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The Limits of Science[#]

What science is, is a slippery topic, as the science wars show. According to some, it is a religion, ripe for deconstruction as a myth-making cultural activity. Well, fine. That strikes a chord with anyone familiar with the way scientists operate in real life, and as even the clear headed Karl Popper remarked, "science must begin with myth, and with the criticism of myths." Others say that, on the contrary, science is an internal process insulated, if done well, from social and even psychological influence, and therefore from such analysis. That argument, too, seems undeniable.

Perhaps it simply boils down to which science, and which scientist, one is talking about. Sciences vary. As do scientists, a species that includes, as Peter Medawar observed, "collectors, classifiers, and compulsive tidiers up; many are detectives by temperament and many are explorers, some are artists and other artisans. There are poet-scientists and philosopher-scientists and even a few mystics."

The practice of science varies according to which community one is considering. At one end, there is mathematics, clean and tidy and a law unto itself, its results immune to culture, unaffected by human foibles and prejudice. Then there is the rest of science, in various degrees hypothetical, uncertain, and open to interpretation, and thus influenced by human psychology, sociology, politics, and other corruptions. "All the sciences aspire to the condition of mathematics," as Santayana observed, but they rarely make it. Personally, I love the scientific ideal, and wish all scientist were pure as mathematicians. But since they aren't, I welcome the attention of science studies professors.

Any fresh way of scrutinizing science, and drawing attention to the difference between the naive ideal and the more complex reality, can only be helpful. Sometimes this gap is a chasm. Scientists rule without much challenge as the high priests of today's popular faith, and they do so by virtue of their monopoly on expertise, which outsiders are ill equipped to dispute. A little demystification never does any harm, where there is self-serving arrogance to be deflated.

There is one dim corner of science in particular, where there is every sign that the public interest is being mugged daily by the arrogance and bias of scientists, and even science editors. I refer to the science of AIDS. What has happened over the past decade in AIDS is a tutorial in how supposedly ideal science as practiced under modern conditions may be massively subverted by careerist politics and possibly unconscious self-interest.

To understand how this can happen, one has to realize that much of science is more open to extraneous influence, and internal manipulation, than pure mathematics. When Andrew Wiles announced his solution of Fermat's Theorem after over 300 years, he produced his written proof, it was gone over by his expert colleagues and he was sent back to his attic study to labor for a further year before the major kink the reviewers had found could be smoothed out. In physics too, when cold fusion in a jar was announced, it took only a few weeks worth of independent checking in other laboratories to indicate that journalists could begin writing interesting books on how scientific ambition feeds self-delusion. Even Einstein's most radical ideas were validated by observations and the paradoxes of quantum mechanics deconstructed in experiment. Among the tracings of linear accelerators you can even see subatomic particles that have, in theory, traveled "backwards in time". This is not to say that paradigms won't be overturned, as understanding is improved with fresh evidence, and even more brilliant hypothetical speculation to fit the jigsaw together. But at least in such cases the ideas are wide open to inspection, they can be tested with repeatable experiment, and one can confidently say, with Karl Popper, that the test of theory is 'correspondence with the facts'. It is hard for the orthodox or the unorthodox to maintain a position for very long with hocus-pocus, bluff, bluster or influence.

[#] *The Cultural Studies Times*, Fall 1995.

But why then did Popper also say that the task in science is to separate bias of any kind from scientific results. ("Science must begin with myths, and with the criticism of myths.") Because in science, as in life, truth is not always made apparent in black and white. To a greater or lesser extent, it is a matter of inference, and interpretation of incomplete evidence. Many results, particularly in certain fields, are wide open to different interpretations, and thus to human bias, witting or not. Who can deny a sophisticated awareness of external mental influences at work in the less certain fields of medicine, biology, paleontology, zoology and the like, where limits to experiment so often confound certainty? No one can travel to examine a pulsar close-up or revisit past eras to see the incomplete fossil record, or the broken finds of archaeology, in life. Evolution can't be rerun to test a new theory of life's beginnings, or the development of wings. Truth is inferred, provisional, the best guess.

Nowhere is this difficulty more obvious than in medicine. The results of health studies, for example, are often extremely provisional, as the day's news often teaches us (as I write, we are being told that eggs, bad for us last year, have just been rehabilitated). So much depends on epidemiology, the statistics of disease, and on studies where all the variables cannot all be controlled at once, and experiments (testing candidates for fatal disease on humans, for example) cannot always be done. Scientists who cultivate these vineyards must go with what incomplete evidence they have. Opinions and informed judgments replace verifiable fact, and this room for interpretation opens a Pandora's Box of anti scientific forces, from government interference to commercial influence and self interest, whether unconscious or not.

Just how far from the purist ideal the practice of science really is has been clear since Jim Watson's account of the discovery of DNA, but science as careerist struggle was most exhaustively portrayed by David Hull in *Science as a Process* (University of Chicago, 1988). Hull concluded that while scientists cooperate well enough, the very engine of scientific achievement is the competitive urge which won't let them sleep till they have bested their rivals. Historians of science find many examples of corners being cut as scientists compete. Just recently, research on the papers of as great a hero of science as Pasteur has revealed claims which anticipated proof. All in all, science in practice is not always a gentlemanly business.

What this all means is that overturning the orthodoxy is no easier in science than other disciplines, despite the professed open-mindedness of science as a vocation. As Thomas Kuhn pointed out, updating the received wisdom in a science is typically a no holds barred struggle where all the forces of bias and entrenched interest are brought to bear against the challenger, at least until the weight of logic and evidence becomes overwhelming, and perhaps even beyond that point. The opinion, for example, that the blueprint of life was contained in a protein, rather than the simpler molecule of DNA, lasted well past firm evidence to the contrary. The proof was dismissed as a mistake. Talk to any Nobel prize winner, and he/she will tell of the prejudice and close-mindedness which met their novel publications. The establishment reviewers will strenuously resist a new interpretation, and it doesn't take a cynic to suspect they are rationalizing their stake in the old paradigm, even if the motivation is unconscious.

Which brings us to the latest and greatest example of paradigm protectionism, the sputtering, almost suppressed challenge to the ruling notion in the science of AIDS: the hypothesis that the syndrome is an infectious disease caused by the notorious retrovirus, HIV. What is still not widely enough appreciated is that there is substantial doubt among some well-informed scientists and commentators that this simple retrovirus is the right answer to the puzzle of AIDS, that is, the severe immune collapse and its many attendant diseases, which are called AIDS if HIV is present. But over the past decade this doubt has been largely stifled, and prevented from attaining a full airing in the science journals and in the media.

There are many reasons for the doubt, not the least of which is that the theory was announced before compelling evidence was in. In fact even today, despite the theory's universal adoption by virtually all of the scientists in the field (those who publicly think otherwise cannot obtain federal funding), there is no published paper any scientist can point out as quotable proof that HIV causes

AIDS ("A Conversation with Kary Mullis", *California Monthly*, Sept 1994, p. 16). Tens of thousands of published papers assume the notion as a premise, and thus appear to bolster the paradigm beyond dismantling critique. The very name of the retrovirus Human Immunodeficiency Virus suggests certainty about its role. Yet, critics point out that, after a decade and some \$25 billion worth of investigation, convincing lab proof for how HIV might induce immune collapse on the molecular level is still missing. Other indications of a problem with the current hypothesis is that it has "failed to produce public health benefits, as no antiviral drug, no vaccine, and no efficient prevention have been developed. Above all, the HIV-AIDS hypothesis has failed to make valid predictions, the acid test of scientific hypotheses. For example, the prediction that AIDS would spread exponentially in the general population proved to be flawed." (P. Duesberg, *Genetica*, Vol. 95, No. 13, March 1995, p.3).

Perhaps the greatest weakness of the ruling paradigm is that the evidence that HIV is the cause of AIDS remains purely epidemiological, an association of HIV with AIDS that doesn't prove it is the cause, because correlation does not prove causation. This sole exhibit of the prosecution is vitiated by a circularity; according to the CDC (Centers for Disease Control), if HIV is present, the disease symptom (for example tuberculosis) must be AIDS, and if it isn't, then it's not. To add to the illogic, critics count more than 4000 references in the scientific literature to patients whose symptoms were classified AIDS although HIV was absent, and the CDC acknowledges that a positive test for HIV has not been documented in over 43,000 of the 253,000 cases registered in the US by 1992. (*Genetica*, Vol. 95, Nos. 13. March 95, p. 84).

Year after year, the position that HIV is the cause of AIDS is maintained by the scientific establishment in the teeth of a gale of findings that cast doubt on the idea. Among the latest is a new probable cause of Kaposi's Sarcoma, the rare purple skin cancer that was originally the prime marker for what was eventually named AIDS. Now mainstream researchers believe it is not caused by HIV, but a new virus (L. Altman, *The New York Times*, 16 Dec. 1994). Another concern is the accuracy of both the Elisa and Western Blot blood test, which have proved to cross-react with an abundance of other diseases including malaria, casting grave doubt as to the reality of any AIDS epidemic at all in Africa ("AIDS in Africa: Distinguishing Fact from Fiction", *World Journal of Microbiology and Biotechnology*, 1995). Whether the skepticism is ultimately vindicated or not is beside the point here. What is important is that it is clearly well-founded, and the history of the early suffocated debate perfectly illustrates that enormous pressures can be brought to bear against dissent, even when the challenge comes from the ranks of the leadership in a field. In this case, the chief exponent of review was a senior, prizewinning retrovirologist, who first urged reassessment in *Cancer Research*, a leading journal, and then at exhaustive length in what is arguably the most reputable scientific journal in the world, *The Proceedings of the National Academy of Science*, eight years ago. (Both articles are so far without reply in the same journals, though at the time of the *Proceedings* article Robert Gallo, the NIH scientist who invented the HIV-AIDS theory, promised the editors a refutation). The Berkeley professor of retrovirology who so rashly took on this role was and is one of the most prominent figures in retrovirology, blessed at the time with one of the richest federal grants (\$350,000 a year) in science to pursue research avenues wherever his mind led him. Today, however Peter Duesberg is virtually without grants, graduate students or influence, prevented from replying to his critics in leading journals and routinely ignored or detracted in the mainstream press. The Nobel he was expected to win for his earlier work has gone to others, and coverage of his ideas in the science news journals and in the mainstream press has been fitful, gratuitously antagonistic and uniformly disparaging of the heresy and heretic both.

All this, despite the plain fact that Duesberg's doubts have not been satisfied in any respect, his credentials are otherwise unsullied, and his hundreds of scientific supporters now include at least three Nobel prize winners. Of his two most influential opponents on the issue, one (Gallo) barely fought off public censure for stealing credit for the discovery of HIV, and the other (David Baltimore) was forced to resign a prestigious university presidency after unsuccessfully resisting the retraction of a false research article to which his Nobel-prize winning name was attached.

None of that affects the scientific argument, of course, but it does raise questions as to why the media has proved so reluctant to cover the dissent. The New York Times, for instance, which systematically refers to HIV as the virus that causes AIDS, has covered the Duesberg dispute with only five brief stories in nine years. A string of mainstream magazines have assigned pieces only to kill them and coverage by network television has been non-existent until recently, owing to pressure from scientists at the NIH. (B. Ellison and P. Duesberg, "Why We Will Never Win The War On Aids", Inside Story Communications, 1994 and Regnery Gateway, 1995).

Blatant, even admitted censorship has also been seen in the coverage of the dispute by the most widely read general news journals in science, *Science* and *Nature*. *Science* early on published a four page exchange between Duesberg and his opponents, but then cut off the debate and, apart from a sprinkling of letters, has published only tendentious news articles since, casting Duesberg and his ideas in an unfavorable light, quoting his critics liberally and limiting his replies. *Nature* has three times published unreviewed 'correspondence' claiming to refute Duesberg's ideas, and remarkably, has then explicitly declined to allow Duesberg to respond in full. Indeed, editor John Maddox advertised the censorship in a full page editorial entitled "Has Duesberg a Right of Reply?" (The answer was no).

The peculiar extent to which *Nature* is willing to head off Duesberg's views was further exhibited when the *Sunday Times* of London printed extensive coverage of the unorthodoxy and of what it called "The Conspiracy of Silence" last year. Maddox wrote an editorial blasting the newspaper, and advising his readers not to buy the paper. The episode was reminiscent of an incident earlier when a NIH bureaucrat important in AIDS warned that reporters who covered Duesberg "are going to find their access to scientists may diminish." (*The AAAS Observer*, Sept. 1, 1989, p. 4)

Paradigms are not overthrown save by new ones, and Duesberg has argued exhaustively that drugs are the prime candidate for a cause of AIDS. His latest work on the topic, refuting a study published in *Nature* which claimed otherwise, is in *Genetica*, a journal published in the Netherlands, which has devoted a special issue to alternative AIDS hypotheses, intended to redress the balance in the debate. Experimental work on such hypotheses remains limited, however, by the monopoly of federal funding by the AIDS establishment. Duesberg has applied for numerous grants to carry out experiments exploring the drug hypothesis but has always been turned down even, as in the latest instance, when his proposal had the strong support of the editor of *Science*.

Thus the Galilean challenger is censored, and the 20th Century Church of the science establishment maintains its hegemony as effectively as the Church of Rome did in the 17th. In modern times the repression is abetted by an uncritical press, and the cooperation of funding officials who have an incestuous relationship with the ruling scientists. Then there is the power and influence of the drug companies, on which the few investigative reporters in the field have had nothing good to report.

All this difficulty in overturning the entrenched orthodoxy may be nothing special to AIDS, or to science in general, but it hinges on a close-mindedness, a psychological and perhaps even venal attachment to the status quo that is contrary to the values professed by scientists as vital to good work. Is it naive to demand better? Much of the philosophy of science, and much of what has been written about the way science and scientists work, seems to argue that this behavior is inevitable as long as scientists are human, and anyway not entirely a bad thing. I once asked Thomas Kuhn whether the political battle forced on every reformer of orthodoxy in science was not contrary to the professed ethic of scientists, and he gave the question short shrift. Without such an obstacle course, he demanded, how otherwise would the new paradigm be tested?

Such philosophical equanimity might fit with Kuhn's essential point that we must understand science as *realpolitik*, but I suggest that its force dissipates in an instant if one asks the obvious question: would Kuhn feel the same way if his own doctor informed him that his blood had tested positive for HIV? It is hard to imagine that he would not quickly develop a consuming, not-so-philosophical interest in seeing what conclusion might be reached freed of all political, cultural and psychological bias.

And that's my point. We need cultural studies in science because some science isn't being practiced as good science. The philosophers may be right in saying that ultimate reality is forever beyond our grasp. The pragmatists may be right that complete objectivity is impossible for any human. But the aim, at least, should be good science, as far as we can achieve it. The public interest demands that scientific method in practice has to try, at least, to bring the fantasy of theory as closely in accord with reality as humanly possible. To that end, scientists should be ashamed of restricting the free flow of information and debate which is the lifeblood of good science. So should the science editors who abet them.

In the end, the best definition of science may be Peter Duesberg's. He has sacrificed much material advantage to a sense of public responsibility and to an ideal of science which is simple, straightforward, has absolutely nothing worldly about it, and no mystification either. "Science", Duesberg has written, "is the search for the ultimate match between facts and theory." Science studies may, ironically, help to educate scientists, the press and the public to restore this fundamental notion to primacy by suggesting that scientists have their moral obligations as well. They do, when lives hinge on truth.

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