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ABSTRACT

Some feminists have become discouraged because the theoretical and conceptual changes leading to a feminist science have not yet occurred. A scheme has been developed which charts the phases through which the disciplines in the social sciences and humanities progressed before reconceptualization from the new scholarship on women transformed those disciplines. Application of this scheme to biology, the discipline within the sciences with the most activity regarding feminism and science, suggests that biology is only beginning to approach the phase of reconceptualization. The roots and form of a feminist science undoubtedly lie in the phases which we have completed; we may be on the threshold of discovering the framework of the feminist science. (Author)

THE FEMINIST PERSPECTIVE ON SCIENCE:

IS RECONCEPTUALIZATION POSSIBLE?

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ABSTRACT

Some feminists have become discouraged because the theoretical and conceptual changes leading to a feminist science have not yet occurred. A scheme has been developed which charts the phases through which the disciplines in the social sciences and humanities progressed before reconceptualization from the new scholarship on women transformed those disciplines. Application of this scheme to biology, the discipline within the sciences with the most activity regarding feminism and science, suggests that biology is only beginning to approach the phase of reconceptualization. The roots and form of a feminist science undoubtedly lie in the phases which we have completed; we may be on the threshold of discovering the framework of the feminist science.

INTRODUCTION

On two separate occasions within the last six months, during public lectures at women's studies events, I have heard two different scientists, each associated for more than a decade with the feminist critique of science, say that she has stopped her work on a feminist science and returned to working full-time on her traditional scientific research. We obviously need competent women scientists who have the benefit of the feminist perspective working on traditional scientific research. However, I was very upset at their disillusionment and shocked by the assumptions which provided the bases for their decision no longer actively to pursue the theory of a feminist science. Their actions indicate that they see little hope of developing such a theory; it seems to them that feminists in science will never move beyond demonstrating the unscientific biases behind current biologically deterministic theories such as sociobiology and endocrinology where hormone levels are assumed to differentially affect brain and behavior in males and females. In short, they feel that we can never provide more than a feminist critique of science and that a feminist reconceptualization of science will never be possible.

Indeed some of the very interesting and important work of recent historians and philosophers of science does seem to lead to that very conclusion. In exploring the whole question of subjectivity/objectivity, Keller (1982) has suggested that the

"objective" or "scientific" approach to the world may be synonymous with a masculine world view. "The presumption is that science, but its very nature, is inherently masculine, and that women can apprehend it only by an extreme effort of overcoming their own nature which is inherently contradictory to science" (Hein, 1981, p. 370). Fee has stated that a sexist society should be expected to develop a sexist science. Conceptualizing a feminist science from within our society is "like asking a medieval peasant to imagine the theory of genetics or the production of a space capsule" (Fee, 1982, p. 31).

Consideration of these statements makes one aware of possible reasons why no theory of a feminist science has yet evolved. Clearly, with all of the obstacles to women in science, it will be more difficult for feminists to transform and reconceptualize science from our perspective.

PHASES OF CURRICULUM TRANSFORMATION

I do think such a reconceptualization is possible. My optimism is not based primarily on the progress made so far by the feminists in science. Rather, it is based on the radical and often far-reaching transformations made by feminists working in the other disciplines. (Leavitt, 1975 and Leacock, 1977) As more and more disciplines are changed by the new scholarship on women, it has become possible to chart the developmental phases through which the scholarship progresses. Peggy McIntosh, Director of Faculty Development Programs of the Wellesley College Center for

Research on Women, is in a excellent position to observe transformation by the feminist perspective in a varitey of disciplines across the curriculum. She has developed the scheme which I paraphrase below, using her major example, history, to delineate the five phases of transformation:

Phase I: Womanless History--This is the very traditional approach to the discipline which is exclusive in that only great events and men in history are deemed worthy of consideration.

Phase II: Women In History--Heroines, exceptional women or an elite few who are seen to have been of benefit to culture as defined by the traditional standards of the discipline are included in the study.

Phase III: Women as a Problem, Anomaly, or Absence in History--Women are studied as victims, as deprived or defective variants of men, or as protestors, with "issues." Women are at least viewed in a systemic context, since class and race and gender are seen as interlocking political phenomena. Categories of historical analysis still are derived from those who had the most power.

Phase IV: Women As History--The categories for analysis shift and become racially inclusive, multi-faceted, and filled with variety; they demonstrate and validate plural versions of reality. This phase takes account of the fact that since women have had half of the world's lived experience, we need to ask what that experience has been and

to consider it as half of history. This causes faculty to use all kinds of evidence and source materials which academic people are not in the habit of using.

Phase V: History Redefined and Reconstructed to Include Us All: Although this history will be a long time in the making, it will help students to sense that women are both part of and alien to the dominant culture, the dominant version of history. It will create more useable and inclusive constructs which validate a wider sample of life. (McIntosh, 1984)

Many, including McIntosh herself, (1983) may question whether or not the developmental scheme that she posits is the best way to depict the transformation of the disciplines by the new scholarship on women. However, I think that for three reasons it is a useful paradigm to consider applying to the sciences. First, applying her scheme to the sciences should underline the fact that reconceptualizing a discipline, particularly ones that have been long-established and presented extreme barriers to women, will only occur after going through other phases. Passing through these phases may take varying amounts of time. I think that it is important to emphasize the accomplishments (phases) we have completed, as well as those not yet reached (reconceptualization). Becoming explicit about the fact that reconceptualization occurs relatively late (phase IV) in this developmental process, may make women in science less discouraged about the point in the process where currently we are. Second, it is important to apply her scheme to as many

disciplines as possible to determine whether or not the phases are in the accurate order and whether or not the notion of a developmental sequence is applicable. For example, if in several disciplines, phase IV preceded phase II, one might question the validity of the scheme. It is not inconceivable that theoretical changes might have preceded specific examples. Third, it is necessary for scientists to incorporate the material from the early phases into their research and teaching. A total reconceptualization is not necessary in order to use the considerable material already available. Furthermore, use and consideration of that material by many scientists may be important steps towards reconceptualization. For example, if many scientists begin using female rats or monkeys as subjects for hormone experiments, the entire theory regarding steady states versus cyclicity for hormone levels may be revised (Hoffman, 1982).

At this point, I would like to develop the application of McIntosh's scheme to biology. Although McIntosh (1984) has outlined briefly how her scheme might be applied to biology, I would like to develop that sketch. My development of her scheme will also deviate from McIntosh's ideas in one major conceptual way: I do not accept her implication that we really have made much, if any progress in phase IV, the reconceptualization of biology. Although her brief sketch (McIntosh, 1983) is ambiguous on this point, many readers might infer from some of her examples and suggestions that more far-reaching theoretical changes have already occurred. It is precisely the fact that such changes have not yet occurred that has led, I believe, to the discourage-

ment of many feminists in science, and which provided the impetus for this paper.

Biology is the discipline in the sciences which probably has had the most activity in terms of the new scholarship on women. Biology is also the science, which according to the statistics of the National Science Foundation (1984) includes more women than any of the other sciences, outside of the social sciences. Undoubtedly these two factors are linked in a significant way. It was not until a substantial proportion of women were present in the disciplines of the humanities and social sciences that the feminist perspective was felt and transformations in those disciplines occurred. Thus, it is not surprising that the discipline within the sciences which has the most women is also the discipline where substantial work is proceeding on feminism and science. However, biology still has substantially fewer women (Vetter, 1981) than the disciplines within the humanities and social sciences where feminists have had the most impact at the theoretical or conceptual level. We should therefore not be surprised or discouraged because reconceptualization has not yet occurred in biology.

POSITION OF BIOLOGY IN DEVELOPMENTAL SCHEME

How then does biology fit into McIntosh's scheme? At what phase are we?

Obviously many scientists and most courses are in phase I: Womanless Science. Many scientists would deny that their gender influences their theories, data collection, subjects, or questions asked. They suggest that science is "manless" as well as "womanless". However, Thomas Kuhn (1970) and his followers have

suggested that all scientific theories are products of individuals living in a particular historical and social milieu. As such, they are biased by the perspective and paradigms of those individuals. Keller (1982) and Fee (1981) have suggested that the absence of women from the decision-making levels of science has produced a science which views the world from a male perspective and is therefore womanless. The failure of scientists to recognize this bias, has perpetuated the idea of the "objectivity" of science.

Some scientists have been able to recognize the shortcomings of phase I science. Considerable research is now being done on phase II: Women In Science. Just last year Vivian Gornick's book appeared under that very title (1983). Historians of science, in particular are busy discovering the lost women of science. It is becoming very clear through the work of Margaret Rossiter (1982), Evelyn Fox Keller (1983), and Ann Sayre (1975), to name a few that women always have been in science. Frequently their discoveries and roles have been brushed aside, attributed to others or misunderstood. The new studies of Rosalind Franklin (Sayre, 1975) and Barbara McClintock (Keller, 1983) provide excellent examples of the documentation of the work done by women making important discoveries in biology.

Many teachers have reached phase II in their teaching and make efforts to integrate women into their classes when discussing important scientific experiments. It can be rewarding for students to learn of the women who have succeeded in the traditional scientific establishment and won the Nobel Prize. In some cases, just mentioning the first name of the experimenters,

for example Alfred Hershey and Margaret Chase when discussing the experiments determining that DNA was the genetic component in bacteriophage, (Taylor, 1965) will break the stereotype that all scientists are male. It is also crucial to convey to students that although the scientific hierarchy is set up so that often only one man wins the Prize or heads the laboratory, much of the actual work leading to the important discovery is done by many people, most of whom are women.

Much work has also been done which might be categorized as phase III: Women as a Problem, Anomaly, or Absence in Science. That women are seen very frequently in this context is evident from article titles written by and about women in science:

"Adventures of a Woman in Science" (Weisstein, 1979)

"Rosalind Franklin and DNA: A Vivid View of What It Is Like to be a Gifted Woman in an Especially Male Profession" (Sayre, 1975)

"Sex Discrimination in the Halls of Science" (Vetter, 1980)

"Women in Academic Chemistry Find Rise to Full Status Difficult" (Rawls and Fox, 1978)

"The Anomaly of a Woman in Physics" (Keller, 1977)

"The Disadvantaged Majority: Science Education for Women" (Kahle, 1983)

"Can the Difference Between Male and Female Science Majors Account for the Low Number of Women at the Doctoral Level in Science?" (Baker, 1983)

A further aspect of this phase shows up in the current studies being made with the attempt of attracting more women into science and math, the traditionally "male" disciplines. The National Science Foundation (1984), the Rockefeller Foundation (Berryman, 1983) the American Association of Colleges under the auspices of

the Carnegie Corporation and the Ford Foundation (Hall and Sandler, 1982), American Chemical Society (1983) along with other foundations and professional societies have each issued studies and reports with statistics documenting the lack of women in science and possible "causes and cures".

I believe that this phase is analogous to the woman as victim aspect of phase III described by McIntosh (1984) for history. Frequently, biologically deterministic theories such as sociobiology and hormone effects on the brain have been used to provide biological bases that justify women's position in society. Many feminist scientists have repeatedly attempted to demonstrate the biases, poor data, and unscientific nature of the research underlying the biologically deterministic theories of which women have become the victim (Bleier, 1984; Hubbard, 1979; Lowe, 1978; Rosser, 1982). Bleier (1979) has discussed at length the subtle problems that occur with biochemical conversions of hormones within the body so that an injection of testosterone may be converted to estrogen or another derivative by the time it reaches the brain. She and others have also repeatedly warned against extrapolating from one species to another in biochemical as well as behavioral traits. Feminist scientists have warned the sociobiologists about the circularity of logic involved with using human language and frameworks to interpret animal behavior which is then used to "prove" that certain human behavior is biologically determined since it has also been found in animals.

These refutations and warnings about the problems of biologically deterministic assumptions are necessary. However, women

in science must move beyond this phase. As McIntosh points out for phase III in history, "Phase III work reveals its own limits; we will never make most of ordinary women's experience seem either real or valid if our teaching and research still rest on the categories of historical analysis which were derived from the experience of those who had the most power" (1984, p.3). Feminists in science will also be limited as long as we continue to question some of the methods, subjects, or interpretations of traditional science while basically accepting and remaining within its paradigms. We must make a quantum leap to reconceptualize some of the existing paradigms of science before we can have a Phase IV or feminist science.

It is my contention that this leap in reconceptualization has not yet occurred. Therefore, I cannot describe it here. I think that much of the language in which we might think about a different approach to science has not yet evolved. That is one of the obstacles to reconceptualization. However, if the current "scientific and objective" way of doing science is in fact synonymous with a masculine view of the natural, physical world, perhaps what is needed is the "feminine" view of that world. By this, I do not mean replacing theories such as "man the hunter", which are based on bias and conjecture from a male point of view of power and dominance rather than data, with equally unscientific and speculative theories about "woman the gatherer" (Morgan, 1973) which are also based on fantasy rather than data. What I do mean by a reconceptualization of science, is an expan-

sion of the number and kinds of questions asked, the experimental models and subjects used, and the design and interpretation of experiments. Some of the recent work of women in science hints at the sorts of changes that might come from phase IV research.

TOWARD RECONCEPTUALIZATION

Barbara McClintock is an achieving scientist who is not a feminist. However, in her approach towards studying maize, she indicates a shortening of the distance between the observer and the object being studied and a consideration of the complex interaction between the organism and its environment. Her statement upon receiving the Nobel Prize was that "it might seem unfair to reward a person for having so much pleasure over the years, asking the maize plant to solve specific problems and then watching its responses" (Keller, 1984). This statement suggests a closer, more intimate relationship with the subject of her research than typically is expressed by the male "objective" scientist. One does not normally associate words such as "a feeling for the organism" (Keller, 1984) with the rational, masculine approach to science. McClintock also did not accept the predominant hierarchical theory of genetic DNA as the "Master Molecule" that controls gene action but focussed on the interaction between the organism and its environment as the locus of control.

Models which more accurately simulate functioning complex biological systems may be derived from using female rats as subjects in experiments. Women scientists such as Hoffman (1982) have questioned the tradition of using male rats or primates as subjects. With the exception of insulin and the hormones of the

female reproductive cycle, traditional endocrinological theory predicted that most hormones are kept constant in level in both males and females. Thus, the male of the species, whether rodent or primate, was chosen as the experimental subject because of his noncyclicity. However, new techniques of measuring blood hormone levels have demonstrated episodic, rather than steady, patterns of secretion of hormones in both males and females. As Hoffman (1982) points out, the rhythmic cycle of hormone secretion, as also protrayed in the cycling female rat, appears to be a more accurate model for the secretion of most hormones.

As more women have entered primate research, they have begun to challenge the language used to describe primate behavior and the patriarchal assumptions inherent in searches for dominance hierarchies in primates. Lancaster describes a single-male troop of animals as follows:

> For a female, males are a resource in her environment which she may use to further the survival of herself and her offspring. If environmental conditions are such that the male role can be minimal, a one-male group is likely. Only one male is necessary for a group of females if his only role is to impregnate them. (1975, p. 34)

Her work points out the androcentric bias of primate behaivor theories which would describe the above group as a "harem" and consider dominance and subordination in the description of behavior.

Even the New York Times (Sept. 18, 1984) recognized the fundamental changes occurring in primate research primarily due to the increased number of women scientists in the field in recent years. In its article "New View of Female Primates Assails Stereotypes--Studies by Women Influencing the Field" the following statements are made:

"We have learned more about primate behavior in the last 10 years than in the previous 10 centuries"; "An explosion of knowledge about monkeys and apes is overturning long-held stereotpyes about sex roles and social patterns among the closest kin to humans in the animal world"; "Dr. Hrdy believes that improved methodology, the broad questioning of sexual stereotypes by the women's liberation movement (influencing scientists of both sexes), and the infusion of female scientists have all contributed to the new understanding of primate societies" (Eckholm, 1984, p. C1).

These examples provide hints of some forms that the reconceptualization of phase IV might take. I think that it is important not to become discouraged because we cannot yet see the exact form that reconceptualization will have. It seems likely that developments towards that form may be embedded in the very work we are doing now; we are quite naturally blind to them since it is difficult to understand the full implications and ramifications of ideas which are currently evolving. The work of Bleier (1984), Fee (1982), and Hein (1981) suggests central ideas to a feminist science may be the rejection of dualisms such as subjectivity/objectivity, rational/feeling, and nature/culture which focus our thinking about the world. Primatologists (Lancaster, 1975) and ecologists (Carson, 1962) have shown us that the concepts of dominance and hierarchy might be replaced by relationship, interdependence, and contextuality as more suitable approaches to viewing complex behavior within and among species on the earth. The work of McClintock as interpreted by Keller (1984) demonstrates the importance of considering multi-causal factors and interactions among those factors rather than a uni-causal, hierarchical theory such as the "Master Molecule" which oversimplifies complicated biological processes in living

organisms.

At this point, I am too constricted by my training, the language of science, and its paradigms to suggest other parameters for the reconceptualization of biology. Based on an examination of what has happened in other disciplines, I am confident that reconceptualization will come which will define a new science. From that reconceptualization may develop the roots of a Phase V: Science Redefined and Reconstructed to Include Us All. Clearly this would mean for the first time that science would be formulated from a perspective other than that of the white, middle and upper class Western males. I can't imagine what that would be like or that it would occur in our life time, but I am sure that it would be a better science. Therefore, I think that it is important to recognize that our current position in the process is likely to be followed by the fundamental theoretical changes for which we are currently hoping and searching.

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