

Hilary Rose

Talking about science in three colours: Bernal and gender politics in the Social Studies of Science

This paper is written in three parts. The first part reflects on Desmond Bernal* and the silences in the orthodox Marxist analysis of science, around both sexual politics and also concerning the fate of the 'two sciences' thesis. The second part then considers the new Social Studies of Science and reflects on the continuing persistence of gender blindness, and the third turns, more positively, to the new feminist critiques of science. I am very conscious that feminists, while drawing on both Marxist and non-Marxist traditions in the social studies of science, are not only addressing a fundamentally different problematic of the silences; they are also primarily addressing one another. They are not concerned to dialogue with the master world and its problematics. As during the eighties black feminism has successfully challenged white feminism, that master world has been increasingly understood as white as

well as bourgeois and patriarchal. Dialogue between the white master world and its discourses and the subordinated discourse of feminism is not possible, as they are divided, not by misunderstanding but by deep antagonism. This is not to say that the feminist movement has only reached into women's lives and changed our consciousness of who we are and what we might become; it has also unevenly and with difficulty reached into the lives and political consciousness of men.

Let me make a partial analogy with the sixties, when the voices from the Third World spoke with renewed force as historical subjects. Jean Paul Sartre was one of those who recognised the epistemological and political significance of these voices. In responding to *The Wretched of the Earth*, Sartre observed that Frantz Fanon was not speaking "to us". The Third World, he went on, was speaking "to itself". Sartre then went on to advise the white First World to listen if they valued their own survival. The analogy can only be partial, as

* John Desmond Bernal, was variously known as Sage, Desmond, Bernal and by his initials — JDB.

this laboratory, to be a woman scientist was to enter in an honorary capacity the brotherhood of men and thus to be above heterosexual invitation. As many women who have worked in almost entirely male enclaves know, becoming this kind of honorary man is one strategy to desexualise the environment and make work relations possible⁷. The sexual self is denied, and the woman scientist is that much less a whole person, but at least it is no longer quite so easy to have work appropriated, as the King's lab culture had tolerated, or to be written off as sexually unattractive, as the Cambridge laboratory culture had declared. At least the honorary man is that much freer to be a creative and productive scientist.

Bernal's ideology of sexual freedom, however challenging to the ideology of monogamy, was nonetheless unthreatening to the accepted construction of scientists' masculine sexuality. Even at Cambridge, where a certain toleration extended to the homosexuality of arts dons (and even economists), not least E. M. Forster and his circle, it seemed that for the natural scientists heterosexuality ruled. It was not that natural scientists were or are seen as glamorous, sexually desirable figures; they had, however dully and conventionally, to be 'real' men. Those who were caught transgressing this rigid construction of an acceptable masculine sexuality came under intense social pressure. Two highly publicised cases symbolise this compulsory heterosexuality for natural scientists. In the fifties, Alan Turing the mathematician and code cracker, a homosexual, was arrested for cottaging and elected suicide as a way out. Later in the more 'liberal' sixties the biochemist Kenneth Harrison, another Cambridge scientist and homosexual, also killed himself.

Perhaps it is at last possible now to be able to reflect on the silences, to write a critical biography of Bernal, from his belief in human liberation through class struggle, in abundance and peace through science, and in personal happiness through sexual freedom, to the accommodations made with both Stalinism and the cold war. Today, fifty years after the high optimism of *The Social Function of Science* —

when such immense shifts are taking place in the political landscape in Eastern and thereby Western Europe, so that it feels as if nothing can be taken for granted — and when feminism has taught us something of the complexity and pain of men's and women's relationships, and their implications for the production of knowledge, we can begin to talk seriously about science with all three colours⁸.

2 The new Social Studies of Science

(i) *Their epistemology in action.*

Yet there remains a stubborn silence in the orthodox accounts of SSS. While the feminist critique of science has learnt to talk with a multiplicity of colours, not least the colour purple, the masculinist orthodoxy is monochrome. With certain notable exceptions, orthodox SSS locates science and politics as public knowledge and public politics and continues to relegate gender to the naturalised realm of the private and thence to silence. Instead the mainstream social studies of science is locked into a dichotomising debate between realism and social constructionism. The silence around gender uncritically reflects science's self-account as being above gender. Indeed not only are such accounts above gender; they are also above "race" and class. While the empiricists have largely captured realism⁹ and almost drained it of any social anchoring, the capacity of the social constructionists to set their hyper-reflexive accounts of the production of science in such a sea of complex social influences that they become almost free-floating from the profound divisions of gender, "race" and class which shape everyday life, in or out of the laboratory, is, to say the least, rather remarkable.

The stubborn refusal by most of SSS to treat seriously the literature produced by the feminist studies of science over the last two decades requires explanation. It seems easier for Evelyn Fox Keller to be invited as an internationally regarded feminist critic of science to give a plenary address to the 4S (Social Studies of Science Society) than for her work to be

reviewed in the SSS journals. Indeed it seems easier for a feminist contribution to the social studies of science to be reviewed in say *Science*, or even *Nature*, than it is for it to be reviewed in the journal *The Social Studies of Science* itself.

Science in particular, with its special place as the journal of the AAAS, has a twentyfour year track record of discussing the under-representation of women in science as a social problem. It was as long ago as 1965 (and only two years after *The Feminine Mystique*) that Alice Rossi published her germinal article in *Science* entitled "Why So Few?" in which she explored the reasons for the under-representation of women in the sciences. Both the timing of the article and its strategic location are important to understanding the debates about gender within science in the subsequent period. It was published in the socially optimistic context of the 1960's when the domain assumption of the plasticity of individual human beings fused with the corresponding assumption concerning the collective capacity for societal self-reorganisation along more socially just lines. Further, while it would be an error to assume that a feminist utopia has broken out in US scientific institutions, it is true that *Science* has maintained this public voice on the need to make science accessible to women. Thus an editorial by Daniel Koshland (1988) discussed women's needs for child care, flexible work hours and a change in the attitudes and practices of men both as colleagues and as partners. In the same year the AAAS was, for the first time, headed by a woman committed to increasing women's representation in science. Such an editorial would be quite unthinkable in *Nature*, and it would be hard to envisage a comparably senior elective position occupied by a woman scientist publicly committed to advancing women scientists in Britain. However both *Nature*, and even more *New Scientist*, regularly review feminist work. Of course it is true that a certain ambivalence, not to say double standard, can be discerned in *Nature* in that an apparent commitment to pragmatic reform means that theoretical texts such as the Harding and O'Barr (1988) collection can be trashed by in-

house journalists for not being directly oriented towards being practically helpful to women, while the editorials which might (like those of *Science*) address those self-same practical matters, remain unwritten. However the adage that all publicity is good publicity holds, and hostile reviews can flag attention to a book that needs to be read. Feminist writing at least gets some publicity in the natural science journals — from the *Social Studies of Science* it receives silences. And how about *Science Studies*? What are its plans?

Two searches through the SSS literature, carried out by Sara Delamont (1987) and Evelyn Fox Keller (1987) document the absence of gender. Delamont's self-styled outsider account was published in the journal *Social Studies of Science* and surveyed the reviews and articles published since 1980 for four journals (*British Journal for the History of Science*; *History of Science*; *Studies in the History and Philosophy of Science and Social Studies of Science*) and came to three conclusions. These were that there was (i) a failure to draw on the wealth of research on the sociology of occupations; (ii) a lack of attention to the learning of science by novices; and (iii), a failure to examine gender divisions in scientific practice and knowledge, especially the division of labour in science. While Delamont's feminist analysis of the orthodox British publications is on target, she, and also the *Social Studies of Science* editors and referees, are unaware that outside the carefully defended journals of orthodoxy there is a very different and better story told by the heterodoxies of feminism.¹¹

In parallel pursuit Evelyn Fox Keller (1987) searched through the *Social Studies of Science* over a twelve year period — an exercise which yielded a score of one. This was an article called "Women University Teachers and the Natural Sciences, 1971—2. (Her keywords approach meant that she missed the Delamont article.) Nonetheless using the same approach the more historically-oriented US journal *ISIS* contained some thirty entries over the same period.

While the social studies of science (SSS) has a distinctly undemocratic relationship with the heterodoxies of feminism, it has taken a

particular interest in heterodox scientific claims, and is concerned to ensure that orthodox science behaves tolerantly and democratically towards them. Thus there has been a long-standing and tolerant interest in the claims of fringe science from say Velikovsky and Uri Geller to the worm-runners. The argument is that the way science manages these 'outsider' truth claims is, as Harry Collins puts it in his discussion of L'Affaire Benveniste, nothing less than 'epistemology in action' (1988). This controversy arose in the wake of the publication in *Nature* by the biologist Jacques Benveniste of results that seemed to support the possibility of homeopathy. The editor, John Maddox, had apparently only agreed to publication providing the French laboratory submitted itself to a visit from a "fraud squad" appointed by Maddox himself. Collins argues that only "outsiders" to the production processes of science — such as the *Nature* group — could conceive of scientific experiments as yielding unequivocal results. Neither heterodox nor orthodox science, he argued, can stand up to such an approach. In consequence Collins reads the story as bad news for the democratic organisation of science. Instead of the heterodox claim — represented here by the publication of just one article — falling into the vast category of the more or less unread where some 90 % of all scientific papers lie, *Nature's* "Editorial Leviathan," feeling threatened by any credence being given to the outsider knowledge of homeopathy, abruptly imposed its orthodoxy. The not dissimilar approach to the administrative suppression of heterodox claims, on an earlier occasion but on the side of scientific fraud, and with lethal rather than embarrassing outcomes for the losers, had of course been played out by the Stalinist Leviathan in the Lysenko affair. However in that a very considerable section of the reaction to the Benveniste affair expressed in letters to *Nature*, and in editorials within other prestigious scientific journals criticised *Nature's* editor as robustly as Collins, it seems that epistemology in action in the natural sciences is more tolerant of heterodoxy than SSS.

The interest, even sympathy, of SSS seem

to be warmest for those who are often very marginal, not least in terms of the social significance of their heterodox claims. It seems that by celebrating the trivial within natural science, feminism, with its serious political and theoretical concerns, can be marginalised within the mainstream social studies of science to the point of invisibility. In the Leviathan stakes, SSS's erasure seeks to outdo Nature's fraud squad.

(ii) *Their epistemology in theory*

The androcentricity of orthodox SSS is particularly acute within the sociology and the philosophy of science — in books as well as journals — while history has made rather better accommodation with the new analytical categories (eg. Edward Yoxen, Everett Mendelsohn). Nowhere is this more marked than within the masculinist philosophers' debates in a recent and very elegant collection edited by Appignanesi and Lawson, *Dismantling Truth* (1989) which sets out the dichotomy between the realists and the social constructionists. No feminists are included so the 'Either/Or' choice of masculinist dichotomies is left unquestioned; feminism's ability to work with 'Both /And' positions is safely neglected. Thus their epistemology in action and theory mutually reinforce one another. These strongly relativist views were present within the radical science movement (Young 1977) (which alas we have to see was a men's radical science movement) a decade before and were criticised as exposing the new social movements to the dangers of hyper-reflexivity and being incapable of determining rival truth claims (Rose 1978).

Unlike Nils Roll-Hansen (1989) who sees the new grouping of SSS as the inheritors of the radical science movement, I read SSS as a rather professionalised, politically unengaged group¹². Indeed the politically engaged who work on science and are part of the new social movements are much less close to the profound relativism of the highly professionalised.¹³ But whether we consider the strong social programme of Barry Barnes and David Bloor (1982) or the double relativism of Malcolm

Ashmore (1988) or the softer line of the "science in context" of Steven Shapin and Simon Schaffer (1985), between them they are sensitive to every nuance of the social production of knowledge — except the profound social cleavages of "race" and gender. Science itself is predominantly produced by white men. Indeed for all the claims of reflexivity, an androcentric and ethnocentric science is studied by a discourse unconscious of its own androcentricity and ethnocentricity.

Both the old sociology of science and the new have shared the scientists' privilege-maintaining definition of themselves as the sole producers of scientific knowledge. When the new sociology invokes the apparently secular metaphor of the "factory" to frame the analysis of the production of knowledge, this factory is thus rendered both privileged and sacred, for the metaphor is restricted to the specific sector of their scientific workforce with the right to inscribe their names on the artifacts. All others are excluded. By contrast the tradition of both the radical science movement and feminism uses a "factory" metaphor which includes the entire scientific labour force from the cleaners and technicians (typically female and not infrequently black) to the Nobel Laureates (almost entirely white males). Indeed while left theorists have noted that industrialised and indeed global science has become less critical (Ravetz 1973; Rose and Rose 1976; Cicotti et al 1976) feminists (Rose 1983; Harding 1986) note that as science has become more industrialised it has excluded women from its leadership with greater efficiency. Feminist knowledge by contrast has been most effectively produced on a craft model of single or small groups of research workers.

While initially the new SSS researchers read the scientific papers and interviewed scientists, the continuing silence has been more surprising as the research methods have shifted to include detailed ethnographies where it would seem more difficult to exclude sections of laboratory life. (But perhaps conscious of the history of anthropology, not really so hard to believe, as some anthropologists talked only to rulers, men only to men and so on.) Nonetheless the commitment to reflexivity, the

appearance of the subjective voice in the research, and in the case of Latour and Woolgar an account written from the location of the ethnographer working in a lab as a technician, makes it all the more surprising that technicians are for the most part still not "seen". (There are hints of an explanation in that Latour takes an inverse/perverse pride in his lack of dexterity, which reminded me of the housework literature of the late sixties: "his resistance is the measure of your oppression"). In one critical passage there is an account of exchange as to whether certain forms of help are indispensable to the production of science. This reports but leaves unexamined the conflicting accounts between the scientist (male) and the technician (female) concerning the indispensability of the technician's contribution. This neglect is all the more marked if we look outside the occupation of science which shows that skill is not a given but is socially constructed and routinely institutionalises sexism and racism. Both UK and USA legislation of "comparable worth" and "work of equal value" contest this. It is surely unusual to find legislators more conscious of social constructionism than the social constructionists themselves?

(iii) *Their epistemology and our reality?*

One of the interesting things about SSS is the language — the changing metaphors — within which it couches its analyses. One metaphor is that of economic processes (under capitalism of course — but that makes sense as that is where the actors studied are located) in which ideas of investment and profitability are used to illuminate the actors' doings. Here I want to focus on the metaphor of war as it has been deployed by Latour to extend his ethnographically based account of the science production process. The choice of the metaphor is not uninteresting, for the practice of war — like the practice of modern science — is very much the activity of men in which the others become increasingly the casualties. I shall draw extensively on Shapin partly because his review of *Science in Action* is both a brilliant analytical exegesis and also is unabashedly linguistically sexist. Taking discourse analysis

seriously means that this 'lapse' should not be ignored...

I quote:—

The recalcitrant reader has now been shown the forces arrayed against his resistance, and therefore the price to be paid should he continue to deny the truth of what is asserted. As he persists in his resistance the debate becomes at once more technical and more social. It becomes more technical because the doubter has to be shown in the text what claims (and who) he must also doubt if he wants to doubt this one. It becomes more social because allies are being mobilised and enemies are being isolated. "In general the technical appearance of the scientific literature, Latour says, is nothing but its social character, its display of phalanxes of armed allies making it pointless to resist. "If being isolated, besieged, and left without allies and supporters is not a social act, then nothing is. This literature is so hard to read and analyse not because it escapes from all normal social links but because it is more social than so-called normal social ties" (my emphases)

Latour goes on to show how the scientific literature displays the costs of doubting but 'the show of the instruments of torture may not be enough for the committed heretic: they may have to be applied to his flesh. The doubter may resist all rhetorical tricks; he may want to follow the scientists into the actual place where the work is done: the laboratory. He may want to see the reality that is said to 'lie behind' the text. What he sees there raises the cost of resistance still further. If you don't believe the representations produced by your antagonist, you will ultimately have to learn to make them yourself, more than that you will be obliged to build your own instruments and to gather them in one place. You will have to secure the resources to construct a 'counter laboratory'.

Latour's metaphor ties in well with feminist experience at the hands of orthodox SSS, and his vision of the armed phalanxes moving forward to annihilate the individual expression of dissent, sounds like an action replay of many of our lives. His metaphor of violence is

a mixture of the economic — which gender controls the jobs and grants — and the interpersonal — the taken for granted erasure and the sexual harassment. Insisting on an alternative account is indeed to be charged with impugning the reputation and integrity of an antagonist.

Thus Latour's metaphor and his appeal *Give me a laboratory and I will raise the World* (1983) is full of resonance for feminists. Yet while no-one gave feminism a laboratory, feminist knowledge has proposed a different world view. The science question has been raised within feminism (Harding, 1986). Unquestionably it is the immense, diverse and collective resource of the feminist movement which constitutes our laboratory. The history of the preparation of the instruments of analysis of feminist research is rather different from those of the high tech contemporary laboratory. The most effective work uses craft models of production; its prescriptions for successful work speak of disclosure and self-disclosure; the boundary between the knower and the known is permeable. In the first phase, consciousness-raising groups were seen as a collective method for generating alternative conceptualisations. With so many of the concerns of women relegated by men to the trivial, the trivial has itself entered the problematic and been celebrated (indeed *Trivia* is the name of a journal). Not surprisingly this alternative laboratory is unlike both normal science or even normal SSS, as its interpretations, knowledges and truth claims concerning the social and natural worlds are written from below. In all their diversity the voices of feminism are located within and returned to the social movement. Such views are anathema to the academic gatekeepers of the dominant masculinist knowledge system. The sense that these alternative accounts are constantly under siege is ever present. As the historian Linda Gordon (1986) observed "*Existing in between a social movement and the academy, women's scholarship has a mistress and a master and guess which one pays the wages?*"¹⁴

The conclusion to which many radical feminists have come, that it is a mistake to

waste further precious time trying to promote change in men is articulated most strikingly in the separatist feminist utopias of feminist science fiction, such as that of Joanna Russ's *Whileaway* or Sally Gearhardt's *Hillwomen* which refuse both men and their science. It is also present in the enraged politics of Finnrage — the Feminist International Network against the New Reproductive Technology and Genetic Engineering — which seeks to oppose all genetic screening, in vitro fertilisation and embryo research. This fundamentalist feminist antiscience stance, while profoundly flawed, cannot be politically dismissed, not least because it is allied within Western Europe, the USA and Australia with the development of a still expanding Green politics which seek in a rather positive way to protect "nature", as well as negatively with right wing "pro-life" groups with their project of restoring the family and traditional values. The history of eugenicism in the genocidal practices of the Death Camps means that German politicians, other than those of the far right, are very sensitive to Finnrage's presentation of the issue as eugenicist science.¹⁵ Yet this feminist fundamentalism, which campaigns with universalistic slogans, is a politics primarily fashioned in the runaway technological environment of the USA and transferred and imposed on all women who are not only located in very different economic and political contexts but who have different personal biographies and needs. Within a world science production system where the market, rather than democracy is sovereign, the politics of refusing the work to be carried out within the national frontiers of one advanced industrial society under some measure of control rather than accelerating its exportation to a poorer country with few or none, has not been adequately addressed by radical feminism. A universalistic politics of reproduction fashioned by white middle class feminists obliterates and negates differences of 'race', class and nationality. Yet even while criticising these politics, it must be recognised that they emerge in response to a male monopoly both of the production of science and of the discourse about science — its history and meaning.

3. Feminist debates in epistemology

Debates which are going on in SSS are also taking place within the feminist critique but have a qualitatively different character. Where between men the realist/social constructionist debate has led to a hardening of positions, with battle lines drawn — albeit to do SSS justice — often wittily drawn, (see Ashmore 1988) feminism has been slow to foreclose options. New theoretical projects, such as the rise of postmodernism, which operate not unlike Paulinian conversion in the mainstream social sciences, are rarely accepted within feminism without first, and very publicly, being very carefully considered as to what they potentially offer theoretically and politically to feminism. It has not passed unnoticed by feminists that postmodernism's claim that verbal constructs do not correspond with reality has only arisen when women and non-western people have begun to speak for themselves. Is postmodernism singularly the theory of white men whose universalistic project is (rightly) seriously under question? Both Harding (1987) and Hartsock (1987) sharply challenge the appearance of relativism as a potentially sexist and racist response to preserve the hegemony of white men. Harding observes "*That it is worth keeping in mind that that the articulation of relativism as an intellectual position emerges historically only as an attempt to dissolve challenges to the legitimacy of purportedly universalistic beliefs and ways of life. It is an objective problem, or a solution to a problem only from the perspectives of dominating groups.*" Feminist theorising has long understood that existing theories need substantial reworking before they may be transferred to work fruitfully on feminism's problems. Even then grave doubts remain as to whether the founding fathers may not still exercise their patriarchal influence even within our revisioned projects. Not only are there armed phalanxes bearing down from outside feminism but the conditions of internal siege require constant vigilance.¹⁶

Science was relatively slow to appear as a significant concern of the feminist movement. For a long time the radical feminist Shulamit

Firestone's (1971) text which saw women's liberation advancing through reproductive technology stood alone. Although the science fiction novel *Woman at the Edge of Time* by Marge Piercy (1975) played with a similar theme, as a socialist feminist Piercy was very clear that the social and economic context also required transformation. In the eighties science and technology have been central arenas of struggle for feminism, both in reproduction but also in production. With the achievement of human in vitro fertilization the concept of motherhood moved from two meanings to three (from biological and care mothers to biological, care and carry mothers); images of the unborn become part of the proud set of baby pictures of the comfortably-off parents in the West, the electronic factory in the newly industrialising countries presides over the new international and sexual division of labour. Women's lives and the social meanings of gender are being transformed by rapidly changing technologies in alliance with a footloose and international capital. Women's bodies, whether through the increasingly industrialised birthing for USA women, or the eyesight of the very young women working in the electronics factories in Taiwan, are the terrain of struggle.

At an ideological level, in reaction to the feminist movement's attempt to transform the social relations between the genders, a newly conservative science has come to the rescue of the status quo, to defend inequality and to keep the oppressed in their proper place. Sociobiological theories have been central within this reactionary project. Feminists and their allies have neither been silent in resisting this onslaught nor have they limited themselves to defence, for feminism has moved forward to the critical examination of science, technology and gender. While there is necessarily no single feminist "voice" as there are differences — even contradictions — within this fast-developing body of theoretical work, there is a common agreement that the tradition of Western science is built on the assumptions of male domination and patriarchal power.

We owe a debt to Merchant (1980) and Keller (1985) for revealing the extent to which

the scientific revolution was imbued with the metaphors of sexuality and male domination. For the Baconian project (which JDB was so keen on), Science was male and Nature female; for Science to know Nature he must strip her bare and forcibly penetrate her, compelling her to give up her secrets. Nor did this dualism of Man as Mind, Woman as Nature, retreat in any simple way, but reached new levels within 19th century evolutionary biology and anthropology. (Jordanova, 1980; Fee, 1981; Haraway, 1978; Hubbard, 1982). Nineteenth century feminists such as Frances Power Cobbe, who contested both the method of cruelty in the new experimental physiology and wife battering, used dualism creatively as the basis of their opposition. If men generally, and scientists in particular, were inherently brutal, then it was women, closer to nature and inherently kinder, who must modify them. Arguably De Beauvoir's pioneering text (1953) is trapped in the same biological dualism, for she sees women as enslaved by their bodies, held back from creativity by motherhood. Woman's reproductive capacity leaves her closer to nature with men as the makers of culture. There are echoes still in Mary O'Brien's *The Politics of Reproduction* (1981) in which women's unique capacity to give birth is set in contrast with men's ceaseless pursuit of creativity to create himself. That strand in feminism which accepts the Body/Mind, Nature/Culture Feminine/Masculine dualism is a continuing presence in feminist politics, using it as a resource, indeed the basis of its opposition to male domination.

Nor is this story of a sexualised relationship of male scientists to a female nature one that can be forgotten as an antiquarian story, rooted only in 17th or even 19th century texts. Sharon Traweek's (1982) anthropological account of a high energy physics laboratory indicates the persistently sexualised language of scientists when they talk about nature and their peculiarly impersonal language when they talk about one another. She quotes Richard Feynman's 1966 Nobel acceptance lecture in which he talks about an idea "as so elegant that I fell deeply in love with it. And like falling in love with a woman it is only possible if you don't

know much about her, so that you do not see her faults. The faults will become apparent later, but after the love is strong enough to hold you to her... so what happened to the old theory? Well I would say its an old lady... But we can say the best we can for any old woman, she has become a very good mother and has given birth to some very good children."

It is within the oppositions to this masculinist epistemology, its theories, methods and 'facts', that the practice and theorizing concerning the possibility of a distinctively feminist epistemology has been created. Keller's biography of McClintock suggested that there was a distinctively women's perspective even while the woman scientist had no conscious feminism. More strongly within a feminist-marxist tradition something like the "two science thesis" has been restated but with a recognition that there are potential connections with other radical epistemologies which need to be integrated. Thus there is both a return to Marxist preoccupations with the class basis of science (and, what is often forgotten in the discussion of the two science thesis, a co-operative relationship between proletarian culture and nature) and also a recovery and new respect for the non-violent relationship, indeed mutual interdependence between nature and culture, of Aboriginal, traditional Chinese, African and native American thought. These are set positively as rich models for green theorizing against the "domination of nature"¹⁷ thesis and practice which threatens the planet itself.

A major feminist project has been to locate a distinctively feminist epistemology from within women's experiences rather than from within women's biologies, yet to do so in a way which refuses the Cartesian dichotomy and so admits physiological along with other differences. Standpoint theory, elaborated by Hartsock (1982), Smith (1985), and Rose (1983), sometimes but not necessarily drawing on object relations theory, suggests that it is within the commonality of women's experience in reproductive labour that the possibility of a feminist epistemology is offered. (Such labour had been erased by Marxist scholarship and political practice). To the old claim and

aspiration of the workers' movement to bring together the knowledges derived from mental and manual labour as sensuous practices in the world is added the feminist claim of the knowledge derived from emotional labour, a knowledge of relationality of interconnectedness between the knower and the known. To restate a metaphor I have used before, the goal is to bring together the knowledges of hand, brain and heart.

Standpoint theory has, not least in contesting the power of masculinist science, the strength of the claims of a successor science. The truth claims of feminism directly challenge those of the old authority of science. As such, standpoint theory is particularly close to the work of the biologists who have taken on the responsibility for exposing and opposing some of the more outrageously sexist claims of sociobiology. In exposing the biases as bad science such feminists claim that that they do better science precisely because they are feminists. While at one level the work appears to be set within the epistemological framework of positivism with its assumptions about the impersonality of the knower, at another, positivism is frontally challenged by the open insistence that feminist science is more scientific. As Annette Kuhn puts it, feminist inquiry is characterised by passionate objectivity. Sarah Hardy's (1986) work as a feminist sociobiologist is exemplary of this contradiction. At the same time postmodernist strands of feminism enter the critique of science decentering the experience and unitary voice of dominant white male science (Haraway 1978). There are dangers as postmodernism can invoke an equality between the discourses and so dissolve the issues of power.

Yet in practice the empiricists (perhaps critical realists would be a better term) and the postmodernists handle the arguments about truth claims with exceeding care, each not dismissing the other, but insisting on the common feminist project. The value of these apparently contradictory claims/stories to the defence of women and the creation of space for women is evident to all. Keller too reflects this complexity; she is unwilling to abandon the truth claims of the realist account, and so

are Harding and Rose, but nor do they wish to jettison the analytic power of social constructionism and evidently anguish over postmodernism lest its deconstructionist tendencies remove the ground on which feminism itself stands. But the centrality of body politics in feminist struggles presses the realism of its presence in our lives. In consequence it has been particularly through the discussion of the body that fluid accommodations are made between those committed to postmodernism and to realism. The title and the text of Emily Martin's *The Woman in the Body* (1989) speak to this process. As Janet Sayers put it some time ago, feminist theory needs a constrained social constructionism and a limited essentialism if we are not to lose sight of women's bodies. Women's bodies, metaphorically and literally are the terrain of struggle for the entire women's movement, and this puts tremendous pressure on the task of theory building.

In one paper it is not possible to do more than touch on these issues. In consequence I hope that, having begun with Desmond Bernal's project of a biography in three colours, reviewed the stubborn resistance to feminist work displayed by mainstream SSS, and indicated the wealth of the feminist critique of science that *Science Studies* will make an hospitable space for both Bernal's and feminism's colour purple.

Acknowledgements:

A preliminary version of this paper was given at the joint meeting of the 4S and EAST in 1988 in Amsterdam as a keynote address to the pioneering Women's Studies section. It was much helped by discussion there and by the thorough commentaries of *Science Studies* anonymous referees.

FOOTNOTES

1. The differential price of parenting the child even though both shared the ideology of sexual freedom — was very real. Hurtfully, even in the memorial arrangements neither of his "illegitimate" offspring were formally acknowledged.

2. Wersky also had difficulties with interviewing his subjects, as a US historian he was automatically cast as part of the cold war scenario and was spoken about with considerable suspicion by a number of the old left scientists — particularly those still within or very close to the CPGB: eg Eric Burhop, Lancelot Hogben. (Personal Communication Eric Burhop)
3. At the launch meeting of the British Society for Social Responsibility in Science the new radicals who were above all morally enraged by the "abuse" of science were supported by the Liberals and old Left and initially were very much influenced by old hierarchical styles. For example the launch meeting was held at the Royal Society and with the FRSSs and Nobel Prize Winners in abundant attendance. From the platform the physicist Cecil Powell, was regretting that Bernal was not present because of his illness, when others called that "Sage is here." Indeed despite being in a wheel chair and unable to speak JDB was present. But from this initial harmony the epistemological and political divisions were to follow rapidly as the thesis of the two sciences was reborn (Rose and Rose 1976a).
4. This antiscience strand was more strongly articulated within the counterculture (eg Theodore Roszak 1973), but has remained as a strand in most of the new social movements often getting uncomfortably close to mysticism which has historically often made less than fortunate alliances with the extreme right.
5. Needham, because of his commitment to China, the cultural revolution and his support for women's struggles was always experienced as closer to the new radical movement even though he spoke unequivocally of there being one modern science (Needham 1976).
6. I am grateful to Francis Apprahamian who worked very closely with JDB for many years for confirming this hunch.
7. This doesn't mean that rampant sexism wasn't present in the Birkbeck laboratory environment. While waiting for a meeting to start, one of Bernal's scientific colleagues in the early 70s showed a group of activists with the radical science movement a set of pornographic photographs. While the group's evident embarrassment persuaded him to put them away, as the one woman present I acutely recall my feelings of extreme humiliation and rage.
8. Although I have many quarrels with Bernal, from his understanding of sexual liberation, through his denial of the reality of Stalinism, to his enthusiasm for science and progress which fostered technoeconomism, he was also a profoundly political person, with an extraordinary capacity to inspire love. His approach to class struggle was direct and practical and is probably one of the rather few Fellows of the Royal Society who has been to a rent struggle demonstration with a half brick in his pocket. And when Bernal was confined to wheelchair and was almost without speech, I overheard a gentle discussion going on between his wife Eileen Bernal and Margot Heinemann about how the latter would 'as usual have Sage for the weekend to give Eileen a break'. Perhaps I am utopianist but my hunch is that if Bernal, keeping the same passionate engagement with the natural and social worlds, had been born rather later, then unlike much of SSS — which I see as suffering from an overdose of professionalism — he would have talked using three colours.
9. I am unfair here to Roy Bhaskar and his project of a critical realism, it is simply that the term has been captured by liberal objectivism.
10. Hence when one of my male colleagues active within the social studies of science tells me that he has read some extensively reviewed feminist science studies book such as Keller's *A Feeling for the Organism* or Carolyn Merchant's *The Death of Nature*, I find that my reaction is not uncomplicated. I am clearly being invited to approve his reading a feminist book; well, I do, so that is easy enough, but simultaneously it is as if his reading this feminist book justifies his manifest ignorance of all other feminist literature in the area.
11. The feminist journals, such as *Signs: the Journal of Women in Culture and Society*, *Hypatia*, *Women's International Quarterly*, *Donnawomanfemme*, *Resources for Feminist Research / Documentation sur la Recherche Feministe*, etc., regularly publish and survey feminist work on science. An increasing number of books particularly but not only the USA, such as those in the series *Genes and Gender*, together with those — to cite some of the most outstanding — of Carolyn Merchant, Sandra Harding and Evelyn Fox Keller, and also a myriad of papers from the Netherlands, USA, Australia, Finland, Norway, Canada, Poland, Britain, etc. And at last (1988) the Dutch women saw to it that there was a women's studies section at the 4S. Judging by the seriousness with which women from the Soviet Union were addressing feminist concerns in the 1988 international philosophy of science meeting, and the anger recently reported (*Nature* Vol 336 3 Nov. 1988) at the inadequate representation of women within the Soviet Academy, it will not be long before contributions to the feminist critique of science are heard from within Russia. Two surveys of the main strands of feminist SSS by Rose (1986) and Scheibinger (1987), together with the bibliographies compiled by a number of research groups, while useful, become rapidly dated under the flood of new publications.
11. The debates within the new social movements moved away from this extreme relativism as the truth claims of a realist science were needed within the Green movement, the health movement and the women's movement. What has happened within feminism in particular is an ability to hold a *both* realism and social constructionism position.
12. If this is the case then a process of professionalisation has occurred which has cut much of SSS from its moral and political commitments. The competing accounts between knowledge producers who make truth claims for their accounts and identify themselves as left wing, and those claiming to be apolitical and equally make truth claims are subjected to different kinds of scrutiny. For the former political motivation and interest are analysed, but not the latter. This bias has led SSS into an apparent tenderness towards scientific racism. Indeed orthodoxy and heterodoxy were turned upside down when a leading figure within the strong programme, speaking on a radio show, characterised Arthur Jensen as a latter day Galileo. Given the ideological support, indeed political comfort, that Jensen's thesis afforded the US government in retreat from its War on Poverty, claiming Jensen for heterodoxy seemed at best

perverse. SSS by contrast is silent concerning the debates about the biologically determined inferiority of women. Thus we have so far been spared seeing whether, for example, the interest perspective of the strong programme, which might have pronounced on the social production of the Inevitability of Patriarchy, and indeed similar biological determinist texts, interpreted the determining patriarchs as Galilean heroes and their feminist opposition the custodians of orthodoxy. But the silence itself invites explanation. One suggestion would be that the analysis of the spoon benders and worm runners is much safer than taking on the feminist movement.

There seems to be a by-and-large unacknowledged left-right political dimension to SSS, with differential procedural practices associated with the discussion of each, particularly within Britain. In France SSS seems to be able to include both orthodox and heterodox perspectives, whether this is translated as right-left perspectives or as state funded or unfunded research. In the British account the issue of the relationship to SSS to state funding is undiscussed. Unfortunately this more democratic survey of the French state of the art still excludes the work of French feminists, despite the fact that one of the earliest theoretical texts concerning the phallogocentric character of science was French (Stehelin, 1976).

13. Only in 1989 were 'scientific samples' of Mengele's work still held within the museum of a major biological research institute at Frankfurt, buried as the relics of victims and not as science. Surely an example however overdue of epistemology in action, for Nazi "science" was refused the name science.
14. So where does Rosalind Franklin fit in? It has been the outsider Ann Sayre's (1975) biographical study of Franklin which has seriously thrown into question the DNA story. Her retelling has questioned the legitimacy of the procedures and the accreditation process. While Nobel prizes are not reallocated, not least to the dead, Sayre's account of the appropriation of Franklin's material in her life time, and the writing out of her contribution after her death has become a byword for women. Yet why isn't this conflict interesting to mainstream SSS?

It is not without irony that it is there is sensitivity to at least one woman's knowledge claims in the old sociology of science. In a self correcting footnote to his classical paper on The Matthew Effect in Science, Merton (1973) acknowledges the way that this drew on Harriet Zuckerman's work on the *Scientific Elite: the Nobel Laureates in the USA*. He says "It is now belatedly clear to me that I drew on the interview and other materials of the Zuckerman study that, clearly, the authorship should have appeared under joint authorship". The Matthew effect said that "To him who hath it shall be given", feminists would in the light of the Sayre and other stories wish to regender the second part "to her that hath little it shall be taken away."

Before I wax too enthusiastic about saving graces of the old sociology of science, while Merton displayed sensitivity to women's claims in this footnote, his disciples did not. The Coles' study of women in science, commissioned by the Ford Foundation, came to the conclusion that women did not experience discrimination. While Gayle Tuchman subjected *Fair*

- Science* to the methodological criticism it deserved, the new SSS seems so unable to see gender issues, that Michael Mulkey for example, who has subjected the kind of citation technique used by the Coles to very stringent criticism, misses out this text.
15. The hostility to the feminist critique of science seems stronger than the general hostility directed to women's studies not least because its approach is not so much inter-disciplinary but, as Ann Oakley remarks, anti-disciplinary. Thus when well intentioned men ask any of us to write an account of women's studies/feminist research, within for example the problematic of the study of disciplines within SSS, there is genuinely a problem. For despite any wishes on the part of women's studies to give up the struggle and to be accepted merely as a "discipline" not only can we rely on less well intentioned men to see the cultural and political enterprise as profoundly threatening and to be opposed, but there is a problem for an anti-discipline with an anti-hierarchic tendency to be located in the structures of scientific disciplines and scientific hierarchies.
 16. The theoretical and political response to the internal contradictions of feminism within the critique of science is well represented by Sandra Harding's (1986) pioneering attention to "race" and racism.
 17. The "domination of nature" thesis describes that tradition characteristic of masculinist science even in the hands of its Marxist proponents, which sees the task of science in the service of a universalistic "man" to control, exploit, dominate nature — see Leiss, Schmidt, the Frankfurt School etc. It is the peculiarly masculine nature of this view of the task of science to which feminism points.

REFERENCES:

- Ashmore M.
1988 'The Life and Opinions on a Replication Claim' in Woolgar S. (ed) *Knowledge and Reflexivity*. London, Sage. 125—153
- Barnes B. and Bloor D.
1982 'Relativism, Rationality and the Sociology of Knowledge' in Hollis M. and Lukes S. *Rationality and Relativism*. Oxford, Blackwell. 21—47
- Bernal M.
1987 *Black Athena: Vol1*. London Free Association Books.
- Birke L.
1986 *Women and Biology: the Feminist Challenge*. Harvester, Brighton.
- Bleier R.
1986 (ed) *Feminist Approaches to Biology*, Oxford, Athene, Pergamon
- Cicotti G. et al.,
1976 'The Production of Science in Advanced Capitalist Countries' in Rose H and Rose S (eds) 1976c op. cit. 32—57.
- Code L.
1987 *Epistemic Responsibility*, Hanover, New Hampshire, University Press of New England.
- Collins H. M.
1988 'Perspective' *Times Higher Educational Supplement*, Oct 21,14.
- De Beauvoir S.
1953 *The Second Sex*. London, Cape
- Delamont S.
1987 'Three Blind Spots? A Comment on the Sociology of Science by a Puzzled Outsider' *Social Studies of Science* 17, 163—70.
- Fee E.
1981 'Is Feminism a threat to Scientific Objectivity?' *AAAS Meeting Toronto*,
1986 *Critiques of Modern Science: the Relationship of Feminism to Other Radical Epistemologies*, in Bleier (ed) op cit.
- Firestone S.
1970 *The Dialectic of Sex*, New York, William Morrow & Co.
- Goldsmith M.
1980 *Sage: a Life of J.D Bernal*, London, Hutchinson.
- Gordon L.
1986 'What's New in Feminist History?' in *Feminist Studies/Critical Studies* (ed) De Laurentis T, Bloomington Indiana University Press, 1986 p 21. I am indebted to Judith Stacey for this quote, *Signs*, Autumn 1989 p190.
- Haraway D
1978 'Animal Sociology and a Natural Economy of the Body Politic, Part1 A : Political Physiology of Dominance', *Signs: Journal of Women in Culture and Society*,4,1 Autumn.
1989 'In the Beginning was the Word: the Genesis of Biological Theory', *Signs: Journal of Women in Culture and Society* 6.3, 469—481.
- Harding S
1986 *The Science Question in Feminism*, Milton Keynes, Open University Press,
1987 (ed) *Feminism and Methodology*, Bloomington Indiana University Press.
1986 'The Instability of the Analytic Categories of Feminist Theory' *Signs: Journal of Women in Culture and Society*,11.4. Summer
1988 and Jean O'Barr (eds) *Feminist Inquiry*, Chicago, Chicago University Press
- Hartsock N.
1983 *Money, Sex and Power*, Longmans, NY and London,
1987 'Rethinking Modernism', *Cultural Critique*,7 Fall
- Hubbard R. et al.,
1982 (eds) *Biological Woman, the Convenient Myth*. Cambridge, Mass., Schenkman.
- Hardy S.
1986 *Empathy, Polyandry, and the Myth of the Coy Female* in Bleier op cit
- Jordanova L.
1980 'Natural Facts: A Historical Perspective on Science and Sexuality' in MacCormack C. and Strathern M. (eds) *Nature, Culture and Gender*, Cambridge, Cambridge University Press.
- Keller E.F.
1981 'Feminism and Science' *Signs: Journal of Women in Culture and Society* 17,2.
1985 *Reflections on Gender and Science*, New Haven Conn., Yale University Press.
- Lecourt D.
1977 *Proletarian Science? The Case of Lysenko*, London, New Left Books.
- Levins R. and Lewontin R.
1976 'The Problem of Lysenkoism' in Rose and Rose (eds) 1976b also in *The Dialectical Biologist* 1988, Harvard UP, Cambridge, Mass
- Latour B.
1983 'Give me a Laboratory and I will Raise the World' in Karin Knorr and Michael Mulkey (eds) *Science Observed: Perspectives on the Social Study of Science*, London, Sage.
- Latour B. and Wolgar S.
1979 *Laboratory Life, the Construction of Scientific Facts*, London, Sage.
- Latour B.
1987 *Science in Action*, Milton Keynes, Open University Press.
- Mascia — Lees F.E. et al,
1989 'The Post Modernist Turn in Anthropology', *Signs: Journal of Women in Culture and Society*, Autumn. 15,1, 7—33
- Martin E.
1988 *The Woman in the Body: A Cultural Analysis of Reproduction*, Boston, Beacon.
- Merchant C.
1982 *The Death of Nature*, Wildwood, London, 1982.
- Merton R.K.
1973 *The Sociology of Science*, Chicago, Chicago University Press.
- Needham J.
1976 'History and Human Values: A Chinese Perspective for World Science and Technology' in Rose and Rose (eds) 1976b
- Potter E.
1986 *A Feminist Model of Natural Science*, Haverford College Press.
- Ravetz J.
197 *Scientific Knowledge and its Social Problems*, Oxford, Oxford University Press.
- Roll-Hansen N.
1989 'The Practice Criterion and the Rise of Lysenkoism', *Science Studies* 2,1: 3—16.
- Rose H.
1978 'Hyper-reflexivity, a New Danger for the Countermovements' in Nowotny H and Rose H. (eds) *Countermovements in the Sciences*, Dordrecht, Reidel.
- 1983 'Hand, Brain and Heart: Towards an Epistemology for the Natural Sciences', *Signs: Journal for Women in Culture and Society*, 9,1 Autumn.
- 1986 'Beyond Masculinist Realities' in Bleier (ed) op. cit.
- Rose H. and Rose S.
1976a 'The Radicalisation of Science' in (eds) Rose H and Rose S. 1976b
1976b (eds) *The Radicalisation of Science*, London, Macmillan.
1976b (eds) *The Political Economy of Science* London, Macmillan
198 'The Two Bernals: JD Bernal and the Social Relations of Science Movement' *Fundamenta Scientia*
- Roszack T.
1973 *Where the Wasteland Ends*, London, Faber.
- Sayre A.
1975 *Rosalind Franklin and DNA: A vivid view of what it is to be like to be a gifted woman in an especially male profession*, New York, WW Norton.
- Shapin S.
1988 'Following Scientists Around' *Social Studies of Science*, Vol 18, 533—50.
- Shapin, S and Schaffer, S
1985 *Leviathan and the Airpump*. Princeton University Press.
- Smith D.
1988 *The Every day World as Problematic, a Feminist Sociology*. Milton Keynes, Open University Press.
- Stehelin L
1975 *Sciences, Women and Ideology*, in Rose and Rose (eds) 1975b op. cit.
- Traweek S.
1989 *Particle Physics Culture*, Cambridge Mass. Harvard University Press.
- Tuchman G.
1980 'Fair Science Reviewed', *Social Policy*, May/June, 11,1,59—64.
- Wersky G.
1978 *The Invisible College: The Collective Biography of British Socialist Scientists in the 1930s*, London, Allen Lane.
- Young R.M
1977 'Science Is Social Relations' *Radical Science Journal*, 5, 65—129
- Van Sertima I.
1986 (ed) *Blacks in Science: Ancient and Modern*, New Brunswick, Transaction.
- Hilary Rose
West Yorkshire Centre for Research on Women
University of Bradford
Bradford West Yorkshire BD7 1DP
UK

- Science* to the methodological criticism it deserved, the new SSS seems so unable to see gender issues, that Michael Mulkey for example, who has subjected the kind of citation technique used by the Coles to very stringent criticism, misses out this text.
15. The hostility to the feminist critique of science seems stronger than the general hostility directed to women's studies not least because its approach is not so much inter-disciplinary but, as Ann Oakley remarks, anti-disciplinary. Thus when well intentioned men ask any of us to write an account of women's studies/feminist research, within for example the problematic of the study of disciplines within SSS, there is genuinely a problem. For despite any wishes on the part of women's studies to give up the struggle and to be accepted merely as a "discipline" not only can we rely on less well intentioned men to see the cultural and political enterprise as profoundly threatening and to be opposed, but there is a problem for an anti-discipline with an anti-hierarchic tendency to be located in the structures of scientific disciplines and scientific hierarchies.
 16. The theoretical and political response to the internal contradictions of feminism within the critique of science is well represented by Sandra Harding's (1986) pioneering attention to "race" and racism.
 17. The "domination of nature" thesis describes that tradition characteristic of masculinist science even in the hands of its Marxist proponents, which sees the task of science in the service of a universalistic "man" to control, exploit, dominate nature — see Leiss, Schmidt, the Frankfurt School etc. It is the peculiarly masculine nature of this view of the task of science to which feminism points.
- REFERENCES:**
- Ashmore M.
1988 'The Life and Opinions on a Replication Claim' in Woolgar S. (ed) *Knowledge and Reflexivity*. London, Sage. 125—153
- Barnes B. and Bloor D.
1982 'Relativism, Rationality and the Sociology of Knowledge' in Hollis M. and Lukes S. *Rationality and Relativism*. Oxford, Blackwell. 21—47
- Bernal M.
1987 *Black Athena: Vol1*. London Free Association Books.
- Birke L.
1986 *Women and Biology: the Feminist Challenge*. Harvester, Brighton.
- Bleier R.
1986 (ed) *Feminist Approaches to Biology*, Oxford, Athene, Pergamon
- Cicotti G. et al.,
1976 'The Production of Science in Advanced Capitalist Countries' in Rose H and Rose S (eds) 1976c op. cit. 32—57.
- Code L.
1987 *Epistemic Responsibility*, Hanover, New Hampshire, University Press of New England.
- Collins H. M.
1988 'Perspective' *Times Higher Educational Supplement*, Oct 21,14.
- De Beauvoir S.
1953 *The Second Sex*. London, Cape
- Delamont S.
1987 'Three Blind Spots? A Comment on the Sociology of Science by a Puzzled Outsider' *Social Studies of Science* 17, 163—70.
- Fee E.
1981 'Is Feminism a threat to Scientific Objectivity?' AAAS Meeting Toronto,
1986 *Critiques of Modern Science: the Relationship of Feminism to Other Radical Epistemologies*, in Bleier (ed) op. cit.
- Firestone S.
1970 *The Dialectic of Sex*, New York, William Morrow & Co.
- Goldsmith M.
1980 *Sage: a Life of J.D Bernal*, London, Hutchinson.
- Gordon L.
1986 'What's New in Feminist History?' in *Feminist Studies/Critical Studies* (ed) De Laurentis T, Bloomington Indiana University Press, 1986 p 21. I am indebted to Judith Stacey for this quote, *Signs*, Autumn 1989 p190.
- Haraway D
1978 'Animal Sociology and a Natural Economy of the Body Politic, Part1 A : Political Physiology of Dominance', *Signs: Journal of Women in Culture and Society*,4,1 Autumn.
1989 'In the Beginning was the Word: the Genesis of Biological Theory', *Signs: Journal of Women in Culture and Society* 6.3, 469—481.
- Harding S
1986 *The Science Question in Feminism*, Milton Keynes, Open University Press,
1987 (ed) *Feminism and Methodology*, Bloomington Indiana University Press.
1986 'The Instability of the Analytic Categories of Feminist Theory' *Signs: Journal of Women in Culture and Society*,11.4. Summer
1988 and Jean O'Barr (eds) *Feminist Inquiry*, Chicago, Chicago University Press
- Hartsock N.
1983 *Money, Sex and Power*, Longmans, NY and London,
1987 'Rethinking Modernism', *Cultural Critique*,7 Fall
- Hubbard R. et al.,
1982 (eds) *Biological Woman, the Convenient Myth*. Cambridge, Mass., Schenkman.
- Hardy S.
1986 *Empathy, Polyandry, and the Myth of the Coy Female* in Bleier op cit
- Jordanova L.
1980 'Natural Facts: A Historical Perspective on Science and Sexuality' in MacCormack C. and Strathern M. (eds) *Nature, Culture and Gender*, Cambridge, Cambridge University Press.
- Keller E.F.
1981 'Feminism and Science' *Signs: Journal of Women in Culture and Society* 17,2.
1985 *Reflections on Gender and Science*, New Haven Conn., Yale University Press.
- Lecourt D.
1977 *Proletarian Science? The Case of Lysenko*, London, New Left Books.
- Levins R. and Lewontin R.
1976 'The Problem of Lysenkoism' in Rose and Rose (eds) 1976b also in *The Dialectical Biologist* 1988, Harvard UP, Cambridge, Mass
- Latour B.
1983 'Give me a Laboratory and I will Raise the World' in Karin Knorr and Michael Mulkey (eds) *Science Observed: Perspectives on the Social Study of Science*, London, Sage.
- Latour B. and Wolgar S.
1979 *Laboratory Life, the Construction of Scientific Facts*, London, Sage.
- Latour B.
1987 *Science in Action*, Milton Keynes, Open University Press.
- Mascia — Lees F.E. et al,
1989 'The Post Modernist Turn in Anthropology', *Signs: Journal of Women in Culture and Society*, Autumn. 15,1, 7—33
- Martin E.
1988 *The Woman in the Body: A Cultural Analysis of Reproduction*, Boston, Beacon.
- Merchant C.
1982 *The Death of Nature*, Wildwood, London, 1982.
- Merton R.K.
1973 *The Sociology of Science*, Chicago, Chicago University Press.
- Needham J.
1976 'History and Human Values: A Chinese Perspective for World Science and Technology' in Rose and Rose (eds) 1976b
- Potter E.
1986 *A Feminist Model of Natural Science*, Haverford College Press.
- Ravetz J.
197 *Scientific Knowledge and its Social Problems*, Oxford, Oxford University Press.
- Roll-Hansen N.
1989 'The Practice Criterion and the Rise of Lysenkoism', *Science Studies* 2,1: 3—16.
- Rose H.
1978 'Hyper-reflexivity, a New Danger for the Countermovements' in Nowotny H and Rose H. (eds) *Countermovements in the Sciences*, Dordrecht, Reidel.
1983 'Hand, Brain and Heart: Towards an Epistemology for the Natural Sciences', *Signs: Journal for Women in Culture and Society*, 9,1 Autumn.
1986 'Beyond Masculinist Realities' in Bleier (ed) op. cit.
- Rose H. and Rose S.
1976a 'The Radicalisation of Science' in (eds) Rose H and Rose S. 1976b
1976b (eds) *The Radicalisation of Science*, London, Macmillan.
1976b (eds) *The Political Economy of Science* London, Macmillan
198 'The Two Bernals: JD Bernal and the Social Relations of Science Movement' *Fundamenta Scientia*
- Roszack T.
1973 *Where the Wasteland Ends*, London, Faber.
- Sayre A.
1975 *Rosalind Franklin and DNA: A vivid view of what it is to be like to be a gifted woman in an especially male profession*, New York, WW Norton.
- Shapin S.
1988 'Following Scientists Around' *Social Studies of Science*, Vol 18, 533—50.
- Shapin, S and Schaffer, S
1985 *Leviathan and the Airpump*. Princeton University Press.
- Smith D.
1988 *The Every day World as Problematic, a Feminist Sociology*. Milton Keynes, Open University Press.
- Stehelin L
1975 *Sciences, Women and Ideology*, in Rose and Rose (eds) 1975b op. cit.
- Traweek S.
1989 *Particle Physics Culture*, Cambridge Mass. Harvard University Press.
- Tuchman G.
1980 'Fair Science Reviewed', *Social Policy*, May/June, 11,1,59—64.
- Wersky G.
1978 *The Invisible College: The Collective Biography of British Socialist Scientists in the 1930s*, London, Allen Lane.
- Young R.M
1977 'Science Is Social Relations' *Radical Science Journal*, 5, 65—129
- Van Sertima I.
1986 (ed) *Blacks in Science: Ancient and Modern*, New Brunswick, Transaction.
- Hilary Rose
West Yorkshire Centre for Research on Women
University of Bradford
Bradford West Yorkshire BD7 1DP
UK