

Editorial Comment

Men, Women, and Brains: What's Hardwired, What's Learned, and What's Controversial

Poor Lawrence Summers. The beleaguered president of Harvard University created a ruckus in January that has still not subsided: he suggested that the reason why there are so few women on the science and math faculties at Harvard (and presumably at other institutions like it) is because women simply don't have the innate ability that men do to excel at those disciplines. In a recent development in March, the Faculty of Arts and Sciences at Harvard registered its distress by passing a vote of no confidence in Dr. Summers' leadership. So far he's escaped dismissal, but one wonders how much longer he'll actually survive at Harvard. Had Dr. Summers spoken with me before making his opinion known, I could have warned him that even raising the subject of the differences between the sexes has to be done very carefully—much less asserting that those differences are in competence!

Despite the personal cost to Harvard's president, nothing could have been healthier for the new science of gender-specific medicine than the flurry of discussion his remarks provoked. TV pundits and experts on every op-ed page in the nation had something to say. Books on the differences between male and female abilities and behavior were rushed into stores, and even CNN's news anchors Paula Zahn and Anderson Cooper hosted a series on the subject of the differences between the sexes. In the midst of these events, I couldn't help but recall discussing the name of our new program at Columbia University 8 years ago. When I suggested calling the program "The Partnership for Gender-Specific Medicine," the universal response was, "No one ever heard of gender-specific medicine, no one will even know what the words mean." How times have changed! Since we first began to study women in detail, we have uncovered countless ways in which men and women differ. We've put the "bikini view" of women, which concentrated only on their breasts and reproductive organs and assumed that everything else was exactly as it was in men, behind us forever.

Very few disciplines are more exciting—or relevant to the practice of medicine today—than the science delineating the sex-specific features of every part of the body. Even the composition and behavior of the X and Y chromosomes are a focus of intense interest, and the resultant findings are proving to be a treasure trove of unanticipated information. We are, in fact, stunningly and unexpectedly different. According to William Byne, associate professor of psychiatry and director of the Neuroanatomy Laboratory at Mt. Sinai School of Medicine, women have as many as 130 more active genes per cell than men!¹ In short, as the Institute of Medicine's blue-ribbon committee on gender medicine reminds us, "Sex does matter. It matters in ways that we did not expect. Undoubtedly, it also matters in ways that we have not begun to imagine."²

Saying that the ingredients and flow rates of our saliva differ as a function of sex is politically neutral; no one is going to be outraged by the fact that the salivary flow rates of males are higher and the sugar content lower than that of their female counterparts. But to point out the many sex-specific differences in brain anatomy and chemistry and in the systems involved in cognition is a different story. And to hypothesize that we are not equally gifted or that we at least excel at different things—and to say so—is the equivalent of loping across a minefield and expecting to reach the other side without incident. Despite the dangers of traveling this path, many institutions are investing huge sums of money and effort into expanding the whole realm of neurobiology—my own university, for one.

The new science of gender-specific medicine has been compared to the California gold rush: simply walking across a field in areas rich with the mineral is akin to what we are doing, finding with very little effort fabulously interesting nuggets of information at every turn. Proving what these new

discoveries imply, though, is the difficult part of the research. For example, scientists are examining the living human brain at the moment of a specific intellectual activity in real time. They use functional MRI and the PET scan to immediately and accurately identify what areas of the brain are supplied with increased blood flow during that activity. The fact is, the *size* of the area to which blood flow increases in the brain may not correlate with the *ability* to perform the task. Noting that blood flow increases to specific parts of the brain in response to a request to perform a task doesn't mean other areas of the brain aren't also involved in completing it. Perhaps the most difficult issue is to decide what about our brains is different because of the sex-specific interplay between our genes and hormones and the impact of our experiences on brain structure and function. Eric Kandel's Nobel Prize-winning work in neuroscience proved that the structure of the brain is not fixed, but that *experience actually modifies its anatomy and neurochemistry*. He often remarks in his lectures that listeners will not leave the auditorium with the same brains with which they came in!

As fascinating as it is to unfold how we process information from the world around us, a few obvious questions arise when we try to correlate the findings with how well men and women accomplish the same tasks: How does sex-specific behavior influence our abilities? What in particular about who we are and how we behave is hardwired into our brains? How do the experiences we have during the course of our lives affect us?

Starting in the womb and for the length of our lives, we receive information into sex-specific brains that differ in anatomy, neurotransmitter concentration, and distribution blood flow. Indeed, pioneering research by Sally Shaywitz at Yale University, the Gurs at the University of Pennsylvania, and Bruce McEwen at Rockefeller University suggests that the very systems we use to produce ideas, to create memories, to conceptualize and internalize our experiences, and to solve problems are different for men and women. But others, like William Byne,

point out that "the statistical differences between men and women in the distribution of brain activity while performing a particular task could reflect either a sex difference (eg, a difference in brain organization orchestrated by genetic and hormonal factors) or a gender difference (eg, a difference in socially acquired problem-solving strategies and thus a difference in the brain circuits activated by the particular task)."¹

Byne gives us this further caveat: "...I share the belief that understanding the differences between genders is essential to the advancement of human health. At the same time I am aware that gender differences—particularly in the brain—have been exploited in the past to rationalize and to perpetuate gender inequities in society. The past should not limit ethical research into gender differences; however, we must not forget the past, lest we repeat it."¹

What Dr. Summers might have more accurately expressed is that when vast numbers of people are tested, there are well-documented differences in some abilities between the sexes.³ He should also have mentioned that individual women excel at math and science (for example, in 1903 Marie Curie was the first woman to win a Nobel Prize [in physics], and in fact, she won a second Nobel in chemistry in 1911), and that individual men have verbal abilities equal or superior to those of the general female population. To me, one of the most intriguing possibilities is that as men and women are offered the same educational and vocational opportunities, their intellectual equipment and abilities will become more similar. After all, Kandel has shown us that the brain literally changes as a result of experience, which explains our ability to learn new skills, perfect rudimentary ones, and create memories that modify our behavior. Put another way, brain sex may not be as fixed as we think it is.

We can all agree that the newest findings document the marvelous and unexpected variety of sex-specific characteristics of humans. Understanding how these differences came to exist and what impact they have on human behavior, though, is another and, in many ways, much

greater challenge. Whatever our emotional response to the new findings, it's impossible to look at the latest science without being amazed by its possible implications. For example, using the new information, we may be able to decide whether schools should be teaching boys and girls in the same way and in the same classes, how and why puberty affects self-image, and why aging impacts husbands and wives quite differently, with important implications for continuing marital harmony. Politicians and merchants want to know if they should be communicating differently to men and women, and others wonder if they will soon be able to test the efficacy of their messages by monitoring what goes on in the brains of their audience!

So much that's new is threatening to old ideas and entrenched systems. Because of the outraged response of his Viennese colleagues, Freud had to retract his assertion that incest and the sexual abuse of children were commonplace. Charles Darwin's ideas are still a forbidden subject in some of the fundamentalist communities of our country. But more rapidly than I thought would happen, we've reached what best-selling

author Malcolm Gladwell calls a "tipping point." The idea that men and women are more marvelously and unexpectedly different than we ever suspected has certainly taken hold, and we are irreversibly embarked on one of the most exciting explorations in modern biology.

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