprowski;
- Beatrice Hahn, whose recently published work (Hahn et al., 2000) dismissed the polio-vaccine theory and who had been quoted in the media as critical of the theory;
- Bette Korber, whose recently published work on dating of the origin of HIV was incompatible with the polio-vaccine theory (Korber et al., 2000) and who had been quoted in the media as critical of the theory;
- Kevin De Cock and Paul Sharp, co-authors of Hahn.

In contrast, the only open supporter of the polio-vaccine theory was Edward Hooper. My own role, as a social scientist who had pointed out the way the polio-vaccine

theory had been marginalized (Martin, 1993, 1998), could be interpreted as providing de facto support for the polio-vaccine theory (Martin, 1996). Of the main speakers, the only scientists whose work might be expected to give some comfort to the polio-vaccine theory were Tom Burr and Pascal Gagneux. Burr, a collaborator with Gerald Myers, stood in for Myers, who was ill. Myers had been quoted as critical of Korber's conclusions. Gagneux's work on chimp gene flow was compatible with the polio-vaccine theory. But neither Burr nor Gagneux could be expected to take a stand for any theory.

Some of the other speakers had not previously taken a partisan position and could be expected to discuss technical matters that had little direct bearing on the controversy - though it could be argued that these contributions provided important contextual material for assessing competing explanations of the origins of HIV. Preston Marx would be presenting the case for a different theory, namely that medical re-use of needles in Africa had allowed otherwise limited natural transfers of SIVs to explode into the AIDS epidemic.

Thus, the line-up of speakers seemed stacked against the polio-vaccine theory. On the one side were Koprowski, Plotkin, Hahn, Korber, De Cock and Sharp; on the other was Hooper. It was especially noticeable that this pitted several scientists against a nonscientist. The polio-vaccine theory's greatest scientist supporter, Bill Hamilton, had died earlier in the year. Myers, an important figure who was known to be open to the theory, was unable to attend. Jennifer Alexander and Mike Lecatsas, who had followed the theory since their early contributions in the late 1980s, were not invited to be speakers.

Of the 15 discussants, the most prominent supporter of the polio-vaccine theory was Julian Cribb, author of a book on the topic (Cribb, 1996); the most obvious opponent was Claudio Basilico, member of the Wistar Committee that had earlier dismissed the polio-vaccine theory (Basilico et al., 1992).

Another dimension to the meeting was a press conference scheduled for 15.45 on the first day. There certainly was plenty of media interest in the meeting. There were stories in the press in the days leading up to the meeting (e.g. Connor, 2000). As Hooper arrived in a taxi at the Royal Society, television cameras followed him into the building. However, television crews were not allowed into the meeting room - except for relaying the proceedings to an overflow room. Every one of the 350 seats in the main venue was taken.

The meeting proceeded as might have been predicted from the line-up of speakers. Hahn and Korber criticized the polio-vaccine theory, as anticipated, while Hooper came on strongly, introducing new evidence suggesting that some of

Koprowski's polio vaccine might have been manufactured in Africa as well as at the Wistar Institute in Philadelphia and at labs in Belgium. Plotkin, following Hooper, also came on strongly - as suggested by the title of his talk, "Untruths and consequences" - denying that chimp kidneys had been used to make any polio vaccine and claiming that numerous individuals linked to the 1950s polio-vaccine trials had signed statements denying that chimp kidneys were ever used, in apparent contradiction to quotes from these same individuals in *The River* used by Hooper to argue that this could have happened. In subsequent "discussion," the exchange between Plotkin and Hooper became so heated, with allegations of lying, that the chair of the session, Professor Neal Nathanson, threatened to shut down the meeting if civility was not restored (Cohen, 2000).

Another element in the politics of the meeting was an alteration to Monday's Session II, notice of which was distributed to participants on arrival at the meeting that morning. The new arrangement was as follows (Table 2):

Table 2. Speakers at the Royal Society Discussion Meeting on "Origins of HIV and the AIDS epidemic," Session II, Monday afternoon, 11 September 2000, as listed in an addendum to the brochure announcing the meeting.

Session II (Monday afternoon)	**Chair: Professor Neal Nathanson**	**Oral polio vaccines**
14.00	Mr Edward Hooper	Experimental oral polio vaccines and AIDS
14.35	Dr Stanley Plotkin	Untruths and consequences
15.10	Professor Claudio Basilico	Announcement of results
15.25	Professor Hilary Koprowski	Hypotheses and facts
16.40	Dr John Beale	Polio vaccine development and retroviruses

Note that Hooper's talk was moved half an hour earlier in order to squeeze in Basilico's and Koprowski's contributions just before the press conference at 15.45. The rearrangement had the effect of making the announcement of the testing of Wistar samples a prime news story without the opportunity for a studied response - or preparing a press release - by those who might give a different interpretation than Basilico's.

As expected by all parties, the results of the testing of samples released by the Wistar Institute showed no evidence of SIV or HIV. Furthermore, the cells on which

the polio vaccine had been prepared were found to be Asian monkeys - though in one case the possibility of an African monkey - with no evidence of chimp cells. While this provided no support for the polio-vaccine theory, arguably it was not a serious blow to it. In *The River*, Hooper presented evidence that Koprowski's polio vaccines used in Africa had been manufactured both at the Wistar Institute in Philadelphia and at labs in Belgium. Furthermore, in his paper at the Royal Society he provided new evidence that some polio vaccine may have been produced in Africa itself.

While the testing of the samples was carried out with a rigorous method, the provenance of the samples was far from clear. As pointed out by AIDS activist Billi Goldberg (personal communication, 11 October 2000) after the Royal Society meeting, Koprowski had claimed in 1992 that no samples of polio vaccine used in Africa remained at the Wistar (Koprowski, 1992). In summary, it might be said that whereas a Wistar sample revealing SIV or chimp cells would have been powerful evidence for the polio-vaccine theory, a negative finding in itself was not a significant blow against the theory. Yet the press statement put out by the Wistar Institute stated that "the findings provide strong evidence to refute the theory" (Wistar Institute, 2000).

The press conference was an event in itself, with dozens of journalists and half a dozen television cameras. The five invited participants from the meeting - Hahn, Korber, Hooper, Plotkin and myself - were each given two minutes, in that order, to summarize our talks, and then questions were taken from the floor. Robin Weiss chaired. The questioning was vigorous and there was a repeat of the heated exchange between Plotkin and Hooper, especially over Plotkin's collection of statements from scientists saying they had not used chimp kidneys in vaccine preparation. The media interest was extraordinary for a scientific issue. As science communicator Julian Cribb remarked to me at the time, an announcement by the prime minister would hardly produce the same media enthusiasm. Part of the media interest can be attributed to public relations efforts and the prospect of fierce controversy - fully realized - but, at a deeper level, the idea that the major killer AIDS might have arisen from a well-intentioned medical intervention against a previous killer disease, polio, provided journalists with an angle that was hard to resist.

As might have been expected from the timing of the press conference on the first day of the meeting and the repositioning of the results of the testing of Wistar samples just before the press conference, many news stories featured the first day's events and the negative results on the samples in particular (e.g., Hawkes, 2000; Highfield, 2000). However, quite a few journalists looked more

deeply, noting the lack of resolution of the debate (e.g., Anon., 2000; Cohen, 2000; Vidal, 2000).

Meanwhile, the Royal Society meeting continued, with a variety of contributions later on Monday and through the day Tuesday. Attacks on the polio-vaccine theory came from a number of different angles. As noted, Plotkin and Koprowski denied that any chimp kidneys were used in the manufacture of polio vaccines, while Korber dated the origin of HIV to about 1931. John Beale, one of the speakers, concluded that insufficient SIVs in simian kidney tissues would have survived the vaccine preparation process to cause infection. Hooper virtually single-handedly countered these scientific criticisms, displaying an amazing grasp of detail in a range of different fields.

What was striking to me was a systematic asymmetry in the discussion. The polio-vaccine theory was treated by hostile scientists as a fixed target to be shot down. Contrary findings, such as Korber's 1931 dating and the testing of Wistar samples, were treated as refutations of the theory, which was accorded no flexibility. Hooper's new evidence, such as that some polio vaccines may have been manufactured in Africa, was simply ignored. In contrast, the cut-hunter theory was not given much critical scrutiny and was allowed to remain quite vague and malleable, thus making it virtually impossible to refute. This asymmetry in treatment of the polio-vaccine and cut-hunter theories was in fact the subject of my paper at the meeting (Martin, 2001).

Robin Weiss, one of the meeting's organizers, summed up at the end. Speaking as though on behalf of all the participants, he concluded that the polio-vaccine theory had been found wanting. In particular, he stated that chimp kidneys had not been used to produce polio vaccines. In effect, he presented his own views as if they were shared by nearly everyone. In reality, there had been no testing for consensus about any of the matters covered. Given that hundreds of people were present and most did not contribute to the discussion, it was impossible to know for sure what views prevailed. I personally spoke to quite a number in the audience who were not convinced that matters had been settled, some of whom saw Weiss's summing up as an attempt to prematurely close the debate.

Politics of the Origin-of-AIDS Debate

The Royal Society meeting was a culmination of years of struggle over the polio-vaccine theory. Having described the lead-up to the meeting and the meeting itself, albeit in brief terms, it is now possible to summarize various political dimensions of the debate over the polio-vaccine

theory of the origin of AIDS.

Let me first note that "political" is used here in a broad sense referring to the exercise of power. Analysis of political dimensions is not a commentary on conscious intentions or motives. My assumption in this analysis is that all participants have been well intentioned throughout, acting sincerely in accordance with their own interpretations of scientific evidence and the public good. This is quite compatible with an assessment of political dimensions, which reflect the role of interests - such as research funding, scientific status and the image of science - in shaping the dynamics of the debate. The confluence of well-intentioned individuals, operating in systems of professional and economic power, gives rise to the politics of science. For example, Sir Aaron Klug, President of the Royal Society, in brief opening comments at the meeting, said there was no political agenda in postponement of the meeting. There may have been no conscious political motive in the decision, but that does not rule out influence from social and political factors.

First consider the scientific marginalization of the polio-vaccine theory prior to 1999. One facet of this process was the blocking of submissions about the theory, including rejection of Pascal's paper (the short one) by several journals and rejection by *Science* of replies to Koprowski (1992) by Curtis and by Hamilton. A second facet of the marginalization process was refusal to investigate the theory, most prominently the refusal to test Wistar vaccine samples.

One explanation for this marginalization is that the theory is a threat to the image of medical research and especially to vaccination programs. If polio vaccinations were widely thought to have caused AIDS, then this might well stimulate much greater scrutiny of current medical inquiry, such as xenotransplanatation, AIDS vaccines and genetic engineering. Most of all, it would put a tremendous dent into medical research's image as a saver of lives. In his introduction to the Royal Society meeting, Simon Wain-Hobson stated that the probity of current vaccines would not be questioned and that if anyone said otherwise then he and Robin Weiss would disabuse them. Koprowski claimed in his paper that the polio-vaccine theory was hindering polio vaccination efforts, sentiments that had been expressed by a number of other scientists (Hooper, 2000a: 436, 783), though without any supporting evidence. This expression of worry about the way vaccination is perceived hints at the danger to the image of science posed by the polio-vaccine theory.

The most effective response to scientific marginalization was publication outside scientific journals. This included Pascal's 1991 paper, Curtis's 1992 *Rolling Stone* article and Cribb's 1996 book *The White Death*. The *Rolling Stone*

article in particular had a tremendous impact, cutting through the scientific marginalization and prompting a response from the scientific community, namely the Wistar Committee report (Basilico et al., 1992).

Koprowski's lawsuits constituted another form of politics, serving to transfer the issue from the public domain to the legal system. After the lawsuits, there was much less media discussion of the theory, a correlation compatible with the documented "chilling" effect of defamation law on the media (Barendt et al., 1997). Arguably, then, the lawsuits contributed to marginalization of the theory.

So matters might have remained except for the appearance in 1999 of Hooper's book *The River* - another publication outside scientific journals. The book generated such wide interest among both scientists and the public that it could not be ignored. *The River* triggered two important responses from the scientific community: serious scientific investigations - among them the testing of Wistar samples - and the holding of the Royal Society meeting. These provided a visible signal that the theory was being addressed "scientifically." However, political marginalization of the polio-vaccine theory continued through these ostensibly scientific vehicles, mainly by the interpretations placed upon them.

At the organizational level, the Royal Society meeting had several political dimensions. First was the postponement of the meeting, enabling critics of the polio-vaccine theory to complete their investigations. Cancellation would have been more problematical given the visibility of the original meeting. Second was the choice of speakers, with numbers favoring opponents of the polio-vaccine theory. This would have been seen by the organizers as a fair representation of the evidential support for each perspective; Hooper and Cribb told me before and during the meeting that they saw it as a form of stacking. Third was the last-minute rearrangement of the program to put the announcement of the results of testing of Wistar samples just before the press conference. Fourth was the press conference itself, presenting a take on the issue before the meeting was more than half completed. Fifth was Weiss's summing up, which can be interpreted as rhetorically closing the debate, with the polio-vaccine theory refuted. These dimensions of the meeting worked in combination to make the meeting seem to be the scientific community's definitive rejection of the polio-vaccine theory, effectively communicated to the wider public through the mass media.

The Royal Society meeting also had several political dimensions at the epistemological level, namely the struggle over knowledge claims. First was the emphasis on refuting the polio-vaccine theory without providing any convincing evidence for the cut-hunter theory, the main alternative. Second was the interpretation of the testing of

Wistar samples as definitive evidence against the theory. Third was the treatment of the polio-vaccine theory as a fixed entity, without the capacity for modification or rebirth. Fourth was the assumption that scientific calculations or evidence - such as phylogenetic computer modeling - were sufficient to refute the polio-vaccine theory, without any need to address other bodies of evidence, such as interview material or historical archives.

It has long been recognized in the social studies of science that no evidence or calculation on its own is sufficient to refute a theory, since theories can be rescued by rejecting the evidence as incorrect or irrelevant or by modifying the theory, among other strategies (Barnes, 1974; Chalmers, 1976; Collins and Pinch, 1998; Hess, 1997). This occurred previously with the polio-vaccine theory when the case of the Manchester sailor was thrown out as incorrect.

It is certainly possible that calculations such as Korber's could be rejected or superseded, with different results obtained using modified assumptions or an entirely different model. The polio-vaccine theory could even survive a definitive finding that chimp kidneys were never used to produce polio vaccine, if a suitable monkey SIV were discovered. While Hooper has tied his argument to polio-vaccine manufacture using chimp kidneys and argues strongly for it against alternative routes of SIV contamination, in principle the theory could be resurrected or reformulated in other ways. For example, Goldberg and Stricker (2000) argue that human cell lines may have been used to produce the suspect polio vaccines, though this contention has been largely ignored.

Supporters of the cut-hunter theory have accorded it a remarkable degree of plasticity, with little done to pin down the proposed times and locations of infection and spread. Even some of its supporters admit that it is not easily falsifiable. In contrast, Hooper's version of OPV theory has been treated as a rigid, final structure that can be sunk by a single hit to any component. His evidence that polio vaccine may have been manufactured in Africa showed the potential modifiability of his picture. Perhaps because this evidence did not fit with the way the theory had been solidified in the minds of its opponents, and because it was outside the disciplinary scope of the scientists, it was simply ignored at the meeting.

Despite the organizational and epistemological hurdles put in the path of the polio-vaccine theory, it was not totally defeated at the Royal Society meeting. Hooper showed a remarkable capacity to counter the points made by opponents, and he had some degree of support within the meeting. More importantly, though, the politics of the issue could not be contained in a hermetically sealed meeting with a single definitive output. *The River* remains in print and ever more widely read. Many journalists have

probed beneath and beyond the Wistar Institute's claim that testing of samples had refuted the polio-vaccine theory and have not accepted Weiss's portrayal of scientific closure at the meeting. The rise of the web and the use of email now mean that discussion of alternatives and new contributions can occur more readily without relying on publication in leading scientific journals.

Another political dimension to the issue is the issue of "undone science," namely research that might have been done but wasn't due to social factors (Hess, 2001: 64-69). Over the years, quite a number of scientists have been discouraged from investigating the polio-vaccine theory, or issues relating to it, due to their awareness that this would not be good for their careers. At the meeting, one participant told me that he had been given several warnings not to become involved with the OPV theory. Another told me that after circulating Pascal's paper years earlier, he had been shunned by the AIDS establishment. Yet another said that Koprowski's lawsuits had deterred an English translation of his work.

Disincentives for investigating risks of vaccines are not new. Bernice Eddy, the scientist who exposed contamination of early polio vaccines with monkey virus SV40, "was silenced, chastised and demoted" (Curtis and Manson, 1992: A-1; also O'Hern, 1985: 150-59). Since then, the effects of SV40 have been understudied (Bookchin and Schumacher, 2000; Elswood and Stricker, 1994). Given the SV40 saga, as soon as SIVs were discovered in 1985 it should have been obvious that contaminated polio vaccines were a possible explanation for the origin of AIDS (Pascal, 1991: 9-10). Curtis (1992d: A-1) reported that "a senior AIDS researcher said it has been an open secret to many AIDS researchers for at least four years that polio vaccines might have been contaminated by HIV or a related retrovirus." But scientists did not go about exploring the possibility of contamination of early polio vaccines, with only Lecatsas and Alexander even publicly voicing the possibility. The task of investigation was left to nonscientists such as Pascal, Elswood, Curtis and Hooper. The prime exception was Hamilton, a scientist who was sufficiently prominent and idiosyncratic to be able to resist peer pressure, but for others the cost may have loomed larger than the benefits. If the message wasn't clear enough already, the Royal Society meeting certainly sent a signal that pursuing the polio-vaccine theory is not a promising path for a mainstream scientist.

Control of the media is another matter. Scientists, through public relations efforts, can influence media coverage but hardly control it. In 1992, Koprowski's lawsuit discouraged further media coverage. Should there be another lawsuit - Hooper (2000a: 595-96, 808) reports that he has been threatened with an action for defamation - this will signal to some that the Royal Society meeting on its own was not

enough to remarginalize the polio-vaccine theory.

Every scientific meeting has politics. At the Royal Society meeting, the political dimensions were far more visible than usual, and it is for this reason that it is a useful vehicle for revealing what is otherwise much less obvious. Drawing on the discussion here of the Royal Society meeting, Table 3 gives some political dimensions of a scientific meeting, with a list of several features for each dimension.

Table 3. Some political dimensions and associated features in a scientific meeting.

Dimension	**Features**
Pre-meeting factors	Publication or rejection of papers Access to data or samples Access to funding Investigation or refusal to investigate Media coverage Legal action Undone science
Organisational	Decision to hold meeting Timing of meeting Cancellation or postponement Format of meeting Selection of speakers Arrangement of agenda Media coverage
Epistemological	Burden of proof Definitiveness accorded to evidence Flexibility accorded to theory Types of evidence accorded significance

Although the features listed here grow out of analysis of the Royal Society meeting, many of them will be relevant to other scientific meetings. Certainly some of the features, such as access to funding, undone science, format of meeting, selection of speakers and burden of proof, will be of significance at most meetings even when political

dimensions are submerged or downplayed.

The list of features in Table 3, derived from the examination of a single meeting, is far from complete or definitive. By studying other scientific meetings and noting political aspects, a more comprehensive list of features can be developed. However, a long list is not so useful as one giving features most frequently of significance, and for this an examination of other meetings is essential. With such a list, analysis of the political dimensions of scientific meetings - especially those that seem most apolitical - can be facilitated. Of course, the politics of scientific meetings is simply one part of the wider politics of science. But meetings often play a special role in presenting and legitimating scientific ideas, so it valuable to show that more goes on at scientific meetings than "just science."

Postscript

The politics of the origin-of-AIDS debate continued, predictably, after the Royal Society meeting. In April 2001, three studies were published in *Nature* and *Science* reporting tests of surviving vaccine samples, each modestly concluding only that their findings did not support the polio-vaccine theory (Berry et al., 2001; Blancou et al., 2001; Poinar et al., 2001). These were essentially the findings reported verbally at the Royal Society meeting. A fourth study reported a theoretical assessment of HIV-1 phylogeny, with findings seemingly incompatible with the polio-vaccine theory (Rambaut et al., 2001). Although these publications did not support the polio-vaccine theory, they were far from definitive refutations. Yet a typical media report (Brown, 2001) stated that "Four new studies essentially refute the [OPV] theory" and quoted researcher Edward C. Holmes as saying "There is not one piece of hard evidence in favor of the polio vaccination theory." Robin Weiss, one of the organizers of the Royal Society meeting, wrote a commentary in *Nature* titled "Polio vaccines exonerated." (Weiss, 2001). Hooper sent a letter to *Nature* replying to the scientific points; it was rejected (personal communication, 25 May 2001). I sent a letter to *Nature* commenting on the exaggeration in media reports; it also was rejected.

In June 2001 the proceedings of the Royal Society meeting were published (Weiss and Wain-Hobson, 2001), with contributions by all the major speakers, some of the discussants and a few additional contributions. A thorough analysis of these papers could reveal much about the epistemological politics of the issue, but here I comment only on a few matters relevant to the meeting. First, some of the published papers might be said to have been "sanitized" to some extent compared to what transpired at the Royal Society meeting (though Plotkin's paper (2001) is remarkably forthright in criticism of Hooper). Just as

scientific papers seldom reveal the passion and commitment that is involved in doing science (Mitroff, 1974), published papers seldom reveal the full dynamics of a scientific meeting.

Second, without inside information, it is difficult to examine the politics of selecting and editing scientific papers. Walter Nelson-Rees, a discussant at the meeting, wrote me on 16 June 2001 with an account and copies of correspondence with the Royal Society concerning his contribution. One aspect of this was that the Royal Society declined to publish certain passages because of the possibility of defamation. Without this information, a reader of the published article (Nelson-Rees, 2001) would have no inkling of the struggles that occurred over the text.

As well as the papers presented at the Royal Society meeting, the proceedings include an additional paper co-authored by Plotkin replying to Hooper's talk (Plotkin et al., 2001). However, the proceedings do not include any additional paper by Hooper replying to Plotkin's or any other talk. This would appear to represent a double standard by the editors in allowing parties from one side of the debate an opportunity not afforded to the other side. Hooper confirmed to me (personal communication, 13 June 2001) that he had not been given an opportunity to reply to Plotkin or other speakers. Again, knowledge from "behind the scenes" is essential for gaining a fuller understanding of the politics of a scientific meeting.

The Royal Society announced publication of the papers in a media release and Hooper countered with his own comments (personal communication, 12 June 2001). However, there was little media coverage at the time, perhaps because the volume and complexity of scientific argumentation was too great. Even so, I will stick with my social scientist's prediction made at the Royal Society meeting (Cohen, 2000: 1851) that "Whatever happens at this conference, this controversy will continue."

Acknowledgments

I thank Edward Hooper, Gary R. Johnson, Allan Mazur, Michael Primero, Steve Wunsch and several anonymous referees for helpful comments on earlier drafts of this paper, and many correspondents and participants at the Royal Society meeting for valuable insights.

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