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Sexism in Science*

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The introduction of this collection of essays by Evelyn Fox Keller begins by noting that the coupling of science and gender sounds odd; Keller dispels this oddity with laudable simplicity: both masculinity and science are socially determined, and the question is, how do they relate? She is right. Sir Francis Bacon, whose influence on the ideology of science is generally admitted to be enormous, saw science as masculine, since it is a hard and serious undertaking leading to Man's domination over Nature; the undertaking and the domination are masculine characteristics par excellence and Nature, therefore, is female. Bacon's view that the proper method of science is to begin with careful observation of the facts of nature is, he repeatedly explains, that of the man who stoops to conquer. To begin an investigation with a hypothesis, on the other hand, is to put Nature into chains.

Keller opposes not only the traditional metaphor, but also the traditional division of the world into Man and Nature: science is a social institution. Keller contrasts this institutional view of science with that which regards the laws of nature as objective. The contradiction is not obvious. Suppose science is an institution and the laws of nature purely objective. It follows that science is not the laws of nature. Keller agrees with Thomas S. Kuhn in rejecting objectivism and settling for relativism. Relativism equates today's science with today's laws of nature, and yields the conclusion that the laws of nature are not purely objective. Yet this sounds like saying that in the nineteenth century Nature obeyed Newton's laws and today Einstein's laws. There is something faintly comic about this. It is much more congenial to say that science approximates the laws of nature, so that Newton's laws look like Einstein's unless one checks carefully, and that Einstein's laws approximate still later theories, so that none of them are purely objective and none of them are the law of nature, so that science is an institution and the laws of nature are purely objective. This is the view of Albert Einstein and Karl Popper about science, and it fits the feminist view of science much more than Kuhn's sexist view of scientific training as severe and authoritarian.

All this leaves open questions, concerning whether science is the domination of nature, whether knowledge is the product of the (ecstatic) mystic union of Man and Nature, and so on; are these claims mere metaphors or do they convey a sexist theory? If they do, what is that theory?

Before going into all this, let us compare the Einstein-Popper view with Kuhn's and Keller's view. We are still in the Introduction. We find there (p. 11) a passage reading, 'The fact that Boyle's law is not wrong...'. This 'fact', she says, '... must, however, not be forgotten'. Yet Boyle's law is false, as every physicist knows. It is an approximation to Van der Waals's law, which is much more satisfactory, yet which is, likewise, false, as Van der Waals himself

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emphasized. Keller's book, therefore, begins with a huge concession to the macho view of science as always right. She concedes that individuals may be drawn to science by the search for reliable, shareable knowledge. Yet the reliable shareable knowledge science offers is not of the success of Boyle's law but of its successes and failures taken together!

Keller knows of the failures of Boyle's law, as she alludes to them. Her description of the domain of success of the law (still p. 11) clearly indicates her knowledge of its failure in other domains. Why does she not make use of this knowledge? Why does she only hint, then, at the limitations of the law? For, she seems to suggest, the very fact that the law is limited makes the importance of its success depend on our point of view—which has social determinants. In brief, it is the social aspect of science that creates the space for her study of science and gender, and the social aspect of science is the way male-dominant expositions lure readers to the view that the imperfect Boyle's law is a perfect law of nature. This is not good enough. It would be preferable if, contrary to Keller, the genderization of science were to make it humbler, more candid and explicit in its expression of its shortcomings, more aware of its being an aspiration, rather than an achievement.

Boyle's law is a success in that it accounts for some phenomena and a failure in that it conflicts with others. This is a fact, and should be openly and clearly stated. Now, in addition, we may be at times concerned more with its successes, at times with its failures, at times with both, at times with neither. In particular, when we wish to contribute to scientific progress we may be more concerned with the failures of Boyle's law and seek ways to overcome them, as did Van der Waals. At times, however, we may be more interested in its success, for example, as applied scientists and engineers. This, too, suits well the genderization of science since it relegates domination, at the very least, to the domain of technology and the domain of science is thus freed of the desire to dominate; yearning for harmony then becomes the chief substitute for the wish to dominate and a more adequate metaphor for the search for pure knowledge and the ultimate (unattainable) absolute truth. And we have countless historical facts which accord with this view, since many researchers have used this metaphor (Kepler, Galileo, Newton, Oersted, and, above all, Einstein).

It is important, then, to distinguish (scientific) technology from (scientific) comprehension, partial and unsatisfactory though both surely are. This is not to share the traditional sexist denial to women their legitimate place in technology. Perhaps, further, we can distinguish hard technology from soft, especially in matters medical (such as the preference for curing heart ailments and abnormal or irregular blood-pressure, say, by changing life-styles rather than by surgery and drugs). Does Keller agree?

Keller objects (p. 12) to any 'objectivist ideology'; we, the authors of this review, are objectivists. She opposes objectivism because it excludes all subjectivity and thus all criticism. The kind of objectivism she clearly has in mind is the classical objectivism of Bacon, Newton and their followers—now called positivism. We advocate a 'soft' objectivism, objectivism which sees objectivity as an ideal. She seems, in her wording, to hint that a view like the Einstein-Popper objectivism will not meet with her disapproval. But it is hard to say, since she only speaks, and we approve, of 'the pursuit of scientific knowledge as a universal goal'. All we can add is that in order to stick to this view she has to repudiate that of Thomas Kuhn, who is a frank relativist and who has criticized the Einstein-Popper view more than once.

Part one, over forty pages, consists of three historical essays, on Plato, Bacon and the rise of the Royal Society of London. Keller's observations on Plato are

reasonable, and cover parts of his theory of gender, of sex and of knowledge. How much there is to Plato's comparison remains undiscussed. One cannot complain about small beginnings; except about her having missed the most conspicuous and influential metaphor. The forms are Fathers. Matter is imprinted with forms to become things. The Talmud declares the semen to give the progeny bones, i.e., forms, and the menstrual blood to give the progeny flesh and blood. When we read in Maimonides that all good comes from form and all evil from matter, we have a peek at the misogyny that formative Judaism received from Greek thinking—similarly to her daughter religions.

The formula for knowledge which has origins in Plato and Aristotle and which in the Middle Ages used to be extremely common is, knowledge is the unity or parity of the knower with the known. The formula in Bacon is prominently placed before the passage which offers his exemplification of induction (*Novum Organum*, Bk. II, Aphorism 19)—which is, he says, the bringing of the mind and Nature on a par. His mysticism was as commonplace as the idea that goes with it in the traditional Medieval and Renaissance literature that a researcher must be chaste and pure of mind. What is peculiar to Bacon is the view that hypotheses are forbidden in research, that rather theory must arise out of factual knowledge. The fact is that he declared the improper method futile but the proper method powerful and so masculine. Keller stresses this point. Yet it would be just as easy to declare chastity a feminine trait and science feminine because it is productive. Bacon's society was male supremacist and his metaphors were meant to speak to his society; no doubt, assuming him to be speaking to a feminist society he could just as deftly have chosen quite a different set of metaphors. To take one example of Bacon's ease with metaphors: Bacon dismisses the idea that research into excrement is disgusting by viewing it 'childish and effeminate'. Were he a feminist, he would know better. For another example, Nature's slightest whim must be observed, because one must obey her before one can conquer her. This too comes from the literature—of courtly love—which was popular among mystics. Bacon also permits Man to dissect Nature, yet he finally decides we dissect the world, not Nature (*Novum Organum*, Bk. I, Aph. 124). And Bacon compares experiment to torture; it cannot be the torture of Nature—as she must be honoured—but the natures of things, which turn up, therefore, as males. Keller is aware of Bacon's regularly inconsistent metaphor and ascribes it to his inconsistent views, since he was, indeed, 'in many ways a transition figure' (p. 53).

Keller on the rise of the Royal Society of London is weak; she ignores classical studies, such as R. F. Jones's. Yet her study of attitudes to witchcraft comes to a point where sexism and science would clash: witch hunts were sexist campaigns aimed at driving women out of public positions, especially of folk medicine, midwifery and more (p. 63), yet science, especially by the rules of the Royal Society of London, was obliged to, and regularly did, disqualify all evidence on the alleged strength of which so many women were so cruelly maltreated. Nevertheless, the Royal Society of London chose to stay aloof from public affairs and ignored the witch hunts that were rampant at the time. Until the rise of the modern women's movement, then, it was quite unproblematically assumed by all historians of medicine that although it was cruel to persecute women folk healers, excluding them from the medical profession was the inevitable and progressive result of scientific medical progress. Keller should have attacked this view. It conceals the fact that until the end of the last century all medicine was no better than what any competent healer could offer anywhere, that the run of the mill male healers were just as poor as the run of the mill female healers who were so often maligned as witches. In the field of women's specific health care

needs, female healers may be assumed to have been better simply because of their greater familiarity, empathy and sympathy with women. Moreover, the claim that male healers were better was a comfortable excuse for keeping their profession in its backward style. As she follows Kuhn's philosophy, Keller cannot say all that, since Kuhn's philosophy justifies traditional medicine—scientific or not, as long as it commanded unanimity among practitioners—despite these defects and with no qualifications.

Perhaps nowhere can the wish to exclude sexist bias from science and technology make us revise our views of their history so radically as when we reconsider the exclusion of women from medicine between the seventeenth and the twentieth centuries. Surely, Keller should have made this point. She nearly does. When she comes to the point she introduces the term 'industrial capitalism' (p. 63, line 6 from bottom). Does one have to use this term in order to revise our views on the cruel expulsion of women from medicine? Does her use of this term help her make this point? On the contrary, we think it deflects her. Of course, a theory of the rise of industrial capitalism may explain the prevalence of the discrimination involved. Does Keller give such a theory? Not really. In any case, it would never serve as a substitute for the claim that the discrimination was very lamentable—regressive and baseless.

We agree with Keller that the modern scientific movement, beginning with the rise of the Royal Society of London, which was all male, was male supremacist as a matter of fact. We agree that the replacement of symbolic science, including alchemy, astrology, and traditional medicine, with the mechanistic world view excluded from natural science all reference to sex and gender, thus feigning indifference towards the question of the equality of women, while accepting comfortably the then current discrimination against women. Yet, we would go further than she does. The locus of the rise of modern science as a social institution is generally specified as London of the Restoration, 1660. There and then much of the social fabric had to be rewoven so that also a good chance was given to institute more gender equality. Soon afterwards, in the 1670s, discrimination against women was masked as witch hunt, and the Royal Society opposed all assertions of witnesses testifying to any act of witchcraft, friendly or hostile. Hence the Royal Society of London had a golden opportunity to act in an enlightened fashion and fight all sorts of sexist superstition. They did not.

Keller's detailed descriptions of that time (pp. 59ff.) are questionable, and her references to contemporaries are to two thinkers, one not friendly to the Royal Society and one who was allowed to join it only after he changed his views on the supernatural. She also overlooks the fact that alchemy was not a profession open to women—medicine was. And it should be said clearly that the Royal Society did not express views on sex and gender; it merely behaved in a sexist fashion.

Part two, of over forty pages, is psychological. First chapter, objectivism and subjectivism were traditionally claimed as masculine and feminine. This, she says, is an error. Hence, women can be as objective as men or even more. We, the reviewers, agree with all this, but we have a query: should all this alter our image of objectivity? Yes: we should reject the macho view of objectivity as 'hard' and subjectivity as 'soft'. And there are facts to the contrary, we note: some 'hard' science is subjective, such as behaviourism (as Bertrand Russell has noted); and some soft science is objective (as is the true 'soft' theory that macho life styles are psychologically and somatically harmful), Keller regrettably ignores the facts to the contrary. To repeat, she rejects objectivism as macho and we reject machismo as phony objectivism.

The second and third chapters are written, we are told, within the object-relation sub-school within the psychoanalytic school, and deal with dynamic autonomy and dynamic objectivity. Science is never so unemotional as to be fully objective (p. 96). Autonomy is emotionally charged (p. 98). The autonomous interacts with other subjects (p. 99), making boundaries between subjects flexible (p. 100). We accept all this. Except for a quotation of a very brief and fleeting passage of Freud (p. 101), there is nothing Freudian in these chapters. And the idea that the will to control others is a sign of weakness (pp. 102-106) is clearly Adlerian, not Freudian. Keller joins the party which is opposed to the traditional polarities

masculine: feminine
dominant: submissive
separate: connected
aggressive: nurturing

(pp. 113-14). She conceals Freud's (enthusiastic) endorsement of these polarizations.

Chapter 6 is on dynamic objectivity, which, unlike objectivity, is commendable. We do not quite know how to read this. It seems to us as if objectivity is the claim that we have achieved objectivity, whereas dynamic objectivity is not full-objectivity-here-and-now but the aspiration for it. In this reading Keller's view accords with Einstein and Popper, of course, and conflicts with Kuhn. We also do not quite follow her wording. She says (p. 116, line 4 from bottom), 'I define objectivity as the pursuit of a maximally authentic, and hence maximally reliable, understanding'—meaning, we presume, that the maximal available reliability is below the absolute reliability. Yet if we all recognize objectivity where maximal reliability lies, then our view is positivist. As to the 'maximally authentic', we do not quite know what it means. This matters little, perhaps, since she calls 'static objectivity' what we call positivism—though her wording is not very clear (p. 117). It would be helpful if she said clearly that objectivity is a legitimate goal for science, even though perhaps unattainable. Some recent feminist comments on her book take it for granted that she opposes objectivism as male supremacist and as positivist despite her Chapter 6, which advocates dynamic objectivism. One example is Judith Stacey and Barrie Thorne ('The Missing Feminist Revolution in Sociology', *Social Problems*, **32**, 1985, 309).

Yet we may have misread Chapter 6. There are two passages from this chapter which explain our hesitation. First, we learn that scientists pretend to be dispassionate and cool, when they aggressively attack problems and attempt to dominate, because they attempt to secure a separate self—out of fear (p. 124). This seems true of many scientists, but to blame for this the objectivist ideology (line 9) is quite erroneous: subjectivism in quantum mechanics has led to no improvement of our understanding, and objectivists like Einstein are not driven by fear. Second is Keller's remark, at the end of the chapter, that 'erotic themes have . . . been submerged by a rhetoric of the ideology of aggression' and that this is a standard phenomenon throughout the history of science. We agree. But we regret that she does not ask whether this rhetoric is substantive or metaphorical. Maimonides must have worried about this: the psalmist expresses his love of God, Maimonides observed in a prominent passage of *Guide to the Perplexed*, by the use of a term usually denoting physical desire.

Before leaving this part, let us notice that Keller opposes the aggressive and supports the erotic. She equates the aggressive with the male supremacist and the erotic either with the female supremacist or with sexual equality. Of course, we side with sexual equality yet reject any hint of a proposal of female supremacy. And we think science should be egalitarian in matters of gender and its

theories should be neither egalitarian nor inegalitarian. Thus, whether the newest theory in physics more easily harmonizes with male symbolism or with female symbolism or with androgynous symbolism, is of no scientific interest. Some biological theories describe males of some species as in some sense dominant, and other theories describe females of other species as dominant. Such theories may but need not conceal bias concerning the debate concerning human gender equality.

Biases against women and tendencies to overlook their strengths and contributions abound in psychology, in the diverse social sciences and in historical studies. Of course, whenever reformers of science attempt to overcome bias, they are accused of subjectivism and of irrationalism by those who defend the status quo as unbiased and as objective. It is no news that in the human sciences, much more than in the natural sciences, interests of researchers as well as their values lead them to theoretical bias. When claims to be value-free and interest-free are used as masks for bias due to values and interests, then criticism is particularly desirable. And the feminist critique of male biased social science is often of this kind. The male bias was often expressed in male supremacist theory and in methodology which rules out empathy, especially towards women. If Keller deems empathy 'soft', we agree and support it; if she deems empathy 'subjective', we disagree. We cannot say, since she does not claim to be discussing the human sciences except for psychopathology. And even there we do not know how well we follow her.

Part three, of over forty pages, is philosophical/scientific: science is alterable and quite open-ended, so that deviant thinkers may prove superior to normal ones (p. 136). Keller uses here the word 'spaces' to denote discrepancies. She notices two kinds of discrepancies in science: between theory and fact and between ideology and practice. Unfortunately, she exhibits a discrepancy between her theory of discrepancies and her detailed exposition of it. Her theory is Kuhnian, allowing for discrepancies only as an unwelcome but inevitable by-product of research and as possibly leading to a revolution in due course, and to a revolution which preferably keeps the old regime intact; her detailed description is of daring deviants who seek discrepancies between theory and practice, who expose them with a vengeance, and who also expose discrepancies between ideology and practice, thus making past ideas look as defective as they are. In Kuhnian theory there are no rebels seeking a revolution; in Popperian theory there are. Keller continues as if she were Kuhnian but her stories are Popperian.

Chapter seven: physicists cling dogmatically to current theories, which is an error (as Popper says, and contrary to Kuhn). Even the subjectivism of quantum theory, says Keller, does not shake their dogmatism. Keller is in error here: one can consistently be either a dogmatist or not, while simultaneously being subjectivist or not.

Chapter eight: considering a given biological organization, must we postulate the existence of a centre controlling it? Keller has studied organized colonies of mono-cellular moulds, and said, no. She started developing a model for it, her model was unsatisfactory then, but after being corrected and improved, it now reigns. Barbara McClintock later captured her interest, because of McClintock's longstanding denial of the orthodox view that the genetic material controls the living body without any reciprocity. This, incidentally, is part of a historic dispute between organicists and mechanists and Keller (and before her McClintock) would wish to be considered as having an organicist bias.

Mechanism and organicism are perennial theories. It is not always easy to say whether science sides with the one or the other. A theory which yields empirical conclusions, and which is thus both explanatory of given empirical evidence and

vulnerable to alteration due to newer empirical evidence, may look more mechanistic or more organicist. When it looks organicist, mechanists try to alter it, and when it looks more mechanistic organicists try to alter it. And so the ball keeps rolling. And, to repeat, at times a theory looks neither mechanistic nor organicist—like Keller's theory of some centreless living systems. For, such phenomena occur also in physics (in ferromagnetism, super-conductivity and more) and are known, aptly, as cooperative phenomena. Whether cooperative phenomena are the same in organic and inorganic matter is, of course, an open question, and mechanists and organicists will be disposed towards exploring the opposite answers.

This is the heart of the matter at hand. However liberal and open-minded science is, and surely it is more open-minded and liberal than any other segment of our spiritual lives, Karl Popper stresses the fallibility and transitoriness of its theories, and the constant need which science-as-an-institution has to safeguard and encourage deviance. Michael Polanyi, and, following him rather closely, Kuhn as well, stress its authority and the need to safeguard and reinforce uniformity by the exercise of the authority of the leadership. Thus, when Polanyi observed in the early sixties that his adsorption model of 1914 and 1928 had been ignored only to be independently rediscovered and endorsed almost fifty years later, he did not take credit, and he expressly refused to vindicate himself in retrospect, and, in particular, he refused to condemn the leadership which had ruled that he should be ignored. A deviant counts only if he convinces the leadership! A deviant who does not make it, is in error even if, when his time comes, his ideas become the norm! For Polanyi sees the truth as dependent on recognition. So does Kuhn. Keller says she follows Kuhn, yet she sees the rebellion of Barbara McClintock as vindicated by later developments.

The deviant who is Keller's model is Barbara McClintock, who had been unjustly put down both as a deviant and as a woman, who fought for years, and who won the Nobel Prize just when Keller's book on her appeared. We hope that this review will make Keller reconsider her choice between Kuhn and Popper and just because she sides with McClintock all the way. The last chapter, on Barbara McClintock, justifies by itself the purchase of the book. Quite impressively it offers a fair and balanced view, and advocates a 'gender free science' (p. 174); 'Even today, as Nobel laureate... McClintock regards herself as, in crucial respects, an outsider to the world of modern biology—not because she is a woman but because she is a philosophical and methodological deviant' (p. 159). Her deviance, incidentally, looks to us as clearly crypto-Lamarckian—the very extreme, that is! For, she views the transposability of genetic material, which she has championed, and for which she finally won the Nobel, 'as a survival mechanism available to the organism in times of stress' (p. 160, end of second paragraph). Yet Keller puts it otherwise: 'But even though McClintock is not a Lamarckian, she sees in transpotition a mechanism enabling genetic structures to respond to the needs of the organism' (p. 171). Now a well-trained reader need not be scandalized when reading a sentence which looks flagrantly inconsistent, but will expect an intelligent explanation to follow it. The explanation follows, indeed, and occupies the next twelve lines. It is quite unconvincing, alas! Still, here, too, Keller presents a balanced view of McClintock the deviant. McClintock's methodological deviance, her demand to be critically minded, is easy to relate to Popper; but it comes, directly or not, from Claude Bernard's classic *Introduction to the Study of Experimental Medicine*, which is not mentioned by Keller. McClintock is quoted (p. 172) to say she relies on accepted methodology. This, however, is another discrepancy.

Incidentally, McClintock's story proves that Popper's image of science is something of an idealization: whereas Polanyi gave up the struggle after two or three decades and so could not claim victory, McClintock took three or four decades to fight—until she had enough empirical evidence to force her opponents to notice her views. What we need do now is fight the time-lag which the leadership of science imposes on the public attention to any interesting innovation not emerging from the leadership itself.

The Epilogue declares subjectivism radicalist, as opposed to liberalism. Liberalism is more objectivist? Presumably. Where, then, should the liberal be placed who recognizes the need for a radical change? Especially radical change towards liberalization and towards the elimination of discrimination, such as discrimination by race or by gender?

Keller ends by supporting a measure of scepticism and pluralism. On this she is right, yet, popular as pluralism is these days, in science it is still rejected with the hostility that forces Keller to deny McClintock her Lamarckian traits, and to declare Boyle's law true while showing she knows it to be false.

Unfortunately, there is no subject index and the name index is inadequate.

To conclude, the very question, how does science relate to gender, is new and difficult; Keller's effort is pioneering. Her view that a study of science and gender should tell us something about science, about methodology, and more, is vindicated. We learn, in particular, that the view of science as utterly objective and so as utterly free of bias and bigotry, is an idealization and an illusion. On all this she scores, we think: to cling to a false image of science because it is idealized, is to accept together both the discrimination and the value of science. Yet she herself is not free from idealizations of science and of the scientific establishment—due to some misunderstandings, presumably—and so there is still much to be done, particularly since Keller does not treat the social sciences and hardly touches on psychology; and there the problems are much more pronounced. Keller's attack on positivism as an idealization of science is valid, yet her choice of an extreme alternative to it, of subjectivism, is disturbing, since subjectivism may easily destroy science, by blocking all criticism because of some subjective feelings.

As to gender discrimination in particular, and as distinct from racial and religious and other discriminations, Keller claims that it hurts science and technology in a particular way—by promoting a macho positivist ideology of hard science and a hostility to nature and the alienation of the subject; in particular gender discrimination hurts real people. On all this she scores some points, yet her subjectivism , her equation of subjectivism with the feminine, and her 'female' science are as objectionable as 'male' science. No doubt science can greatly benefit from the female experience, and from recruiting, encouraging and recognizing women equally with men; above all, science can only benefit from the elimination of all discrimination and bias, all authoritarianism and dogmatism, and all excessive claims of success.