

Discovering the AIDS virus: Scientific Progress through the Interaction of Human and Non-  
Human Actants

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Without wanting to attribute any sort of special or magical qualities to the object, I must admit I had my own sort of Eureka moment while in the bath. Given a lack of resources available on my topic of interest, Vitamin B12, I had begun my accommodation by thinking of other scientific objects with which to engage with. Although I had not read Bruno Latour's, *We Have Never Been Modern* (1993) in over a year and a half, I had a sudden recollection that Latour mentions *Acquired immune deficiency syndrome* (AIDS) at some point in his book. Perhaps it was my fascination with Actor Network Theory and Latour's role in it that sparked this thought. My plans to utilize the index of the book failed when there was no mention of AIDS. In response, I began to search frantically for any reference to it. Luckily, AIDS came up on the first and second pages of the book, but in less depth than I had hoped for. Latour described the way in which AIDS is capable of transcending the supposed neat sections limited by distinct boundaries in a newspaper. Through reading the text I accomplished what I needed, responding to the resistance that was a lack of resources on B12 by suggesting an alternative object to research. Initially the development of this paper was not of acquiring knowledge that would aid in its progression, but rather coming across things, books to be specific, that would not be of use for my purposes. Initially the paper progressed through determining what would not work. Fortunately, when reading *When Aids Began*, by Michelle Cochrane (2003), I became certain of the topic of this paper. It was the use of the term black box in reference to the effects of a single-cause virus on AIDS surveillance practices (Ibid, 175) that prompted me to explore the discovery of this single-cause virus.

In this paper I will argue that the discovery of a virus as the single-cause of AIDS was one of progression that developed in a network though resistance met in attempts to form

alliances between actants— both human and nonhuman actants alike. Progression was not solely a result of accumulated knowledge, rational thought and calculated decisions, but also due to the unpredictable element in happenings with no apparent cause— *chance*. I will support my argument by briefly exploring the history of retrovirology to illustrate why the discovery should be viewed as one of progression and then discuss the utilization of immutable mobiles by human actants to accomplish their goals. Finally, I will interrogate key events to show how the interactions of actants lead to the discovery. The focus of this paper will be limited to the process of discovery itself at the Pasteur Institute including direct interactions between the Institute and other actants in the network involved with AIDS that were instrumental in the discovery. Beginning at the time when the new syndrome was reported in *Morbidity and Mortality Weekly Report* in early 1981 the paper will investigate the process of discovery until the time that the Pasteur Institute was successful in providing convincing evidence that the virus they discovered was the cause of AIDS through an Enzyme-linked immunosorbent assay (ELISA) in 1984.

### **Paradigm Shifts and Normal Science in Retrovirology**

Before exploring the process of discovery and explaining how this progression took place, it is necessary to understand some of the history of retrovirology. To be clear, the discovery of the virus causing AIDS does not support a view of science as the progressive accumulation of knowledge building upon itself. The discovery can only be viewed as one of progression because the timeframe in which the discovery took place can be characterized as what Kuhn (1970) would refer to as “normal science”: research or scientific work that is based on past scientific achievements that a particular scientific community acknowledges as the foundation of its practice and which determines legitimate problems and accepted methods for

approaching them (Ibid,10). Scientists who engage in normal science share a paradigm (Sismondo, 2010, 12).

Although the discovery of the first human retrovirus in 1981 and later the discovery of the retrovirus that caused AIDS in 1984 changed the focus of what was studied within the field, it should not be viewed as a break or discontinuity within the field of retrovirology, but rather an example of the Duhem-Quine thesis: the accommodation of a theory to match real world data to fit into the webs of belief (Ibid, 5). The discovery of the first oncogenic retrovirus in 1908 by Ellermann and Bang, dates the foundation of the field of retrovirology itself and the discovery of reverse transcriptase in the 1960s, explaining retroviral replication is an example of one paradigm shift within the paradigm (Coffin, Hughes and Varmus, 1997, 16-7). Retroviruses were remarkable as they appeared to defy the laws of genetics, repealing the central dogma of molecular biology– that being the transfer of genetic information from DNA to RNA to protein. Through the use of an enzyme called *reverse transcriptase*, retroviruses are capable of creating DNA from RNA– a feat conceptually similar to a tailor re-creating a person using the measurements of their clothes. Retroviruses then insert their newly formed DNA into their host cells enlisting them to create copies of the virus (Engel, 2006, 56).

As will become apparent, this knowledge of past scientific achievements regarding retroviruses and reverse transcriptase is foundational in the choices the scientists make when attempting to discover the virus that causes AIDS. Retrovirology itself is not immune to paradigm shifts, but the period of time that is the focus of this paper should be viewed as a time of normal science and therefore progression.

### **Immutable Mobiles Enlisted to Promote Alliances and Progress Discovery**

The discovery progressed through the agency of immutable mobiles: non-human actants causing a reaction in other actants in the network. Immutable mobiles are the product of inscription devices that “transform pieces of matter into written documents” (Latour and Woolgar, 1986, 51). These machines (inscription devices) inscribe nature into objects (immutable mobiles) that represent nature. Accepted immutable mobiles are then recognized not as a representation or of interpretation, but are viewed as nature itself (Sismondo, 2010, 85).

The use of immutable mobiles alerted other actants in the network to the emergence of AIDS. In May 1981, Michael Gottlieb, a Los Angeles physician, and his colleagues informed the Center for Disease Control (CDC) in Atlanta, that from a period of October 1980 to May 1981, five previously healthy homosexual men had been treated for pneumocystis carinii pneumonia (PCP). The reason that this was so startling was that PCP occurred almost exclusively in persons with severely suppressed or defective immune systems (Oppenheimer, 1991, 52-3). The typical initial examination for PCP and often the only one necessary is a chest radiograph (commonly referred to as a chest x-ray) (Khan et al, 2008). The X-ray film or image is an immutable mobile developed by an inscription device; an X-ray generator. The X-ray image it produces allows for doctors to diagnose a patient for PCP. Moreover, the X-ray image is a representation of PCP and not PCP itself. The acceptance and establishment of an X-ray image representing PCP allows for easy communication and transportation of this sickness inscribed onto a film, allowing for comparison and diagnosis of future cases. Further, the acceptance of the X-ray image of PCP as an immutable mobile universalizes this knowledge, removing it from the locality of its inscription. At the point when more doctors became aware of this new syndrome occurring in California, the use of the PCP X-ray image could aid in recognizing more cases.

Immutable mobiles can be utilized by actants in a network to share information or convince others of something. On June 5, 1981 the CDC published a short paper describing the patients in its *Morbidity and Mortality Weekly Report* (MMWR). An editorial note in this paper hypothesized that “the fact that these patients were all homosexuals suggest an association between some aspect of a homosexual lifestyle or disease acquired through sexual contact and pneumocystis carinii pneumonia” (Oppenheimer, 1991, 52) which may have contributed to the view of AIDS as a “gay disease”, and for that reason many scientists did not want to become involved (Crewdson, 2002, 43). The MMWR is an immutable mobile that informed readers around the world of the emergence of this new syndrome.

By coincidence, the day that the issue arrived in France, Wily Rozenbaum, a physician who specialized in infectious disease, read the article in a hurry, and later that afternoon treated a homosexual man with pulmonary problems (Ibid, 42-3). The MMWR, a non-human actant, alerted Rozenbaum to the syndrome and as a result Rozenbaum began to recognize the symptoms in future patients. From the time that Rozenbaum first read the June 5th issue of the MMWR to the end of 1981 he was taking care of three to four patients with similar symptoms: cough, fever, and lymphadenopathy (Ibid, 42). During this time Rozenbaum and colleagues set up an informal AIDS working group that would later influence researchers at the Pasteur Institute to become involved with AIDS (Ibid, 43-4). Rozenbaum was one of few physicians in France who subscribed to the MMWR. Had he never read the article it is not certain that he would have recognized the significance of the homosexual man he treated that afternoon or created the informal aids working group, the impact of which will follow shortly. The manner in which that day progressed was unpredictable with no assignable cause as to why two related events occurred in conjunction with one another.

As the discovery progressed, immutable mobiles were utilized by actants to confirm their tentative theories. Luc Montagnier and his colleagues hypothesized that the virus isolated was in fact a retrovirus and with the evidence increasing, Montagnier sent a tiny pellet of the culture to a colleague who presided over an electron microscope (a form of inscription device) to test the theory (Ibid, 48-9). The results were immutable mobiles, specifically photomicrographs (photographs taken with a microscope) that allowed the scientists to recognize the virus as exactly the same size as a retrovirus, but distinct in appearance from the *Human T-lymphotropic virus* (HTLV)—the only other known human retrovirus. The microphotographs allowed the involved scientists to interact with nature (the virus) on a scale impossible without the mediation of the inscription device (a non-human actant). Furthermore, progress relied on alliances not just between human and non-human actant, but between two non-human actants. The successful creation of these immutable mobiles (the photomicrographs) was dependent on the skills of the scientist manipulating the electron microscope, but also the capacity of the electron microscope to capture and eternalize the virus.

The importance of science journals as immutable mobiles cannot be understated. Although the physical text captures human agency in the knowledge that marks the paper with ink, its far-reaching effects are largely a result of the non-human agency of the journals themselves. Articles read in more prestigious journals create a greater reaction in actants within the network not solely because of their increased readership, but because different journals as different immutable mobiles have greater agency than others. Montagnier understood the impact that such an article in *Nature* would have and submitted a manuscript that, if accepted, would have meant the journal's endorsement that the Pasteur Institute had discovered a virus that matched the characteristics of the one responsible for AIDS (Ibid, 71-2). Although the

manuscript was rejected, Montagnier had hoped the immutable mobile (an article in *Nature*) would shift the system of alliances of actants (scientists) in the network— therefore causing a shift away from the widespread suspicions that HTLV was the virus responsible for AIDS. Had such an alliance occurred it is possible that the discovery would have progressed faster.

Immutable mobiles, specifically the X-ray image of PCP, the MMWR publication in 1981, photomicrographs of the virus, and an article in *Nature* (even if such an article was only an attempt at being published) illustrate the significance of non-human actants in the network throughout the discovery. Knowing that these actants caused reactions within a network, they were sought out to do just this, in hopes of forming an alliance with those in the network and progress the discovery.

### **Progress and Delay through the Resistance of Actants**

At times the discovery progressed not by calculated decisions, but in response to unpredictable events through chance. Astonished that no one at the Pasteur Institute was working on AIDS, Rozenbaum shared his sentiments with Francoise Brun, a co-founder of the informal AIDS working group. Brun responded by calling Jean Claude Chermann who taught the course on retroviruses at the Pasteur Institute. Chermann was not in, so his secretary suggested that Brun try his boss, Luc Montagnier. Their discussion led to Brun's delivery of a lymph node from Frédéric Brugière, a thirty-three-year-old fashion designer with pre-AIDS symptoms from the *Hôpital Pitié Salpêtrière* to the Pasteur Institute (Ibid, 42-3). In this instance, the moment of resistance was not the cause of a tangible or material actant. Rozenbaum and Brun had intended to include Chermann in their cause, though through the chance event that Chermann was not in his office at the time of intended contact they sought the alliance and efforts of Montagnier. The resistance was chance and the accommodation was not the result of the action of a scientist, but



of an overlooked actant, Chermann's secretary, who suggested that Brun call Montagnier. Chance as a non-human actant altered the planned approach of those it affected.

Throughout the discovery, scientists relied on their knowledge and the alliance of non-human actants with other non-human actants in the techniques and methods they used to progress. They used their knowledge to create a desired outcome through the use of non-human actants within the network. After cutting the tissue into small slices, Montagnier placed them into a solution that made it easier to separate Brugière's T-cells from his other blood cells (Ibid, 47). Montagnier relied on past knowledge of how to proceed. His choice in progression relied on the solution (a non-human actant), aiding in the separation of the T-cells from other blood cells. Progress was dependent on the alliance of the T-cell separating solution to the wishes of the scientist and the alliance of tissue to the T-cell separating solution. Alliance was sought not solely between human and non-human actant, but between one non-human actant with another. Montagnier proceeded by putting the sample into a solution known to activate T-cells inducing them to replicate. Again, Montagnier was relying on the compliance of one non-human actant to another. He proceeded by placing two separate flasks of Brugière's T-cells into an incubator at 37°C, normal human body temperature. If the T-cells were in fact infected with a virus and remained alive, the virus would begin to reproduce. Additionally, if reverse transcriptase was present, the virus would be a retrovirus (Ibid, 47). Upon Montagnier's initial phone conversation with Brun, he confessed knowing nothing about AIDS other than the knowledge that an American scientist believed it could be caused by HTLV. As the conversation continued, Brun shared some findings of her group that led Montagnier to question whether HTLV could in fact be the cause (Ibid, 44). Montagnier's plan of action was also formulated based on his previous knowledge of viruses; however, this virus would not comply. Progress was limited as the virus in

Brugière's T-cells resisted Montagnier's actions. There was no activity in the culture.

Montagnier accommodated the resistance by enlisting new non-human actants to gain alliance of the virus infecting the T-cells. Montagnier added interferon antibody (a technique pioneered by Montagnier earlier in his career) (Ibid, 46) then T-Cell growth factor, but was again unsuccessful with no activity from Bru (the name which the lab at Pasteur came to refer to the virus infecting Brugière's T-cells, not to be mistaken with Brun) (Ibid, 60).

For reasons unrelated to the work being done with Bru, Montagnier had to leave Paris for a few days, so he moved Bru to an unused laundry room near where Jean-Claude Chermann had his lab. As Montagnier viewed Chermann as a bumbler, he felt comfortable leaving Bru in the care of Françoise Barré, Chermann's assistant, who was said to be "ultra-meticulous" (Ibid, 47-8). Montagnier's direct involvement with the research was put on hold due to his departure and as a result of nature of the virus, a non-human actant, required that someone else attend to it. In order to keep the progression of discovery moving forward (admittedly at this time the discovery progress appeared rather stagnant other than to gain an understanding of what the virus did not react to) Barré was requested to nurture the virus, feeding it nutrients so that it would survive. In this instance, not only is the human actant dependent on the alliance of the non-human actant for progress, but the non-human actant also requires the alliance of human actant or else it cannot survive. The virus is dependent on scientists for its survival as it struggles in its foreign environment outside of the human body.

Non-human actant resistance to alliances was accommodated through the unavoidable process of time, without the decision or intention of a human actant. In response to Barré's continued efforts, Bru began to comply with activity that aligned with one of Montagnier's hypothetical outcomes— the presence of reverse transcriptase. Other than the subtleties in the

manner in which Barré performed the same tasks as Montagnier, the only major difference between the two was that of time. More time was the necessary non-human actant needed to form an alliance with the virus that Montagnier had been working with before Barré's involvement. The inclusion of time as an actant was not through a calculated decision, but simply a result of the wait for Montagnier's return to Paris. After twenty-three days (the first eleven of which there was no activity), through the use of a machine that uses radioactivity to measure the level of reverse transcriptase, Barré had clear evidence that the virus they were working with was a retrovirus (Ibid, 48).

Within the network, actants were met with resistance throughout the progression of the discovery. Progression was slowed due to the resistance of the actants. The knowledge held by human actants was used individually and collectively to determine what action should be taken to induce compliance of the resistant actants through accommodation. To be certain that the retrovirus isolated was not HTLV, the scientists needed HTLV probes: short fragments of HTLV DNA. If the probes reacted to Bru's T-cells, it would provide proof that they were infected with HTLV. The problem was that only two labs in the world had such probes. Montagnier focused his efforts on the American lab, headed by Robert Gallo who he had previous contact with. Unfortunately, Montagnier was only able to receive antibodies to HTLV (not the probe itself) after much delay as a result of many ineffective letters and phone calls that never made it past Gallo's secretary (Ibid, 49). Yet, even without the probe, their knowledge and the use of the HTLV-specific antibody alone allowed the scientists at Pasteur to confirm their belief that Bru was not HTLV.

As a result of previously formed alliances of actants in the network between the informal AIDS working group and the scientists at Pasteur, the former were willing and offered to aid in

progressing the discovery in the face of a slow resistance. To be precise, this resistance was not a result of the virus itself as before, but of the technology and its application that were a form of resistance. Scientists at Pasteur were proceeding by isolating the LAV virus (formally referred to as Bru) from as many different groups of AIDS patients as possible. The problem however was that viral isolations took time and were not always successful. In response to this, Brun, who had been storing blood from AIDS patients, came to Montagnier proposing to forge a link between the virus and disease by performing an ELISA. An ELISA is capable of indirectly demonstrating the presence of the virus in those who are sick through the detection of antibodies to the virus (Ibid, 65-66). In this instance, the increased number of actants working to form alliances within the network progressed the discovery. While some actants preformed ELISAs, others continued with viral isolations.

The resistance of a non-human actant to a human actant occurred again when the virus the scientists were growing was killing the cells it infected (Ibid, 88). Attempts were made to accommodate the virus by growing it in a T-4 cell line. If successful, the T-4 cell line could accept the virus and propagate it without dying (Ibid, 88). The approach of the scientists was instigated by a resistant actant, formulated through past knowledge and careful thought, and reliant on the alliance of two non-human actants in hopes of aligning the resistant actant. Not only would such a plan (if successful) address the death of the T-cells, it would extinguish the limitations of the ELISAs due to the small amounts of virus available and large amounts necessary. Regarding the limitations of the ELISAs, resistance was not caused by a specific actant, but rather a lack of the necessary actants needed to form an effective alliance. Chermann tried for a couple of weeks to grow the virus in existing T-cell lines, but gave up after two weeks. Montagnier succeeded in growing the LAV in an established B-cell line (Ibid, 88). Again, the

human actants in the network were dependent on the desired reaction of one non-human actant (the T-cell line) to another non-human actant (the virus).

As illustrated previously, the increased number of actants in alliance was necessary to progress the discovery. With the ability to grow large quantities of the virus required to perform multiple ELISAs, the Pasteur Institute needed blood samples of numerous patients to perform the ELISAs on. On February 28, 1984, the Pasteur Institute received over a hundred different unlabelled blood samples from the CDC of blood donors, hemophiliacs, and transfusion recipients with confirmed diagnoses of AIDS and pre-AIDS, as well as blood from healthy homosexual males and heterosexuals (Ibid, 104-5). The alliance formed between the CDC and the Pasteur Institute was largely due to the fact that they were both actants in a network with the same objective, finding the cause of AIDS. The alliance of actants in the network was utilized to establish evidence for a causative link between the virus and disease. Through numerous ELISA tests, the Pasteur Institute was successful in determining which of the samples provided by the CDC had AIDS and which did not, providing convincing evidence that the virus, once referred to as Bru, known as LAV in 1984, was the cause of AIDS (Ibid, 106-8).

### **Progression Through Chance and Dependence on the Alliance of Actants**

If the discovery of the virus that caused AIDS can be viewed as progression, it is wrong to view this progression as an inevitable advancement as a result of rational thought and calculated decisions. It is more accurate to view this process of discovery as the progression of normal science due to rational thought and a collection of chance events or luck, rather than either of the two on their own. It is impossible to know if the discovery would have occurred in France when it did had Rozenbaum had never read the article in MMWR, had Bru been given to Chermann rather than Montagnier, had Montagnier never left Paris and had Barré never became

involved. Not all the events leading up to the discovery were calculated or planned, but often determined through an element of chance, or in immediate response to an unpredicted event.

Further, in opposition to a realist view of science, it would be an error to see this progression as solely the result of scientists revealing a deeper nature— a nature that is characterized as passive. Within this realist perspective, non-human actants (nature) are without agency, but as apparent through the discovery of the virus that causes AIDS, non-human actants (nature and material objects) and human actants have equal agency, both contributing to the creation of this deeper order. To be clear, agency is not used in the sense of making autonomous choices, but having the ability to cause an actant to react. Nature is not passive. It is for this same reason that a constructivist perspective of science fails. Non-human actants, or nature in this instance is not merely ordered by scientists. Nature causes reactions in scientists. With the inadequacies of both realist and constructivist perspectives on science of capturing all that is involved in the process of discovery, it must be clear that human and non-human actants react to one another through resistance and accommodation to form an alliance and *create* nature.