

Has Feminism Changed Science? A Biological Perspective

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The work of feminist scholars has raised awareness of the androcentric nature of science and led to changes in language and the integration of women into the scientific process. However, the very nature of science has remained unchanged to a great extent. While the need to include women and more "feminine" thinking styles into scientific explorations illustrates how deeply entrenched gender bias is, the more critical question remains: should and how can science be stripped from its bias? For feminists to change science, they must promote different or varied styles of inquiry as well as change the metaphors and societal parallels that are used to describe results. The inherent gender bias in a number of fields will be discussed, with the main focus resting on biology. In particular, the scientific description of conception will be analyzed from a feminist perspective.

Science is a tool for understanding the world around us. The American Heritage Dictionary (4th ed.) defines science as "The observation, identification, description, experimental investigation, and theoretical explanation of phenomena." Objectivity in science is thought to produce the best theoretical explanations. According to Evelyn Fox Keller in "Gender and Science," "the central claim of the natural sciences is precisely to a methodology that transcends human particularity, that bears no imprint of individual or collective authorship" (Keller, 71). Yet, an examination of cultural history shows that only males are thought to possess the needed characteristic of objectivity. How can objectivity, then, be a masculine trait when it is defined as being independent of the observer? The solution to this paradox lies in the "extrascientific" forces that shape the definition and path of science (Keller). These forces come from the language, beliefs, and ideas of a society. The focus of feminist inquiry is to critically examine these forces and how they perpetuate scientifically sanctioned gender discrimination.

While feminists are focusing on the effects of these fundamental assumptions in every discipline from philosophy and anthropology to physics and mathematics, nowhere is the investigation more critical than in biology, particularly as it pertains to gender. The idea of gender was developed by feminists in the 1970s to distinguish the biological differences (male and female) and the social or cultural differences (masculine and feminine) between men and women (Keller, Fausto-Sterling). This distinction was the first step towards further research into how these differences are created. Biology, like the rest of science, is influenced by cultural assumptions about gender and, in turn, confirms those assumptions through investigation. In "Dueling Dualisms" Anne Fausto-Sterling writes, "our beliefs about gender affect what kinds of knowledge scientists produce about sex in the first place" (Fausto-Sterling, 3). Through examination of the language and metaphor used in biological research, these beliefs and how they shape research become apparent.

Feminists, realizing the influence of social forces on gender research, seek to change the way people conceptualize gender by changing the politics of science. "Such scholars understand practical, empirical knowledge to be imbued with the social and political issues of its time," according to Fausto-Sterling (Fausto-Sterling, 8). Scientific thought has been shaped by a dualistic world view in which sex opposes gender, nature / nurture, male / female, mind / body, etc. The language of these dualisms leads to an understanding of the world in terms of opposing pairs. Dualisms are so entrenched in our way of thinking that we take them for granted. Yet, by questioning their purpose and past, scholars reveal alternative ways of seeing the world. Feminists such as Fausto-Sterling argue that rather than seeing these pairs as opposites we should recognize their interdependence (Fausto-Sterling, 21). A pertinent example of these dualisms in biology is the characterization, sometimes even personification, of the human egg and sperm.

The process of human conception, the joining of the egg and the sperm, provides an excellent example of the embedded beliefs that influence biology through language and metaphor. Anthropologist Emily Martin notes in "The Egg and the Sperm" that "the picture of the egg and the sperm drawn in popular as well as

scientific accounts relies on stereotypes central to our cultural definitions of male and female" (Martin, 485). Martin's analysis of numerous biology texts and articles shows that the language applied to the egg is "feminine" while the sperm is given "masculine" characteristics. For example, the ovum is always described as being "large and passive" while the sperm are characterized as "active," "streamlined," and "strong" (Martin, 489). Further scientific investigations have made it clear that these descriptions are influenced by cultural dualisms rather than observable data. These underlying beliefs are highly influential in determining the direction of scientific inquiry. In fact, one researcher named Erik H. Erikson in 1964 attempted to establish a direct link between the stereotypical behavior of men and women and the activities of the egg and the sperm (Martin).

The "velocity" and force of sperm has been remarked upon in many books and articles. Yet, because the characterization of sperm as active and forceful fit with the socially influenced scientific expectation, very little research had been directed toward the mechanics of sperm until recently. Research conducted at Johns Hopkins University with basic laboratory technology revealed that the power of the sperm is not nearly as forceful as was originally believed. It is interesting to note that the experiment was conducted using equipment and techniques that have been available for nearly a century (Martin). The results suggest that the egg is equally active in the process of fertilization, allowing the sperm to enter because it is not powerful enough to do so itself. Yet, when this research was described in a journal, the language used the same imagery of the sperm as the "active party who attacks, binds, penetrates, and enters the egg. The only difference was that sperms were now seen as performing these actions weakly" (Martin, 493). Clearly, it is difficult to escape from the notion that the "feminine" egg and the "masculine" sperm are opposites. As a result, even though evidence points toward mutuality and active participation by both cells, the language and thought of the scientists, steeped in social expectations, fails to objectively express the new findings.

Keller writes that during the scientific revolution "definitions of 'masculine' and 'feminine' were becoming polarized in ways that were eminently well suited to the growing division between work and home required by early industrial capitalism" (Keller, 79). Economic pressures contributed to the parallel development of industry and science and the strengthening of gender dualisms. The result was an androcentric approach to science embedded with preconceived notions about gender. As Keller explains, "in accordance with the growing division between masculine and feminine, public and private, work and home, modern science opted for an ever-greater polarization of mind and nature, reason and feeling, objective and subjective" (Keller, 79). A historical perspective of science provides insight into the ways society and science are intimately related. That society is gender biased is reflected in the bias of science. Unfortunately, science serves as justification for further gender discrimination in society.

Personification and metaphor further reveal the bias introduced into research through language. Despite claims to objectivity, these metaphors are used so frequently to describe scientific findings that researchers hardly seem to recognize how they limit their field of vision. Keller notes, "it might be said that the metaphoric structures the natural philosophers of the seventeenth century helped put in place have so permeated our contemporary world that we hardly notice them anymore" (Keller 80). These metaphors used by biologists, male and female alike, appear so basic that those in the field rarely question them. Without an awareness of gendered language, scientists are destined to limit their research and perpetuate false or inaccurate information without even knowing it.

In the case of the egg and the sperm, the metaphor used is similar to a fairy tale. The egg is portrayed as a "damsel in distress" and the sperm as "heroic warrior to the rescue" (Martin, 491). This technique serves to reinforce the idea of a passive egg and an adventurous, powerful sperm. By personifying these cells, avenues of investigation are blocked. For example, if popular scientific opinion held that the egg was uninvolved in sperm selection, then it would be very difficult for a researcher to get funding for such an investigation. Thus, financial resources, often controlled by male-dominated organizations, exert pressures on scientists, determining the course of research.

In "Hidden Choices of Females" Tim Birkhead explains that the scientific community was very slow to recognize evidence "cryptic female choice" (Birkhead). The idea that a female could exert control over which sperm fertilized her ovum after insemination did not fit with the beliefs about the role of the female

because "scientists were still entrenched in a male view of sexual selection" (Birkhead, 79). Curiously, the evidence that scientists ignored or rejected for 60 years is considered obvious in retrospect. As Birkhead comments, "in hindsight, it seems entirely logical that under certain circumstances, females would benefit from being able to control which sperm fertilized their eggs" (Birkhead, 79). This interesting reversal of scientific opinion illustrates the bias that holds back research. If the results were so logical, then why did it take so long to recognize? Clearly, the community's lack of objectivity prevented it from acknowledging evidence about females which had long been accepted as true about males.

The article by Birkhead is interesting as a response to Emily Martin's paper written a decade earlier. The Birkhead article, by describing an active female role in conception, appears to be answering Martin's criticisms. Indeed, Birkhead even admits the social climate was prejudiced, leading to slow acceptance of new ideas about female choice. At a talk he gave about female choice his audience was "titillated by the evolutionary view of sperm competition and openly skeptical of the possibility of cryptic female choice" (Birkhead, 80). Again, we see a lack of support for ideas that do not follow long-held assumptions about gender. Yet, Birkhead goes on to say "recent research has made it abundantly clear that females are not passive participants in sexual reproduction" (Birkhead, 81). While all of these aspects of the article are improvements over the scientific denial of the past, the language used by Birkhead reveals the underlying bias is still present.

Using an analysis technique similar to Martin's, the gendered language becomes apparent. First, the use of the word 'hidden' in the title of the piece follows a convention established when the idea of "cryptic female choice" was first developed. Birkhead explains that "since [female choice] takes place at a microscopic level and inside the female reproductive tract" it is known as "cryptic" (Birkhead, 79). Modern biological research is focused almost exclusively on events at the microscopic level, yet, none of them have the distinction of "cryptic." Spermatogenesis, the production of sperm in the male reproductive tract, is not thought of as cryptic or hidden even though it occurs at a microscopic level and inside the male reproductive tract. Why do events which occur inside a female earn this designation? *The Dynamics of Sex and Gender: A Sociological Perspective* lists a feminine quality as "very sneaky" while the masculine side is described as "very direct." Two conclusions can be reached from this evidence. First, the notion that women are sneaky and secretive has played a large role in this area of reproductive research. Second, researchers name this process cryptic and hidden because they are trying to excuse themselves from failing to understand, recognize, or study this aspect of conception until recently. Consequently, they label it cryptic to emphasize how difficult this field is to study and because they believe that females hide their biological secrets. Both of these conclusions indicate a complete lack of objectivity.

Another pitfall that Martin warns of is a shift towards imagery of female reproductive mechanisms "as a dangerous and aggressive threat" (Martin, 498). This change in language allows the egg a more active role, but still utilizes a cultural stereotype about women. Martin comments that "images of woman as dangerous and aggressive, the femme fatale who victimizes men, are widespread in Western literature and culture" (Martin, 498). In research papers that she analyzes the egg is given a more active role, but is still described in negative terms. In these cases the sperm are "captured and tethered" by the ovum (Martin, 494). When the egg coat is described as "a nuisance, a barrier to sperm and hence an impediment to fertilization" it is easy to see how the gender bias of language clouds scientific thinking (Martin 494).

Some of the language that Birkhead uses in his article contains such negative connotations. On the first page of the paper a quote says, "females may have a chance to be picky about their mates even after the sperm are on their way to meet the egg" (Birkhead, 76). The word 'picky' is defined as "excessively meticulous, fussy" by the American Heritage Dictionary. In addition to having negative connotations, it is also a gendered word more often applied to women than to men. Another adjective synonymous with picky such as judicious, discerning, or selective might have been used instead. In addition, the comment that, "since sperm competition is played out inside the female's body, it may be relatively easy for females to manipulate sperm" (Birkhead, 80). The word manipulate also carries a negative meaning frequently associated with women and associated with the stereotypical trait of sneakiness. Maneuver, finesse, and manage are possible alternatives to the word manipulate. None of these words carry the same negative connotation and convey a sense of ability and strength rather than secrecy and deception.

Finally, Birkhead continually emphasizes the idea of competition between the sexes. This fixation on opposing forces is strikingly similar to the dualisms that Fausto-Sterling and Keller site as the basis for western science. The Birkhead article is based on his book entitled *Promiscuity: An Evolutionary History of Sperm Competition and Sexual Conflict*. Already we can see the focus on sperm and the idea of conflict in the title even though the book is about the co-evolution of both sexes.

This stance is perplexing and appears contradictory. On the one hand, Birkhead claims that "perhaps the most significant discovery in reproductive biology of the past two decades [is] that male and female reproductive attributes coevolve" (Birkhead, 81). Other examples of organisms that evolve together such as flowers and insects are not described in terms of competition. They are seen by biologists as cooperating organisms. Yet, he persists in a dualistic depiction, presenting male and female reproductive cells as "contestants" on the "evolutionary battlefield where sexual conflict occurs" (Birkhead, 81). The confusion in his argument can be seen in the last paragraph of his article where he states that even though "there exists a battle between the sexes... it is not obvious that either sex can ever be a clear winner" (Birkhead, 81). Evolutionarily, it would never make sense for there to be a "winner" if as he states "sexual interactions are part of a coevolutionary process of adaptation and counteradaptation" (Martin, 81). The concept of having a winner in the biological battle of the sexes is absurd considering both sexes need each other for continuation of the species. His argument twists Darwin's idea of competition to fit the new findings concerning female choice. Sexual competition takes place between members of the same sex, not between the sexes. The reason for female choice, as Birkhead describes, is so that the female organism can choose the best male to reproduce with. Therefore, the real battle is between the males to try to pass on their genetic material, not between the sperm and the ovum. The idea of a contest suggest that one side is trying to destroy or defeat the other, yet conception is the creation, the joining of the two so-called "competitors."

It seems that the concept of opposing forces in biology, particularly as they pertain to sex, persists in science today. As the female reproductive physiology is recognized as equally active and important as the male physiology in conception, there is a shift in language, metaphor, and interpretation. Language and metaphor have shifted from descriptions of a passive, uncompetitive, dependent, and needy ovum to an aggressive, competitive, and sneaky egg. Accordingly, because researchers can no longer comfortably assume that the sperm is in control of conception and, therefore, that conception is an act of cooperation, scientists such as Birkhead now see conception as a competition. This reaction appears to be an attempt to prevent science from granting the female control at the expense of the male. The solution is to claim that there is competition as Birkhead concludes, "the battle between the sexes is an evolutionary seesaw - subtle, sophisticated and inevitable" (Birkhead, 81). The point *is* subtle. Why can't the new evidence about female choice indicate that the cooperation is simply more complex than was once imagined? Why do we need this misguided notion of competition between the sexes at a biological level? Again, this is a projection of social expectations and assumptions onto the cellular level.

While Birkhead has made progress on some fronts of scientific writing and the work does reflect a more conscious focus on the capabilities of the female, it contains other assumptions and beliefs that are just as dangerous. That any kind of personification at all is being attributed to these gametes indicates a lack of objectivity in science. Martin warns, "that these stereotypes are now being written in at the level of the cell constitutes a powerful move to make them seem so natural as to be beyond alteration" (Martin, 500). Science and society are historically intertwined. Keller writes, "modern science evolved in, and helped to shape, a particular social and political context" (Keller, 76). However, from a modern perspective, in a time of tremendous scientific achievement, science claims to exist independently of language and society. Ironically, the more successful science is, the more the public trusts its infallibility. The successes of modern science are interpreted as the unimpeachability of the objectivity upon which it rests. The result is that "scientists are probably less reflective of the tacit assumptions that guide their reasoning than any other intellectuals of the modern age" (Keller, 82). Yet, it is only by recognizing and questioning the forces that influence science that we can discover the truth about the world.

Beyond improving the tool of science for the sake of science, raising awareness and enacting change will result in enormous social and political transformation. Only by modifying the way in which people uncover the "facts" about gender, race, and class can humanity hope to achieve equality in these areas. Therefore, it

is critical that inquiring scholars and scientists question the motivations of science and its relationship with society.

Works Cited

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