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**WHO RULES
IN SCIENCE**

AN OPINIONATED GUIDE TO THE WARS

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1

Scenes from the Science Wars

A TRIP TO THE MUSEUM

In Canada the science wars are fought by conscientious objectors. I recently went to the Ontario Science Centre in Toronto to see a special exhibit, “A Question of Truth.” The aim was to make us aware of the impact of different “points of view” on theorizing and to raise questions about social and cultural influences on science. I was especially drawn to it by an article in *The Globe & Mail* by Stephen Strauss, the science editor. He complained that the exhibit sent out a “relativistic” message and was, he suspected, motivated by “political correctness.”

What surprised me was just how conservative most of the exhibit was. Strauss couldn’t have been further off the mark—at least as far as relativism goes. The whole thing was polite, cautiously liberal, and designed to give no offense to anyone, including scientists. One of the displays (there are forty in all), titled “East Meets West,” concerns acupuncture. A large plastic body illustrates the procedure; an accompanying text says that western science has made discoveries about nerve endings close to the skin and how stimulating them triggers the release of endorphins in the brain. It goes on to say that this may explain why acupuncture therapy has helped chronic pain sufferers. Notably, there is no mention of eastern explanations of how acupuncture works.

Another exhibit, “Secrets of the Heart,” asks “Who revealed them first?” The display notes that an Islamic physician, Ibn al-Nafis of Syria, described the process of how oxygen enters the blood in the thirteenth century—300 years before anyone in Europe. The moral is that not all great scientific accomplishments are European.

Both of these exhibits reflect a highly conservative and quite traditional view of science—one completely compatible with the most staunchly anti-social constructivist versions of scientific realism. In each case the view is this: there is a way things are—about pain and endorphins, about blood and oxygen—and current, Western science correctly describes them. There is not a hint of relativism about this. “Political correctness”? Yes, it’s there—in the form of giving due credit to those non-Europeans who have discovered the truth. Most so-called political correctness is innocuous in just this way; it’s hard to understand why anyone would oppose it. And if this is what social constructivism is, it’s hard to see why anyone would oppose it either.

The situation is ironic. Political correctness often irritates people because it sometimes appears to embrace a strong form of social constructivism. Yet someone who is a serious constructivist would very likely *deny* the alleged prior discovery of how oxygen gets into the blood. After all, what is “oxygen”? One need only read Thomas Kuhn’s very influential *Structure of Scientific Revolutions* on this very term. He discusses the history of chemistry—Lavoisier vs. Priestley—and claims that it is highly problematic to take a concept like *oxygen* and apply it in distinct theoretical contexts. The museum’s version of political correctness is so conservative, in fact, that it rides rough-shod over Kuhnian incommensurability, a primary source of relativistic inspiration. Looking at an exhibit like this, one might even say with Zola, commenting on the Dreyfus affair: *La vérité est en marche; rien ne peut plus l’arrêter.*

Some exhibits at the Science Centre have a distinctly political tone to them. One of these is on “Race and Prejudice.” It includes a very good short film on race and IQ studies, eugenics, and related issues. It does not simply declare that certain lines of research were racist. Rather, it wisely points out that particular lines of research are in serious conflict with other things established by regular, orthodox science. In short, *good science fights socially pernicious science*—a theme I always find heart-warming.

Perhaps the most interesting and provocative exhibit is the display “Sex and Science,” which asks: “Does your sex determine your point of view? How might this affect scientific research?” There’s a picture of a human egg surrounded by sperm cells. Visitors are asked to choose be-

tween statements *a* and *b* as best representing their beliefs. Although there is a long list of alternative pairs, the first pair is representative:

- a. This is a human egg waiting to be fertilized by fiercely competitive sperm cells, each one a formidable .06 mm weapon, tipped with a chemical warhead.
- b. This is a wastefully huge swarm of sperm flailing aimlessly around a mucus-enshrouded egg. Eventually the egg yanks one reluctant sperm inside so it can fertilize itself and become an embryo.

Of course, these are provocatively posed alternatives, and we are likely to reject both. Nevertheless, when no other alternatives are offered, the results can be divisive. And the statistics make it plain. A record is kept of the answers and of the gender of the person responding. Males tend to pick *a*, females tend to pick *b*. The “Sex and Science” display dramatically makes the point so many feminist critics have stressed: gender influences research. But a distinction quickly leaps to mind: gender influences lines of research and perhaps what people *tentatively believe* to be true, but it does not influence the truth itself. At most one of the *a-b* pair is true, perhaps neither—but certainly not both. Holding both true is a kind of relativism we often hear about, but few (if any) feminist writers on science actually maintain such a view.

If there is a moral that comes out of the exhibit, “A Question of Truth,” it could only be that *point of view* matters to the direction of research, but not to the facts themselves. This is a rather liberal view of science, but quite within the realist camp and quite in harmony with scientific orthodoxy. It is also, I suspect, a reasonable reflection of the educated public’s view of science, as well as a view with which most working scientists can happily live.

As I mentioned already, Canada’s version of the science wars is waged by pacifists. For real bloodletting, we need to look elsewhere. Before we turn to C. P. Snow’s famous book, *Two Cultures*, I will slip in a word about key terms. There is no uncontroversial definition of “social construction,” “relativism,” or other important terms that are scattered throughout this book, not even “Left” and “Right.” But rough definitions might be useful. To say that knowledge is a *social construction* is to

say that it is the product of various social factors and not the result of an objective investigation into how things are independent of our social interests. But there is more to it than just belief—there are no objective facts of the matter to be discovered, according to constructivists.

It needn't be an all or nothing matter. Some social constructivists apply the view to everything, but one could—with considerable plausibility—claim that quantum mechanics, for example, is objective knowledge, whereas economics is largely a social construction.

Relativism is related to social construction and often taken to be a consequence of it. It says that knowledge (scientific, moral) is tied to a group or society (“Polygamy is morally proper for them, but wrong for us.” “The Big Bang is factually true for us, but for them the world started in a different way, and they’re correct, too.”). There is no moral right or wrong, no factual truth or falsehood over and above what is accepted by a particular society. The old saw: “When in Rome, . . .” doesn’t do relativism complete justice, but it captures some of its flavor.

The *Left-Right* dichotomy stems from the French Revolution, when the more progressive members of the National Assembly sat *à gauche* while their opponents were seated *à droit*. The terms have stuck and are used in a common, though loose, fashion throughout the world. Left-wingers today would often include opposition to racism, opposition to sexism, pro-environmentalism, and anti-war activism as part of being on the Left. But if there is one characteristic that is essential and overriding, it is the desire for greater economic equality. Where opinions differ is over how much equality and how it should be achieved. Opinions further divide over the relation between economic issues and others. Marx took all social problems to be at root economic. Many current Leftists think that, contrary to Marx, racism and sexism have a life of their own; they are independent of economic factors and must be separately combated.

The spectrum of opinion on the Right is perhaps even wider. Notions of equality for its own sake—economic or social—are typically shunned. Freedom is commonly stressed. Often tradition as a source of wisdom is upheld; this is especially true of social conservatives. On the other hand, champions of “unfettered free enterprise” often turn out to be social revolutionaries, which in established political parties can lead to serious conflicts with their social conservative allies.

Very often the local social situation can shape the form of Left or Right opinion. The Left in the United States and in most of the world, for instance, is anti-nationalist, taking the view that nationalism is an anti-progressive force. In Canada, on the other hand, the Left is highly nationalistic, adopting the view that it must protect Canada from American encroachment, which will lead to the undermining of its progressive institutions such as national health care. Multiculturalism, to cite another example, is a prominent cause for the Left in the United States. However, the Left in Canada is somewhat ambivalent, since it puts all cultures on a par, thereby undermining the special claim of Quebec (which the Canadian Left supports) in their struggle to maintain the French language and a separate culture in a sea of English-speakers.

This gives some idea of the spectrum of opinion and some idea of why we can't be precise in characterizing Left and Right. But if we say that for the Left, social and economic equality are paramount, we won't go too far wrong. And how social and economic equality relate to attitudes to science is the fundamental question.

Now to Snow's famous polemic.

TWO CULTURES AND THE SCIENCE WARS

The literati were much irritated by C. P. Snow's *Two Cultures and the Scientific Revolution* (1959/63). In this now classic work, Snow asserted that there are two cultures, in England and indeed throughout much of the world, that have little or nothing to say to one another, and that this is an unfortunate and even dangerous turn. One culture is scientific, the other literary. The former find Dickens obscure, the latter glaze over when asked about the second law of thermodynamics. In this little book, both sides seem at first to come in for equal scolding from Snow, the scientist turned novelist. But no, the literati are the worse offenders. And as we continue through his work, we find that "literary culture" (the culture of the literary intellectuals) gives way to "traditional culture" (the stuff of most ordinary folk), and this comes in for much general criticism. Snow ends with a call for major educational reform with much greater emphasis on the sciences in his favored scheme of things. But this is to put it in the mildest way.

When mentioned today, Snow's term, "two cultures," invokes the gulf of unintelligibility between the humanities and the sciences. Even Jeremy Bernstein gets it wrong and he's both a scientist and a writer, like Snow himself. "I am . . . unimpressed with C. P. Snow's discussion of the 'the two cultures.' I wonder if anyone still reads him." Evidently not Bernstein, since he adds: "what Snow is worried about most when it comes to the two cultures seems to be High Table conversation" (1996, 12). But there is much more in Snow's rambling and somewhat disjointed essay than fear of a chasm of incomprehension over dinner. Especially interesting and important are his sporadic comments on the politics of the two sides. Snow identifies the scientific culture with the Left (at least statistically) and the literati with the Right. He confidently asserts that scientific culture could deal much better with serious social problems, and he even makes the inflammatory claim that the major literary figures of the early twentieth century—Yeats, Pound, and Wyndham Lewis—brought us a little closer to Auschwitz.

What did Snow care about? He cared about *who does rule* and *who should rule*. The literati, in his view, were part of the existing ruling class, a pack of muddle-headed right-wingers who have not been able to deliver a decent living to the great mass of humanity. The scientific Left could do very much better and should be given the chance.

Scientists liked the piece, but the literati were incensed. Perhaps the most famous reply came from F. R. Leavis, the Cambridge literary critic, who mocked and denounced Snow on many scores in his *Two Cultures? The Significance of C. P. Snow* (1962). Leavis refrained from calling Snow a bad novelist only because he refused to call him a novelist at all.

Some defenders of literary culture, such as Michael Yudkin, were more temperate. But his remarks in defense of literary and traditional culture actually shed more light on the depth of the divide and even reinforce it. "To read Dickens, or to hear Mozart, or to see a Titian can be in itself a rewarding activity," says Yudkin, "but to find out what is meant by acceleration is to gain a piece of factual information which in itself has no value" (Leavis and Yudkin 1962, 35).

This is a stunning remark. The scientific concept of acceleration was hard won; to understand it is to make a crucial distinction between *velocity* and *change of velocity*; it is to understand *force*, and to grasp the

connection between any kind of change and the mathematical notions of derivative and integral, so brilliantly put together by Newton and Leibniz. To put it on a par with, say, the fact that I keep the forks in the drawer on the left is to miss the point of scientific culture. It's a bit like saying: "Well, perhaps Mozart makes the cows give more milk; but besides that, so what?" It is little wonder that scientists (regardless of politics) are often contemptuous of nonscientist commentators on science.

The battle long ago over Snow's *Two Cultures* has much in common with the current science wars. The differences, however, are more important. What they seem to have in common is a dispute between scientific and the literary types. The warring parties are similar. But that's the end of it. In the current round of fighting, it's (1) the objectivity of science, rather than its cultural importance, that is principally at issue (though its cultural importance is certainly a factor). In Snow's day, this was not at issue. As Yudkin might have put it: science deals with mere facts. Now the focus is different; current science studies commentators are more likely to say that science is as nonfactual as any other part of general culture; its so-called facts are social constructions. (2) Snow was fighting for underdog science, whereas today science is anything but that. It is the literary side who feel under siege from a dominant techno-science culture. (3) Snow took his scientists to be predominantly on the Left and the literati on the Right. Yet, in much of the current science wars commentary, the very opposite is assumed. Gross and Levitt, for example, in *Higher Superstition*, take the opponents of science to be, in their words, the "academic left."

I could go on listing similarities and differences. And not just between Snow's "two cultures" and the rival sides in the current science wars; we could find lots of interesting similarities and contrasts with much earlier clashes such as the Romantic rejection of the Enlightenment. Instead, let's turn to Alan Sokal's now famous prank.

SOKAL'S HOAX

Is the "Sokal Affair" old news? Its persistence is remarkable. Books and articles continue to appear.¹ Ian Hacking confesses: "a few days after the story broke in May of 1996, I said that Sokal's hoax had now had its fifteen minutes of fame. How wrong I was" (1999, 3). The infamous

hoax may be history, but how much has the culture absorbed? Let's start with a quick quiz. One of the following statements is generally accepted by physicists. The other is a deliberate piece of mushy nonsense. Which is which?

- a. Henceforth space by itself, and time by itself, are doomed to fade away into mere shadows, and only a kind of union of the two will preserve an independent reality.
- b. The first homology group of the sphere is trivial, while those of the other surfaces are profound; and this homology is linked with the connectedness or disconnectedness of the surface after one or more cuts. Furthermore, there is an intimate connection between the external structure of the physical world and its inner psychological representation qua knot theory.

Did you have trouble picking out the nonsense? So did the luckless editors of *Social Text*, who are still wiping egg off their faces. They were taken in by Alan Sokal, a working physicist with professed left-wing sympathies. He submitted—and they unwittingly accepted—his parody, “Transgressing the Boundaries: Toward a Transformative Hermeneutics of Quantum Gravity” (Sokal 1996a), a concoction of cleverly contrived gibberish written in the worst postmodern jargon. Within days Sokal revealed his hoax in *Lingua Franca* (Sokal 1996b), saying he was not so much trying to defend science from its empty-headed critics as he was hoping to rescue the political Left from a disastrous form of thinking.

Agitation and anger abound. Diverse issues have been lumped together and the active participants polarized into two camps to fight *the science wars*, as it has come to be called. War, we are told, is politics by other means. This is especially true of the science wars, where social goals loom large. Shifting aims and unnatural alliances make war-watching intriguing but difficult to follow. Some of the concerns, only an academic could fuss over; others are central to how we live our lives. But more of this in a moment. Now, back to Sokal's hoax.

Derrida, perhaps the most prominent postmodern of them all, offers us this piece of fluff:

The Einstein constant is not a constant, is not a center. It is the very concept of variability—it is, finally, the concept of the game. In other words, it is not the concept of a *something*—of a center starting from which an observer could master the field—but the very concept of the game.

With tongue firmly in cheek, Sokal sympathetically elaborates:

In mathematical terms, Derrida's observation relates to the invariance of the Einstein field equation $G_{\mu\nu} = 8\pi GT_{\mu\nu}$ under nonlinear space-time diffeomorphisms . . . In this way the infinite-dimensional invariance group erodes the distinction between observer and observed; the π of Euclid and the G of Newton, formerly thought to be constant and universal, are now perceived in their ineluctable historicity; and the putative observer becomes fatally de-centred, disconnected from any epistemic link to a space-time point that can no longer be defined by geometry alone. (1996a, 222)

And when Jacques Lacan incorporates the Möbius strip into psychoanalysis, Sokal amplifies approvingly with hokey remarks about homology groups. By the way, this particular tidbit of topological tomfoolery was the deliberate nonsense in the quiz above. It was the second of the two quotes; the first passage about space and time giving way to space-time is a remark (also quoted by Sokal) from Herman Minkowski's famous 1908 article that reconceptualized special relativity and set the framework for general relativity.

Of course, Sokal's musings are all bluff and bluster. But who, precisely, was the target of this parody? In his hoax, Sokal criticizes scientists who

cling to the dogma imposed by the long post-Enlightenment hegemony over the Western intellectual outlook, which can be summarized briefly as follows: that there exists an external world, whose properties are independent of any human being and indeed of humanity as a whole; that these properties are encoded in "eternal" physical laws; and that human beings can obtain reliable, albeit imperfect and tentative, knowledge of these laws by

hewing to the “objective” procedures and epistemological structures prescribed by the (so-called) scientific method. (1996a, 217)

By pretending to attack, Sokal is actually defending such a view, an outlook more or less shared by working scientists and presumably by Sokal himself when he’s not posing as a pomo (as postmoderns are often called). Crudely, we can put it like this: *There is a way things are, and scientists are trying to figure it out; they have a variety of (fallible) techniques for doing so and thus far have been quite successful.* Let us call such a view *scientific orthodoxy*. I’m happy to leave it to readers to fill in their favorite version of the details, but if pressed for my version of scientific orthodoxy I would include the following:

- a. There is a world in which there are objects, processes, and properties that are independent of us and our beliefs about them. Any statement we make about them is false or is true (or at least approximately so). Of course, we may never know which.
- b. The *aim* of science is to give true descriptions of reality. Science can have other aims as well (usually associated with technology), but truth is the chief aim of pure science.
- c. We have a variety of tools and techniques (observation, logic, statistical inference) for learning how things are. These methods have developed from earlier methods and very likely will themselves be developed further.
- d. Such methods are fallible; they may lead us astray. Nevertheless, science has made remarkable progress so far. It is reasonable to continue to use these methods (and to continue refining them) in the belief that they are the most reliable source of information about nature.

This cluster of views is just common-sense realism. (A more detailed discussion will be found in Chapter 4.) Common sense is sometimes misleading, however, and in this case, say the so-called social constructivists whom Sokal is parodying, it is profoundly wrong. But is it? One of the many aims of this book is to give a reasonable answer.

A word or two about “science” is also in order. I’d prefer to leave the term slightly vague, but not too ambiguous. The principal meaning of

“science” is that body of current theories that purport to truly describe the world (or at least to systematize our experience). This should be contrasted with technology and applied science, the attempt to control and manipulate the world in the pursuit of our practical goals. “Science” also means the institution of science, the vast collection of universities, research establishments, and government agencies. It’s important to separate these different meanings conceptually, even though they are all involved in many of the crucial policy questions that deeply affect our lives.

Let’s return to Sokal again. Why did he perpetrate his hoax? In his exposé Sokal declares a political purpose. “I’m an unabashed Old Leftist who never quite understood how deconstruction was supposed to help the working class [or promote social justice in general]” (Sokal 1996c). Far from believing that science needs saving from the postmodern crowd, Sokal holds that left-wing politics needs rescuing from idiotic thinking. Like many before him, Sokal holds that relativism, irrationalism, and downright sloppy reasoning undermine progressive political aims. The Left doesn’t have the money or the guns to get its way. Clear thinking is the Left’s best weapon. And only clear idiocy would abandon it.

To a large extent, then, the real issue between Sokal and his postmodern target is not, “How should we think about quantum gravity?,” but rather, “How can we best change society?” Of course, Sokal is not the first to raise such issues, nor will he be the last—but he was certainly the most dramatic.

So how did the science wars get started? Right from the beginning constructivist views have been criticized. A particularly bitter phase began with the publication of *The Higher Superstition* by Paul Gross and Norman Levitt (1994). The subtitle of their polemic is *The Academic Left and Its Quarrels with Science*. It suggests a clear target, but the term “academic Left” is hopelessly vague. Gross and Levitt use it “to designate those people whose doctrinal idiosyncrasies sustain the misreadings of science, its methods, and its conceptual foundations that have generated what nowadays passes for a politically progressive critique of it” (1994, 9).

To define the academic Left as those who “misread” is hardly a generous characterization. It is seldom a wise strategy to characterize one’s

foe as *wrong by definition*—victory is too easy and too short-lived. Instead of defining the academic Left as those who misread science because of their doctrinal idiosyncrasies, it would be much better to use the term “left-wing critics of science” (defined as those who criticize science from a left-wing point of view) and to save the term “academic Left” for what it really represents, namely that set of academics who have left-wing views, allowing the obvious fact that some are and some are not critics of science. Sokal, like many others, is a member of the academic Left, but is not a left-wing critic of science. Parallel terms will also be useful: “academic Right” is similarly neutral in attitudes toward science, whereas “right-wing critics of science” would include, for example, many religious detractors of Darwin. With this apparently petty—but actually important—terminological point out of the way, we can get back to the main story.

Higher Superstition caused quite a stir when it appeared in 1994. Its authors gave several popular and well-attended talks. Some critics, like Andrew Ross (an editor of *Social Text*), saw it as part of a general backlash, an attack on progressive movements in race relations, in gender relations, in the environment, and so on. Thus was born the special issue of *Social Text* with the title “Science Wars.” To some extent the prominent use of the term stems from this, and all sides have found it convenient, since the term is fairly neutral (though there are grumblers—including Sokal himself). The relative neutrality of “science wars” is quite unlike “political correctness,” which started out as playful, leftist, and feminist self-mockery, but in the hands of their opponents quickly became a term of sneering derision.

In his introduction to the “Science Wars” issue of *Social Text*, Ross uses such expressions as “undemocratic” in characterizing science. This is guaranteed to polarize. Scientists will be deeply offended at being so labeled. Or, perhaps, they will respond by saying that, of course, science isn’t democratic—we discover the truth, not vote on it. But when Ross discusses a different point, the true character of his attack on “anti-democratic” science is clarified. He is worried, for example, about the relations between “remote” scientific experts and the local worker.

The unjustified conferral of expertise on the scientist’s knowledge of, say, chemical materials, and not the worker’s or the

farmer's experience with such materials, is an abuse of power that will not be opposed or altered simply by demonstrating the socially constructed nature of the scientist's knowledge. That may help to demystify, but it must be joined by insistence on methodological reform—to involve the local experience of users in the research process from the outset and to ensure that the process is shaped less by a manufacturer's interests than by the needs of communities affected by the product. This is the way that leads from cultural relativism to social rationality. (Ross 1996, 4)

There's much crammed into this passage, and with much of it any champion of scientific orthodoxy could agree. The remarks about social constructivism would be rejected, but no scientific rationalist thinks that a local worker's or a local farmer's experience is irrelevant. On the contrary, rational belief should be decided by evidence, and the local workers' experiences are part of the total evidence to be considered. Moreover, it comes as no shock to the most zealous advocate of orthodox science that a farmer might have a different interest than a chemical manufacturer.

Ross believes there is very much more going on. He sees the science wars as a new front in the "holy Culture Wars. Seeking explanations for their loss of standing in the public eye and the decline in funding from the public purse, conservatives in science have joined the backlash against the usual suspects—pinkos, feminists, and multiculturalists of all stripes" (Ross 1996, 6). To what extent, if any, is he correct?

THE ENSUING SKIRMISHES

Sokal published his hoax article in the "Science Wars" issue of *Social Text* in the spring of 1996, and immediately followed with his exposé, "A Physicist Experiments with Cultural Studies," in the May/June issue of *Lingua Franca*. The subsequent exchanges in the popular media, the academic press, and especially on the Internet were fast, furious, and fascinating.

The *New York Times* gave it prominent coverage right from the start. In the May 18, 1996 issue, Janny Scott's front-page article described

Sokal's prank and declared it "one more skirmish in the culture wars, the battle over multiculturalism and college curriculums and whether there is a single objective truth or just many differing points of view" (Scott 1996).

"Is the jargon-infested writing in postmodern academic journals as stupid and empty as it appears? Can people teaching cultural studies get away with absolute nonsense? Sokal devised an experiment, and came up with an answer: Yes, in both cases." So wrote Robert Fulford in the *Globe & Mail* (June 5, 1996); he fears Derrida's influence is here to stay, but is at least grateful for the "glimmer of hope" provided by Sokal.

A "Pomolotov Cocktail" is what Katha Pollitt called it in the left-liberal magazine *The Nation* (June 10, 1996). "Sokal's demonstration of the high hot-air quotient in cultural studies—how it combines covert slavishness to authority with the most outlandish radical posturing—is, if anything," Pollitt writes, "long overdue" (1996, 9). She does note a downside, however. "Unfortunately, another effect of his prank will be to feed the anti-intellectualism of the media and the public." She deplores the fact that brilliant sociological work will be lumped in with the rubbish, and that respectable people "will have to suffer, for a while, the slings and arrows of journalists like the *Times's* Janny Scott, who thinks 'epistemological' is a funny word" (ibid.). As for the work of the postmodern crowd, "What results," says Pollitt, "is a pseudo-politics, in which everything is claimed in the name of revolution and democracy and equality and anti-authoritarianism, and nothing is risked, nothing, except maybe a bit of harmless cross-dressing, is even expected to happen outside the classroom" (ibid.). In similar spirit Gary Kamiya (1996) referred to the "Transformative Hermeneutics of Total Bullshit"—not wanting to put too fine a point on it.

Even the *Village Voice* got into the act with a piece by Ellen Willis called "My Sokaed Life," which correctly predicted that "We can now look forward to months of having the Sokal affair trotted out as definite proof that radical criticism of science, and indeed the entire enterprise of cultural studies, boils down to mindless, fraudulent gibberish" (Willis 1996).

Martin Gardner—everyone's favorite polymath—was delighted with the hoax in his "Notes of a Fringe-Watcher" column in the *Skeptical In-*

quirer. As well as making the anti-constructivist points that are by now familiar, Gardner takes a swipe at Thomas Kuhn's *Structure of Scientific Revolutions*, which "has been responsible for much postmodern mischief" (1996, 16). We'll be looking at Kuhn's views below.

There were interesting reactions to the Sokal affair throughout much of the world. After the United States, reactions may have been strongest in France. Most of Sokal's prominent targets were French. With a Belgian colleague, physicist Jean Bricmont, Sokal wrote *Impostures Intellectuelles* (1997) (in the United Kingdom: *Intellectual Impostures*; in the United States and Canada: *Fashionable Nonsense* (1998)), which is a detailed critique of the misuse and abuse of science in the work of several leading French intellectuals, including Jacques Lacan, Julia Kristeva, Luce Irigaray, Jean Baudrillard, Bruno Latour, and Gilles Deleuze. When word of its impending publication got out, the pages of *Le Monde* and other French dailies were filled with angry exchanges. Some, including Latour and Kristeva, called Sokal anti-French and even anti-European; others, including many French, defended Sokal and heaped additional scorn on the postmoderns. There is no doubt that current French intellectuals must be feeling particularly put upon, especially when they see major foreign newspapers such as the *Guardian Weekly* asking in an eye-popping headline: "Is Modern French Philosophy Just a Load of Pseudo-Scientific Claptrap?" (Henley 1997).

Not all interventions have been quite so partisan. The very prestigious British journal, *Nature*, called for "respect and rigour" (in the Jan. 30, 1997 issue). "The stakes on both sides are high. On the one hand, some scientists believe that they are fighting for the intellectual and social credibility of an enterprise that remains essential for human well-being. On the other, many social scientists argue equally convincingly that only a deep understanding of science as a social (as well as intellectual) process will enable us to strengthen the bridge between the worlds of science and politics that is essential if this well-being is to be achieved" (ibid., 373). This sounds the sweet voice of reason and we can certainly applaud *Nature's* good will, but without some guide to which social constructivist claims are, and which are not, wrong-headed, the call for "respect and rigour" is rather empty.

Speaking of conciliatory, that seems to have been the prevailing—though I must say, unexpected—attitude at the PSA (the biannual meeting

of the Philosophy of Science Association held in November 1996 in Cleveland). One need only peruse the pages of the journal, *Philosophy of Science*, to realize that the Philosophy of Science Association is no happy home for social constructivists. Sokal was an invited speaker; he recounted his hoax and drew the morals he has often drawn before and since. A number of very prominent philosophers of science (Arthur Fine, Philip Kitcher, and Ron Giere) spoke from the floor during the question period and expressed an ambivalence about Sokal's actions,² which I might summarize as "Yes, the hoax was funny, and yes, you (Sokal) were correct about the silliness of those you lampooned—but we really wish you hadn't done it. There was a debate going on, and now, thanks to your hoax, things have become so polarized that further discussion is greatly hampered."

If anything, the opposite has occurred. The Sokal affair has brought the science wars to a head. I find that an increasing number of people who would cheerfully characterize themselves as holding anti-postmodern, pro-orthodox views on science are starting to ask serious questions about specific social constructivist doctrines. Some social constructivists are at pains to distance themselves from postmodern critiques. And Andrew Ross, in a recent opinion piece, admits that the oft-repeated charge that postmodern language is hopelessly obscure is a fair complaint.

There are signs of conciliation all about. Conciliation is not always a real solution, however, and shouldn't be turned into a fetish. Some differences of opinion are settled by coming to a consensus after compromise. Others are settled by having clear winners and clear losers, the latter withdrawing into the woodwork to labor in wretched isolation. Since much of the science wars is about how we live, the outcome will affect huge numbers of people who are not intellectually directly involved in the debate itself. Whether a handful of participating academics feel victorious, humiliated, or just manage to save face is of no real importance. This is not like working out a compromise on parking privileges. Getting things right is of paramount importance for society in general.

THE POLITICAL SIDE

Were those who worried about the political Right being cheered by Sokal's antics merely paranoid? Not at all. Those who saw Sokal's hoax as a right-wing backlash must have felt vindicated when prominent

arch-conservatives quickly got into the act. Rush Limbaugh, on his radio program (May 22, 1996), declared that the gibberish of Stanley Fish (a leading postmodern literary critic and social commentator) is indistinguishable from Sokal's deliberate gobbledygook, and that academics like Fish are effete elitists, living in a different world. In the same broadcast he went on to attack the "pseudo-history" produced in African studies programs. George Will (in his May 30, 1996 column) remarked that Sokal's hoax reveals the "gaudy silliness of some academics." He was quick to denounce "using higher education's curricula to dole out reparations to 'underrepresented cultures'" (Will 1996).

"Cultural studies" was again the focus of animus in Roger Kimball's "Diversity, 'Cultural Studies' & Other Mistakes" (in *The New Criterion*, May 1996). "The irony, of course, is that many of the students who agitate against the 'Eurocentric' curriculum at Columbia and elsewhere are only present at the university in the first place," says Kimball, "because of the discriminatory practice of what is euphemistically called 'affirmative action,' a.k.a. preferential treatment. But once admitted, it turns out that what many such students want is not an education but ideological training designed to confirm their coveted status as 'victims'" (1996, 4). *Social Text's* editor, Andrew Ross, is singled out for special mention by Kimball, who scruples not at the *ad hominem*: "A Scot by birth, Professor Ross has parlayed an accent (proletarian chic), adolescent attire and intellectual interests, and large dollops of Marxist rhetoric into an amazingly successful academic career" (ibid., 5). Kimball's delight with the Sokal hoax was expressed later in *The Wall Street Journal* (May 29, 1996), where he urged "deans and presidents, parents and alumni, legislators and trustees, to take a hard look at the politicized nonsense they have been conned into subsidizing."

The political Right was gleeful, but many on the Left greeted Sokal with equal enthusiasm. Writing in the *Los Angeles Times*, historian Ruth Rosen wholly endorsed the prank. "Sokal's spoof exposed the hypocrisy practiced by these so-called cultural revolutionaries. They claim to be democratizing thought, but they purposely write in tongues for an initiated elite. They claim that their work is transformative and subversive, but they focus obsessively on the linguistic and social construction of human consciousness, not on the hard reality of people's lives" (Rosen 1996). She knows there is a price to pay for this sort of

thing, but it is worth it: “Yes, I know that the conservative right may use Sokal’s parody to further attack ‘tenured radicals.’ But if the progressive left is to survive and be credible, it must withstand the glare of public scrutiny and be worthy of people’s respect” (ibid.).

Michael Albert of *Z Magazine*—a leading left-wing periodical that publishes many of Noam Chomsky’s political pieces—applauded Sokal and his motives. The Left has no weapons of its own but logic and rationality, he notes. Why abandon them? “Elites not only have the guns and money,” says Albert, but if the postmoderns have their way, then “we let them have ‘truth’ too. It would be hard to conceive a more self-defeating stance” (Aug. 1996, *Z-Net*).

To critique bad science and scientists is part of understanding the world to make it better. To suggest methods people could use to avoid excessive reductionism, to guard against exaggerating the scope of scientific insights into domains where it is inapplicable (and there are many), or to ward off sexist, racist, and classist biases is a useful way to aid sincere scientists (and left political activists). But to critique reason and logic as being at the root of science’s many evils is wrong and has no role in making the world better. And that is what rejecting the scientific method amounts to. (Albert, Aug. 1996, *Z-Net*)

THE COUNTER-ATTACK

A few days after the *New York Times* reported the hoax, Stanley Fish launched a counter-attack in the paper’s editorial pages. Fish is a leading figure in “cultural studies.” His “Professor Sokal’s Bad Joke” quickly became a focal piece. In it he decried the “corrosive effects of an academic hoax.” More bizarre—if not disingenuous—was Fish’s claim that social constructivists have actually honored scientists and not denied the reality of the world or its properties. “They [social constructivists] just maintain and demonstrate that the nature of scientific procedure is a question continually debated in its own precincts. What results is an incredibly rich story, full of honor for scientists.” He then drew a curious analogy designed to show that “real” and “socially constructed” are perfectly compatible. In baseball, “strikes” and “balls” are clearly social

constructions; that is, they are human creations, not found in nature. However, once the constructions are made, a particular pitch really is a strike or a ball. “The facts yielded by both [baseball and science] will be social constructions and be real.”

One wonders how good an analogy this is. The rules of a game are rather obvious social constructions, but are molecules and the moon made the same way? Silver dollars are social constructions, but is silver? Fish wants the definition of a strike to be a social construction but allows it to be an objective fact that the trajectory of a ball did or did not pass through a particular region of spacetime. Has any die-hard scientific realist ever claimed otherwise? In many obvious senses silver dollars are similarly social constructions; but if silver itself isn’t, then chemists have nothing to fear from Fish. His analogy is deceptive. It seems to work because he claims (1) strikes are invented, not discovered, and (2) trajectories are discovered, not invented. Most people would agree. The trouble is that no self-respecting social constructivist would concur with (2). Fish doesn’t comprehend (or deliberately obscures) how far-reaching are the views of those he defends.

SCIENTISTS HAVE THEIR SAY

Steven Weinberg is one of the most public of contemporary scientists. As well as being a Nobel Prize-winner for his work in high-energy physics, he writes some of the best popular science available (e.g., *The First Three Minutes* and *Dreams of a Final Theory*). He’ll have no truck nor trade with constructivists, as he made perfectly clear in his *New York Review of Books* piece, “Sokal’s Hoax” (August 8, 1996). Weinberg speaks for many in the scientific community when he allows that the *language* of science is a social construction, but nevertheless insists on the objectivity of physical laws. “To put it another way, if we ever discovered intelligent creatures on some distant planet and translate their scientific works, we will find that we and they have discovered the same laws” (1996, 14).

It’s hard to imagine anything less likely to be true. For one thing, we ourselves have not always believed the same laws. The only way Martians, say, and ourselves would have the same beliefs is by having the same *history* of beliefs—a long Ptolemaic stage of astronomy, followed

by a briefer Copernican/Keplerian/Newtonian interval, then on to general relativity, and so forth. Not only would our histories have to match, but the Martians had better be at the same stage as we are when we meet, otherwise it could be their Priestley counterpart meeting our Planck. Perhaps Weinberg would go to the wall for phlogiston, but not the rest of us. Intellectual determinism of this order is preposterous.

If faced with his choice: believe all intelligent creatures have discovered the same laws *or* believe social constructivism, it's easy to see why many thoughtful people opt for the latter. There are so many accidents, so many little things that affect the course of intellectual life, that it is extremely unlikely that two unconnected intellectual communities would have identical histories. Yet this is what Weinberg's view implies.

Social constructivists have often suggested exactly the same stark and implausible alternatives as the ones Weinberg offers. Unlike him, they choose to reject the objectivity of laws and to accept some form of constructivism as being the far more sensible view. But the dichotomy—certainty vs. construction—is a false one. Scientific objectivity is compatible with a high degree of fallibility. In their day phlogiston, caloric, and the aether were the stuff of excellent theories. Sensible people believed them on the best of grounds. But there's no reason to think that Martian physicists would ever pass through similar stages in their intellectual history.

Weinberg is well-aware of the “whiggism”³ involved in his view, but he boldly clings to the present. “A historian of science who ignores our present scientific knowledge seems to me like a historian of U.S. military intelligence in the Civil War who tells the story of McClellan's hesitations in the face of what McClellan thought were overwhelming Confederate forces without taking into account our present knowledge that McClellan was wrong” (ibid., 15).

How does this help? To be “whiggish” is to be overly present-minded—a sin, but a subtle one. Rather than try to understand the past in its own terms, whiggish history imposes current concerns and concepts on the past; it results in a false account of what actually happened. A full historical account will, of course, include the fact that McClellan was wrong. If the aim is to explain why McClellan hesitated, then the truth about the relative strengths of opposing forces—which was only discovered later—has nothing to do with it. The thing to be ex-

plained is McClellan's hesitation. His *belief* that opposing forces were overwhelming explains that hesitation. This belief in turn is explained on the basis of the *evidence available to him at the time*. The truth itself was not directly available, so it played no role in his beliefs. Of course, evidence is intimately related to the way things are—that is, to the truth—but the relation is not transparent. If it were, science wouldn't be so difficult. Weinberg himself didn't win a Nobel Prize for spotting the obvious.

In his earlier book, *Dreams of a Final Theory*, Weinberg attacks all philosophers of science, not just social constructivists. "The insights of philosophers have occasionally benefited physicists, but generally in a negative fashion—by protecting them from the preconceptions of other philosophers" (1992, 166). Saving us from bad philosophy of science is the one area in which Weinberg allows philosophers to excel. When they read Weinberg's philosophical remarks on truth, most philosophers of science, I dare say, would be delighted to exercise this skill for his benefit.

THE WIDER ISSUES

The science wars are very much wider than Sokal and his specific targets. The social constructivist branch of so-called science studies is huge and diverse. Some of the people lampooned by Sokal (e.g., Derrida, Lacan) are not in science studies proper, but rather concern themselves with more general cultural matters that are rather unrelated to science. Though right to lampoon them, Sokal did pick easy targets. Let's cast our net a little wider. We can start by asking: Who's involved? Why should we care? What are the main battle lines?

In some ways the fight is quite old. Protagoras championed a kind of relativism 2,500 years ago when he said, "Man is the measure of all things." Plato took up the challenge and fought for objective knowledge. The Enlightenment with its emphasis on progress through rationality was no sooner established in the eighteenth century than early in the nineteenth it faced the Romantic rebellion, which stressed feeling over intellect and emotion over rational inference. Much debate in more recent times has been stimulated by Karl Marx, though sometimes his writings pull in opposite directions. Marx sounds distinctly

like a social constructivist when he famously declared: “The mode of production of material life conditions the general process of social political and intellectual life. It is not the consciousness of men that determines their existence, but their social existence that determines their consciousness” (1859, 20f). Yet Marx also thought that objective knowledge is possible; the constructive sentiment gives way to a sensible though subtle form of realism:

With the change of economic foundation the entire immense superstructure is more or less rapidly transformed. In considering such transformations the distinction should always be made between the material transformations of the economic conditions or production which can be determined with the precision of natural science, and the legal, political, religious, aesthetic or philosophic—in short, ideological—forms in which men become conscious of this conflict and fight it out. (ibid., 21)

Current social constructivism has plenty of antecedents, but it is also reasonable to think of it as mainly a product of the past three decades. In the mid-1970s David Bloor (in Edinburgh) announced the *strong programme* in the sociology of knowledge. Why *strong*? It’s in opposition to *weak* sociology of science; any account that focuses on institutions and various other social features of science but takes for granted that the *content* of science has nothing to do with sociology. By contrast, Bloor asserts that the very content of scientific theories is also to be understood in terms of social factors.

The importance of Bloor’s point must be stressed, since a great deal of sociology of science is quite compatible with the epistemology of scientific orthodoxy but at the same time is potentially embarrassing to the orthodox. So-called weak sociology, for example, can ask: Why are there so few women physicists? Why do they feel they must sacrifice career or children, and can’t (unlike their male colleagues) have both? However, weak sociology of science does not ask questions such as: Why do female physicists accept the standard model of elementary particles? Why do women believe that the trajectory of a cannonball is a parabola? The answer to these questions is “the available evidence” and it has nothing to do with their sex, nor with any other sociological factor. Bloor’s strong programme will have none of this hands-off attitude.

He, too, will ask the background questions. But as likely as not, he will relate them to the content of the theory at hand.

Shortly after Bloor started to make his mark in science studies, Bruno Latour (a French philosopher and anthropologist) adopted the role of an “anthropologist in the lab.” With Steve Woolgar he wrote up his experiences of an exotic tribe—a team of California biochemists—explaining their behavior in social, political, and economic terms. Meanwhile in France, Michel Foucault was claiming that *knowledge = power*, not in the sense that by having knowledge one has power (a sense made famous by Francis Bacon), but in the very different sense that having political power allows one to say what knowledge is and is not. Elsewhere, feminist critics of science such as Evelyn Fox Keller and Sandra Harding were claiming that science reflects the scientists who made it—males—and that women could and would make better science. Even this brief sketch indicates why their views might be thought controversial.

THE HOAX ITSELF

Far too much has been made of the details of Sokal’s hoax. The important—and very useful—thing about the hoax is that it brought matters to a head. Those who were stung by it complained that it was deeply dishonest and destroyed the trust that exists in academic life. Piffle. Defenders of the hoax say it clearly revealed social constructivism for the intellectual rubbish it is. Not so.

Though amused at the hoax when I first heard about it, I must confess to feeling a twinge. As a sometime editor,⁴ I often commissioned book reviews and survey articles that I accepted on faith when they came in. I read them over, but (unlike research articles) they did not go out for so-called peer review. It would have been very easy for any of these authors to slip utter nonsense by me, at least if it were in an area of philosophy of science with which I am not familiar. I could have had these papers checked by experts, but it’s so hard to find good, willing referees that I wouldn’t dream of wasting them on book reviews or commission pieces. After all, I invited these people because they are known to be experts in the field. It was perfectly reasonable for the editors of *Social Text* to assume that Sokal knew his physics.

What about the fact that *Social Text* doesn't send out *any* papers for peer review? Perhaps book reviews and survey pieces are one thing, but research articles (which Sokal's hoax paper purported to be) are quite another. Here we need to understand—and defend, if necessary—the fact that some journals have a mission. Physics is a mature and well-established science. That's why *Physical Review* can referee all submissions in a straightforward way. But the “editorial collective” of *Social Text* have a particular social outlook that they want to explore and promote. In this they are not very different from a great many other academic journals. There are academic periodicals of sociobiology, for example, that will have rather limited peer review. They would not send out a submission which argued that racist behavior is genetically determined to Stephen J. Gould for review, though he's as knowledgeable as anyone on the topic. The only criticism considered is from those working within the paradigm (to use the well-worn Kuhnianism). And for that matter, what physics journal is likely to send something on the theory of relativity to Derrida to referee, even though (as we saw above), he's published on the topic?

Sokal's hoax proved little in itself. But it did do something of great (and I'll bet of enduring historical) importance. It raised a flag to rally around. Those who felt sympathetic both to the Left and to science suddenly felt like they had a bit of elbow room. Feeling cramped and uncomfortable with the pro-science Right or anti-science Left option, now they can march into political battle confidently armed with the most powerful weapon imaginable—rational thought.

LEFT VS. LEFT

Even supposing Sokal and other critics of social constructivism are correct, is their attack wise? Andrew Ross, the editor of *Social Text*, says that it is the great tragedy of the twentieth century that the “left eats the left.” This has indeed been a great problem; all progressive movements are beset by doctrinal disputes.

The reaction of most people, including most scientists, is to say this is irrelevant: *The truth is the truth and that's all there is to it; political opinions have nothing to do with figuring out how the world works.* Social constructivists—perhaps with justice—find this view completely incredible. So-

cial factors have been all too obvious in many of the results of so-called objective science; they have been uncovered as subtly operating in others; and they are suspected of working somehow or other in all the rest. But there's also a moral side to science studies—at least in some cases. There is a justifiable outrage at the current social situation. Rather than delve into details, let me just point out some simple, but stunning facts. In 1980 the richest 1 percent of Americans owned 22 percent of the wealth of that nation. That was at the start of the Thatcher-Reagan era. At the end of the Reagan and Bush administrations a few years later, the richest 1 percent owned 42 percent of the wealth. In Canada during the last decade the number of children living in poverty tripled to 1.5 million. Throughout much of the world, the trend has been similar—a massive shift of wealth from poor to rich.

Science, no doubt, has done much to create this wealth. What has science to do with its *distribution*? Have race and IQ studies played no role in this? Has sociobiology been neutral? Have the sciences of economics and sociology been uninvolved? Only the foolish could find this credible and only the wicked could assert it with apparent conviction.

On the other hand, what about high-energy physics, or the topology of differentiable manifolds? They would seem to be as unrelated as anything could be to the plight of the poor, neither helping nor harming. We need to sort what is politically related science from what is not.

At the beginning of the science wars, the common contrast was between the left-wing critics of science and conservative defenders. This is the way Gross and Levitt drew the lines of battle in their attack on the academic Left. They saw the battle as between the mush-minded Left on the one hand and people of good sense on the other.⁵ And many of those they attacked implicitly agreed with this dichotomy. Numerous postmodern authors tend to view things the same way—a Left-Right battle—though they would characterize it as a fight between social progressives (i.e., themselves) and reactionaries who defend science as part of the general defense of the political status quo. In short, Gross and Levitt and many of their postmodern targets agree on this simple-minded but false dichotomy: *anti-science Left vs. pro-science Right*. The Sokal affair has made it perfectly plain that this is not the proper way to draw the lines of battle. This is why Sokal is so very important.

Politically conservative attitudes toward science are similarly divided, too. On the one hand, religious fundamentalists are at war with evolutionary biology. They correctly see that science is occasionally at odds with some of their deepest religious convictions, but they are in no mood to give up those convictions in the face of scientific evidence. On the other hand, some IQ researchers tell us that there is indeed a link between race and intelligence and that we'll just have to accept these facts, however unfortunate, since they were arrived at by a rigorous application of scientific method. And the consequence, in their view? The existing social structure is "natural," so don't try to change it. Being on the Right doesn't determine attitudes to science any more than being on the Left does.

The false dichotomy of anti-science Left vs. pro-science Right must be abandoned. Though still very simplistic, it would be much better to stake out four distinct positions—a pair of pro-science views and a pair of anti-science views. This is only tentative. Later we will have to make serious revisions to the picture, but it will serve us well for the moment. Recall that "scientific orthodoxy" was discussed above. I sketched my version; others might prefer something slightly different. A precise definition isn't necessary or even useful. Champions of "socialism" and "free enterprise" often disagree on the precise meaning of these terms, but in almost every context they have no trouble understanding what is meant and deciding which side they're on. The same can be said here about the "orthodox view of science."

	<i>Political Left</i>	<i>Political Right</i>
Hostile to orthodox views of science	Some social constructivists, post-moderns	Religious conservatives, anti-Darwinians
Friendly to orthodox views of science	Sokal, Chomsky, Gould, Lewontin, the Vienna Circle	Some sociobiologists, race and IQ theorists

Let me elaborate a bit on each of these positions. The top right view plays only a small role in the so-called science wars, but it is certainly an important view in the larger setting. It's worth mentioning here

mainly for the sake of completeness and for a contrast with other views. Such an outlook is typified by the religious Right. The rejection of Darwin's theory of evolution and the upholding of the account of creation in the book of Genesis is perhaps most characteristic. More generally, there is strong opposition from this quarter to what is seen as the intrusion of science into aspects of life that should be governed by moral and religious concerns. The attitude says, for example: don't try to give scientific accounts of homosexual activity, or of juvenile delinquency, or of drug and alcohol dependency, or of teenage pregnancy, since doing so really amounts to making improper excuses for immoral behavior. We're in the domain of free choice, says the religious Right, where God's judgment, not science, belongs.

The top left view might go something like this: There is no such thing as the way the world is, a way that we could discover; rather, we impose frameworks on the world, and those frameworks serve various social and political interests. Current science is a framework that serves the rich at the expense of the working class, it serves men at the expense of women, the West at the expense of the third world, and it serves whites at the expense of people of color. Since there is nothing objective about science, we can adopt different theories that might better serve the oppressed. Existing science should be criticized for the ideology that it is and should be replaced by a science more friendly to the poor, more friendly to women, more friendly to the environment, and so on.

The bottom right is the view held by typical science conservatives. Its self-image is simply this: We're just discovering the facts. Some of the facts we've uncovered, say about race and IQ, might not be very pleasant, but that's not our fault. Sometimes the world just isn't the way we'd like it to be. Don't be angry with us, if you don't like what we have found—that's just shooting the messenger when you don't like the message.

In Gross and Levitt's terms, the top left position (which they call the academic Left) is battling it out with the bottom right (portrayed as ordinary scientific good sense). The Sokal affair illuminates one more position. The bottom left includes a number of pro-science people who are on the Left. The general idea is that objective science can be a powerful tool in progressive causes. It rejects any sort of all-encompassing social constructivism and instead maintains there is a world that exists

independently of us, a world that science can describe and explain. When we understand how that world works, we will be in a better position to improve the lot of all people.

I said this fourfold categorization is still rather simplistic. How so? For one thing—to use a now contaminated expression—these are boundaries we often transgress. Many progressive champions of the orthodox view of science are highly critical of various parts of science. Thus, a completely orthodox but very careful statistical analysis might flush out fallacious reasoning about race and intelligence. Indeed, it is the ability to do this that makes so many on the Left critical of social constructivists—good science is the best weapon in the war on socially pernicious pseudo-science.

On the other hand, social constructivists are a very diverse group. It is a terrible misrepresentation to lump them together as political progressives and as hostile to the orthodox view of science. In North America social constructivists are perhaps more often on the Left than elsewhere, but it is certainly not essential to be so. Indeed, social constructivist views in the past have, more often than not, been associated with right-wing, even fascist views. Postmodern heroes include Nietzsche, who certainly couldn't be called "politically correct," and Heidegger, who joined the Nazi Party.

Moreover, many who follow Bloor's "science of science" think that their social constructivism is a mere consequence of their scientific approach to the study of science, with nothing particularly political about the approach itself. The spectrum of social constructivist opinion is enormous. Again, these are more things to be sorted out in the course of this book.

For my money the most interesting thing about the science wars is the fight for the Left. There is a wide cluster of social goals shared by those on the Left, but there is serious disagreement over the best way to attain them. This leads us to some crucial questions: What role, if any, does science play in creating, sustaining, or changing the social order? What role, if any, do social factors play in the production and maintenance of scientific theories? What view of science should the Left adopt to best promote its social goals? The balance of this book will be devoted to finding out.