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Neuroscience, Gender, and a Scientific Career

On January 14, 2005, Larry Summers, then president of Harvard, caused a stir when he suggested that women are underrepresented in science because of familial responsibilities, lack of aptitude, and discrimination in the field, in that order. Reason number two—that women were not as mathematically or scientifically gifted as men—caused the most stir both at the talk and later in the press. The fallout from Summers's comments eventually became so bad (in combination with other controversies) that Summers resigned as president of Harvard in 2006 after a vote of no confidence by the Faculty of Arts and Sciences (Romano). Right or wrong, however, Summers's speech did bring up plenty of questions and theories as to why women seem to be lagging men in the field. Since 2005, numerous studies have been done in order to tease out the underlying cause. In this paper, I will examine some of these studies, most of which look at the brain itself, as well as the effects of popular culture and commonly held beliefs in order to prove that it is society, and not ability, that ultimately holds women back.

In *The Female Brain*, Louann Brizendine, a neuropsychiatrist with degrees from very prestigious schools, takes the stance that differences between the genders were simply "wired" that way since prehistoric times. As she says,

> though we live in the modern urban world, we inhabit bodies built to live in the wild, and each female brain still caries within it the ancient circuitry of her strongest foremothers, engineered for genetic success but retaining the deeply wired instincts developed in response to stress experienced in the ancient wild…Now we have a situation in which women can perceive a few unpaid bills as a stress that appears to be life-threatening. This response impels the female brain to react as though the family were endangered by

> impending catastrophe. The male brain will not have the same perception unless the threat is of immediate, physical danger" (Brizendine, 6).

It is unclear how primal stress is related to unpaid bills, or why male and female brains should react differently to certain stimuli. It seems that Brizendine is implying that men do not feel a stress response towards bills, because they were hunters and so only perceived physical attacks as threats. In contrast, women supposedly overreact to a wider range of threats because of their role as gatherers and caretakers. This implication is silly, since "gatherer" does not seem a reasonable prehistoric parallel to paying bills. I also doubt that a man would not react to a threat towards his children, even if it did not involve physical violence. Without hard scientific evidence, it is also all too easy to fit a convenient explanation to what is currently held to be true. For example, if it were women who reacted more strongly towards physical violence in the present day, it could be argued that because of their smaller size, they needed to know sooner whether they should run away or protect their children from an attack.

Brizendine goes on to mention Summers's comments on male and female aptitude, saying, "Summers was and wasn't right" (Brizendine, 7). She explains that he was incorrect because at younger ages, boys' and girls' math and science abilities are essentially the same. However, she then posits that puberty and hormones have different effects on teenage brains. She argues that estrogen causes females to be more social and spend less time on "solitary" pursuits such as math and science, which offer little opportunity for girls to use their highly developed communication skills. In contrast, boys under the influence of testosterone have less trouble hiding in their rooms, and supposedly learning math and science while they're there. Brizendine, however, still insists that teenage boys' and girls' aptitudes for math and science are the same, even while arguing that girls are hardwired not to pursue it. She attempts to prove her point using anecdotal evidence, in one case describing her 28-year-old patient, Gina. Gina had a knack for

math and science and became an engineer, but found herself unhappy and desiring "a more people-oriented career and one that would allow her to have a family life, too." Gina's sentiments seem to support part of Larry Summers's claims, that women raising a family do not want to work the hard 80-hour weeks that research in the sciences often requires. That would make sense if Gina were attempting to get ahead at a place like a research university, where science's competitive nature puts women with more familial responsibilities at a disadvantage. However, it is more likely that Gina is working in industry, where her hours would be more comparable to a typical nine-to-five job. At the worst, the hours would be similar to those one would face at a law firm or prominent politician's office, both very "people-oriented" workplaces.

Regardless, Gina's wanting to leave engineering for a more people-oriented profession is understandable and apparently common among plenty of smart women in the sciences, according to Brizendine's colleague. Brizendine tries to prove that females are better at communicating, reading tones of voice, and at defusing conflict because of how their brains have been developing since before birth. She describes in detail the differences between the interactions of young boys and young girls on the playground, and tells how she learned at the Yale School of Medicine that the testosterone bath male fetuses receive *in utero* alters their brains so that they have much smaller centers for communication and processing of emotion. She cites statistics proving that baby girls are much more interested in gazing at faces than baby boys, and links this to greater emotional development at a much younger age. However, if women have such an aptitude for people skills, even as toddlers, why is a field like American politics not dominated by women in the same way that the sciences are so male-oriented? The United States has yet to have a female

president, and only 17 current senators are women (several of whom were not actually elected, but appointed to replace their deceased husbands).

It seems that Brizendine neglects much of the "nurture" side of nature-vs.-nurture, and even contributes to it with her book. Socialization as pertaining to women in the sciences means that when a girl is told over and over that boys are better at something like math, she will actually become worse at it. So, when someone like Brizendine, with all her fancy degrees, writes a popular book giving pseudoscientific and anecdotal evidence detailing exactly why women naturally turn away from math, women will turn away. And, since there seem to be perfectly fine reasons why they do, no one will see it as a problem. Of course, other scientists are quick to criticize her work for being factually inaccurate, sensationalist, and relying on exaggerated claims (Liberman, Languagehat). Unfortunately, the public at large—including schoolteachers, parents, and other influential players in a young girl's development—is far more likely to see Brizendine's impressive credentials and implicitly trust her claims. In this way, Brizendine's book becomes self-fulfilling, as more and more girls are told that there is now scientific evidence for their inability to add, so why bother trying.

Who Says a Woman Can't Be Einstein, an article published in Time magazine in the wake of Summers's comments, attempts to examine whether intrinsic differences in male and female brains have an effect on performance in science and math. Scientists have noticed certain anatomical differences between male and female brains—for example, the corpus callosum is generally accepted to be bigger in women than in men, and women's use of their brains seems less localized then men when answering the same questions. However, scientists are still unclear on what those differences may mean in practical terms. In addition, intelligence tests show negligible differences between men and women (Ripley). What is interesting is the work of

psychiatrist Jay Giedd, who has been studying the brains of children as they develop. He found that brain size peaks at about age 11 in girls, three years earlier than in boys. Harriet Hanlon, at Virginia Tech, also found differences in which parts of boys' or girls' brains mature first: for boys, mechanical and spatial reasoning develops four to eight years earlier, while girls' verbal and facial recognition skills mature much faster (Ripley, 3-4). However, it is implied that in fully mature brains, there is negligible difference in performance between males and females, so it appears that the developmental path may not matter.

Of course, even at young ages, the differences in abilities are probably not as drastic as they seem. It is important to remember that scientists must aggregate a lot of data, and in doing so are forced to throw away a lot of information. So, while the "average" boy's mechanical reasoning skills may be better than the "average" girl's, the distributions are likely two bell curves with a lot of overlap. That is to say, a random girl picked from a pool is not unlikely to perform better than a random boy. However, the way findings are generally reported, one would never know that. Even more insidious are books like Brizendine's, which distill the facts even more so that the general public can understand them. Nuances like bell curves disappear, and what remains are sweeping generalizations and anecdotes that are implied to be representative of the entire population, even though most of us are not actually "average." Often, complex scientific reasons why studies are inconclusive are left out, and something which is only conjecture gets carelessly reported as though it were fact.

In fact, something seemingly objective like the relative sizes of the corpus callosum, and what implications size may have at all, is unclear. In *Sexing the Body*, Anne Fausto-Sterling describes many studies on the size of the corpus callosum (henceforth referred to as CC). For a long time, it was generally assumed that the CC had bigger cross-sectional area in women.

Scientists then concluded that this was a reason why women are more likely to involve emotions in their actions, since the logical, rational part of their brain would have more connections to the emotional and feeling part of their brain. However, these findings are dubious because the CC is not a specific lump, but more of a network connecting the two halves of the brain; it is therefore "essentially impossible to define with certainty" and "so complex in its irregular three dimensions as to be unmeasurable" (Fausto-Sterling, 120). Not to mention the difficulty in studying a live brain, as well as the effects pickling and the measuring techniques themselves have on changing the brain tissue as it is being studied. In Fausto-Sterling's meta-analysis of studies on CC sizes, the data are completely inconclusive, as "only a few researchers find absolute sex differences in CC area" (Fausto-Sterling, 130), and another study "of forty-nine different data sets found that men have slightly larger CC's than women…(because men are larger), but no significant gender differences in either absolute or relative size or shape of the CC as a whole" (131-135).

In any case, even if one gender's CC were found to be bigger than the other's, scientists don't have the slightest idea of what that would mean for the ways in which men and women process thoughts, let alone the effect on something as complex as ability in math and science or spatial reasoning. It is interesting that scientists devote so much energy to studying anatomical differences in the brain, without a concrete way to frame what they find besides conjecture. This fascination with size of the CC is eerily similar to study in the past of racial differences in size of the skull, as scientists attempted to prove the white people's superiority. As Ben Barres says in his essay, *Does Gender Matter?*, "I am suspicious when those who are at an advantage proclaim that a disadvantaged group of people is innately less able" (Barres, 134). The very prevalence of so many inconclusive studies implies that what truly appears to be holding women back is not

some innate disadvantage, but rather an external one, caused by the belief that women are in fact intrinsically less gifted in math and the sciences.

It is telling that Larry Summers, a very prominent academic and then-president of one of the most influential universities in the world, made the comments that he did. Nancy Hopkins, an MIT biologist who has fought for women in science and who attended the infamous conference, puts it best: "It is so upsetting that all these brilliant young women [at Harvard] are being led by a man who views them this way" (Bombardieri). Hopkins brings up an excellent point—even if young girls make it past all of the prejudices they face early in life, it seems impossible for women to advance very far in the field of science when other scientists, particularly those in charge of shaping future generations (and in charge of hiring and tenure decisions), hold such degrading views of their abilities.

In fact, Barres, who used to be a woman, faced instances of gender bias as an undergraduate at MIT and beyond. As he remembers, "I was the only person in a large class of nearly all men to solve a hard maths problem, only to be told by the professor that my boyfriend must have solved it for me" (Barres, 134). Perhaps most telling is a comment Barres (who has no sister) overheard after his sex change, when a faculty member said, "Ben Barres gave a great seminar today, but then his work is much better than his sister's" (134). It is certainly telling that a sex change, and nothing else, would have such a sudden impact on how Barres's work was perceived by his peers and mentors. In other cases, people sometimes assume that women are given certain positions or awards over male candidates as overcompensation. Lauren Williams was offered a lectureship position in the math department at Harvard, a heavily male-dominated department, and remembers a male colleague asking, "Why did Harvard hire you? Did they want a girl?" (Lewin I) Eventually Williams left Harvard for Berkeley, possibly frustrated at having to

face her colleagues' lack of confidence in her abilities and the constant stream of questions about why she was there at all.

Women are already a strong force in biology and chemistry, but are only slowly chipping away in math, physics, and engineering. Studies have shown that women must adhere to a much higher standard to even have a chance in science; Barres cites a study in which Swedish scientists rated their peers' perceived "competence." Women across the board were consistently rated less competent than men of comparable scientific productivity (measured in number of publications), and it was found in many cases that they needed to be 2.5 times more productive than their male counterparts in order to be rated "equally competent." With hurdles like that in such a cutthroat field, it is no wonder that women either choose to leave or stay away in the first place, regardless of intrinsic ability. In fact, a different study has shown that being told that men are naturally better at a skill makes men perform better and women worse. In the study, two groups of mixed gender college students of comparable backgrounds and abilities were given a math test. One group was told that men perform better on the test, while the other was told that both genders perform equally. In the first group, the men had an average score of five times the women's, while the second group showed a much narrower margin (Lewin II). Once again, remarks like those of Larry Summers prove to be dangerously self-fulfilling.

Obviously, women have a long way to go in order to overcome the biases they face and achieve equal footing in science. Perhaps with new advances in neuroscience, people can gradually reach a better understanding of the differences between male and female brains and how they develop, in order to keep boys and girls on equal footing. Hopefully, every time someone like Larry Summers makes bigoted comments, enough people will question him, uncover new biases, and stomp them out. It is also important to educate the public on scientific

methods and uncertainty so that books like *The Female Brain* are met with much more skepticism and do as little damage as possible. Still, it is heartening that women are making it to the higher ranks in academia, albeit slowly. Gradually, as processes for awarding research grants and professorships become more gender-blind, more support is put in place for working mothers, and girls and boys are treated equally in the classroom, women will be able to break out from under the glass ceiling and realize their full potential in the sciences.

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