

# Pink Brain, Blue Brain

*How Small Differences Grow  
into Troublesome Gaps—  
and What We Can Do About It*

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## *Introduction*

YOU'RE FINALLY GETTING to know the new neighbors. They moved in a week ago, but you've had no chance to chat, which is surely why you didn't notice sooner that the woman is pregnant. Very pregnant, by the looks of it.

"How wonderful!" you croon over your common fence. "Do you know if you're having a boy or girl?"

Why is this always the first question we ask when learning about a new baby? The answer is simple: because sex is a big deal. Not just the act of it, but the fact of it. Of all the characteristics a child brings into the world, being male or female still has the greatest impact—on future relationships, personality, skills, career, hobbies, health, and even the kind of parent the child is likely to become. That's why 68 percent of expectant parents learn the sex of their child before birth and why you know your neighbor is naive to answer, "We really don't care, as long as the baby is healthy!"

Most American parents hope to have at least one child of each sex. We enjoy the differences between them, even as we worry about their consequences. Will this little boy, now so active and exuberantly affectionate, settle down enough to begin school? Will he form meaningful relationships with his friends and teachers? Will he still express his feelings or, for that matter, communicate with us at all when he grows up?

For parents of girls, the fears run in the opposite direction. Here she is, so confident and full of life. Will she still dig for worms and wonder

about the planets when she's in middle school? Will she be assertive enough when she lands her first job out of college? Will it be any easier for her generation to juggle career and family when she grows up?

Boys and girls are different. This fact, obvious to every previous generation, comes as a bewildering revelation to many parents today. Raised in an era of equal rights, we assume—or at least hope—that differences between the sexes are made, not inborn. We mingle comfortably with members of the opposite sex, harangue as easily about sports as cooking, and cheerfully compete in the workplace—all the while pretending the two sexes are more or less the same.

Until we have kids of our own, at which point the differences are impossible to ignore.

Like many parents, I could cite endless examples of the differences between our daughter and two sons: Julia loves shopping, while Sam and Toby can barely be persuaded to try on jeans at the mall. Then there was the evening not so long ago that Julia spent drawing pictures of fairies while Sam and Toby raced around the house having a light-saber battle. Even as a young toddler, Julia would lay all our kitchen towels on the floor and then put a stuffed animal on each one for “nappy time.” The only thing that absorbed Sam and Toby as much at that age was seeing how many objects they could jam inside a VCR.

Also, like other parents today, I feel compelled to excuse this gender-typical play with the obligatory “We certainly didn’t encourage Julia to play only with girl toys and Sam and Toby to play only with boy toys.” On the contrary, many of our kids’ building toys—the wooden blocks, Duplos, and Lincoln Logs—were originally purchased for Julia, our oldest child. I try to make a point of praising the boys’ nurturing behavior—like when Sam hugs Toby or cuddles his pet gerbil—and never stand in the way of their attempts to help me cook.

Of course, parents are never truly neutral about gender. Regardless of which toys or clothes we buy them, we cannot help but react in different ways to our sons and daughters—if only because of our own long experience of “male” and “female.” But still, I had thought our kids would be different. As a neuroscientist and Martha Stewart dropout, I am hardly the typical female role model. My husband, also a scientist, fits the male type in many ways (he can fix almost anything around the house—as long as it doesn’t interfere with *Monday Night Football*) but is kinder and gentler than many of the women I know.

And yet, there they are: Julia quietly makes paper flowers or sets up her Playmobil house while Sammy launches cars off his Hot Wheels track or begs me to pitch Wiffle balls to him outside. Even little Toby, with his clear, high-pitched voice, started steering the boy course early, judging from his toddler fascination with trucks, airplanes, balls, and any kind of electrical appliance.

Yes, boys and girls are different. They have different interests, activity levels, sensory thresholds, physical strengths, emotional reactions, relational styles, attention spans, and intellectual aptitudes. The differences are not huge and, in many cases, are far smaller than the gaps that separate adult men and women. Little boys still cry, little girls kick and shove. But boy-girl differences do add up, leading to some of the more alarming statistics that shape the way we think about raising our children.

Here’s a stark one: Boys are at greater risk than girls for most of the major learning and developmental disorders—as much as four times more likely to suffer from autism, attention deficit disorder, and dyslexia. Girls, for their part, are at least twice as likely as boys to suffer from depression, anxiety, and eating disorders. Boys are 73 percent more likely to die in accidents and more than twice as likely to be the victims of violent crimes (other than sexual assault). Girls are twice as likely as boys to attempt suicide, but boys are three times likelier to succeed at it.

On the academic side, girls of all ages get better grades than boys. Women now constitute the majority of U.S. college students—a startling 57 percent. And yet males continue to score some twenty-five points higher on the SAT exam and outnumber females four to one in college engineering degrees. In spite of their educational gains, women earn less than eighty cents for every dollar earned by men.

Sex\* matters. As much as we may strive to treat them equally, boys

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\* I use the term *sex* instead of *gender* because it is more scientifically correct even if it’s less politically so. *Sex* is a biological attribute, defined by chromosomes and anatomic characteristics. It is a binary, either/or trait. *Gender*, by contrast, is a social construct, the sum of all the attributes typically associated with one sex. It is not fixed and binary but a fluid spectrum between masculinity and femininity. For instance, a person wearing a curly white wig would be considered feminine today but wouldn’t have been in George Washington’s era. While the behavioral traits in this book are properly referred to as *gender-typical*, all of the research has divided subjects according to their biological maleness or femaleness—in other words, by sex—and so this is the term I usually favor.

and girls have different strengths and weaknesses and face very different challenges while growing up. Boys are more vulnerable early in life: they mature more slowly, get sick more often, and are less likely to have mastered the language, self-control, and fine motor skills necessary for a successful start in school. In recent years, as academic expectations have intensified, boys' slower start is stretching into a significant handicap even into the middle-school and high-school years, where they trail girls in graduation rates, academic performance, and extracurricular leadership positions.

Girls pull through the early years more easily than boys, hitting their vulnerable phase around puberty, when their confidence slips, their math and science interests wane, and young womanhood comes to be defined by beauty and submissiveness. Then, after girls navigate the minefield of adolescence, they face even greater challenges out in the real world, where they struggle with the contradictions of ambition and femininity and the conflicting values of the workplace and child rearing.

These differences between the sexes have real consequences and create enormous challenges for parents. How can we support both our sons and daughters, protect them, and still treat them fairly when their needs are so very different?

I study the brain and believe we can't even hope to tackle these issues until we know where the differences come from. What is going on inside boys' and girls' heads that triggers such different interests, emotional reactions, and mental abilities? Are male and female brains fundamentally different from each other? Are boys and girls wired differently from birth?

When I set out to answer these questions, I figured it would be simple: just dig up the studies that compare boys' and girls' brains and link any differences between the two sexes to their emerging verbal, emotional, math, and other skills. In this way, I would be able to paint a clear picture for readers of how the brain develops in pink and in blue.

As a biologist, I know that the different hormones boys and girls are exposed to before birth can exert powerful effects on their later behavior. The receptors for such hormones are present in children's brains from an early age, where presumably they act—along with a handful of sex-specific genes—to shape the neural circuits that eventually underlie these boy-girl differences.

But what I found, after an exhaustive search, was surprisingly little solid evidence of sex differences in children's brains. Sure, there are studies that do find differences, but when I looked closely at all the data—not just the research that confirms what we already know about boys' and girls' behavior but a truly balanced collection of findings—I had to admit that only two facts have been reliably proven.

One is that boys' brains are larger than girls'; somewhere between 8 and 11 percent larger, depending on the study. This difference is present throughout life and can be a source of humor or defensiveness (depending on your sex), but it's conspicuously similar in magnitude to males' greater height and weight at birth and in adulthood.

The second reliable fact is the difference that shows up around the onset of puberty: girls' brains finish growing about one to two years earlier than boys'. Again, this mirrors the overall sex difference in children's physical growth, since girls also enter puberty a year or two before boys do.

I suppose one could weave all kinds of theories about how having a bigger brain makes boys more active, physically aggressive, and skilled at spatial and mechanical tasks. It's harder to figure out how having a smaller brain explains females' verbal and interpersonal advantages. The fact that girls' brain size peaks earlier than boys' does suggest some overall faster program of maturation. But there is precious little evidence to support this from electroencephalography (EEG) or any other measures of actual brain activity.

The reality, judging by current research, is that the brains of boys and girls are more similar than their well-described behavioral differences would indicate. Certainly, there are some data showing subtle sex differences in children's sensory processing, memory and language circuits, frontal-lobe development, and overall neural speed and efficiency. Throughout the book, I will evaluate such findings and explain their implications for children's behavior. But overall, boys' and girls' brains are remarkably alike. Just as boys' and girls' bodies start out more androgynous than they end up in adulthood, their brains appear to be less sexually differentiated than adult men's and women's.

This doesn't mean, however, that neuroscience can't teach us something about sex differences in children. It can teach us plenty. To see that, we must turn to another branch of brain science, a newer area that happens to be where my own research is focused.

It is the study of *plasticity*, an admittedly ugly term used to describe the very beautiful fact that the brain actually changes in response to its own experience. Just as petroleum-based plastics can be molded into endless varieties of grocery bags, milk jugs, pipe fittings, playground equipment, and more, so are our brains fantastically capable of modifying themselves to the jobs at hand. Every physical feature of the human nervous system—the brain cells, or neurons, that transmit information; their axons and dendrites that reach great distances to connect with one other; the tiny synapses that are the actual sites of connection; and the supporting cells, or glia, that keep it all going metabolically—responds to life experiences and is continually remodeled to adapt to them. The brain changes when you learn to walk and talk; the brain changes when you store a new memory; the brain changes when you figure out if you're a boy or a girl; the brain changes when you fall in love or plunge into depression; the brain changes when you become a parent.

Plasticity is the basis of all learning as well as the best hope for recovery after a brain injury. And in childhood, the brain is far more plastic, or malleable, than it is at any later stage of life—wiring itself in large measure according to the experiences in which it is immersed from prenatal life through adolescence.

Simply put, your brain is what you do with it. Every task you spend time on—reading, running, laughing, calculating, debating, watching TV, folding laundry, mowing grass, singing, crying, kissing, and so on—reinforces active brain circuits at the expense of other inactive ones. Learning and practice rewire the human brain, and considering the very different ways boys and girls spend their time while growing up, as well as the special potency of early experience in molding neuronal connections, it would be shocking if the two sexes' brains *didn't* work differently by the time they were adults.

So it's all biology, whether the cause is nature or nurture. Sex differences in behavior *must* be reflected as sex differences in the brain, but the older children are, the less confidently their differences can be ascribed exclusively to genes and hormones. There are, to be sure, a few truly innate differences between the sexes—in maturation rate, sensory processing, activity level, fussiness, and (yes!) play interests—which I will describe in detail in the next few chapters.

However, the male-female differences that have the most impact—cognitive skills, such as speaking, reading, math, and mechanical ability; and

interpersonal skills, such as aggression, empathy, risk taking, and competitiveness—are heavily shaped by learning. Yes, they germinate from basic instincts and initial biases in brain function, but each of these traits is massively amplified by the different sorts of practice, role models, and reinforcement that boys and girls are exposed to from birth onward.

Scientists themselves no longer pit nature and nurture against each other as distinct, warring entities but appreciate that they are intricately interwoven. Obviously, boys and girls come into the world with a smattering of different genes and hormones. But actually growing a boy from those XY cells or a girl from XX cells requires constant interaction with the environment, which begins in the prenatal soup and continues through all the dance recitals, baseball games, middle-school science classes, and cafeteria dramas that ceaselessly reinforce our gender-divided society.

Biologists refer to this interaction as *epigenetic*—the environment acting on or through our genes—and every human attribute is shaped in this way. Height, for example, is strongly determined by genes, and yet no matter the genetic potential, a child cannot grow tall if he or she is undernourished. Weight is another example that's strongly biased by genes but ultimately determined by a child's diet, eating habits, and environment (which is now, in many parts of the world, absurdly calorie-laden). Mental traits are even less heritable than height and weight—typically around 50 percent for most measures of intelligence and personality—but this genetic potential too is meaningless outside of the environment in which it develops.

Consider language, our most distinctly human ability. Every healthy child is born with special areas, usually in the brain's left hemisphere, that give him or her the innate capacity to understand and produce speech. But actually molding these areas into a full-fledged linguistic circuit depends on language itself—on a baby hearing literally millions of words in meaningful contexts throughout the first few years of life. We know this because children who are born deaf suffer permanent language deficits if their deprivation lasts beyond the first several years. The areas of the brain that are innately biased for language simply do not develop into this circuit in the absence of normal language experience.

Deafness is the most extreme example, but the power of experience is evident in all children, whose native languages and dialects reflect the wiring of their brains in response to the precise languages they're

reared in. That's why a baby can be adopted halfway around the globe from where he or she was born and grow up sounding just like his or her adoptive community. We call this early learning phase the critical period, and it begins at birth and ends around puberty. Adults can learn new languages, of course, but it is hard, hard work—nothing like the effortless, instinctive learning that takes place in early childhood—and the results are nearly always less than perfect.

Growing up as a boy or girl is a lot like being immersed in one of two different languages from birth. Boys' and girls' brains are not identical from the start—the few extra genes on a boy's Y chromosome\* harness a cascade that clearly influences later behavior and, presumably, underlying brain structure. But fully developing the mental characteristics known as male and female also depends on each child's automatic immersion into either the male or female culture, each one as powerful as the lullabies we sing and the nourishment we provide.

Admittedly, this is not the story parents have been hearing in recent years. If you've read anything about boy-girl differences, you're probably become convinced that scientists have discovered all kinds of disparities in brain structure, function, and neurochemistry—that girls' brains are wired for communication and boys' for aggression; that they have different amounts of serotonin and oxytocin circulating in their heads; that boys do math using the hippocampus while girls use the cerebral cortex; that girls are left-brain dominant while boys are right-brain dominant.

These claims have spread like wildfire, but there are problems with every one. Some are blatantly false, plucked out of thin air because they sound about right. Others are cherry-picked from single studies or extrapolated from rodent research without any effort to critically evaluate all the data, account for conflicting studies, or even state that the results have never been confirmed in humans. And yet such claims are nearly always presented to parents, with great authority, as well-proven and dramatic facts about boys' and girls' brains, with seemingly dire implications.

For now, I want to point out one particularly insidious way in which

\* The human Y chromosome (by far the smallest of the forty-six chromosomes) contains about sixty genes; compare this to the approximately eight hundred genes on the X chromosome and some twenty-five thousand in the total genome. This means that males and females share roughly 99.8 percent of their genes.

neuroscience has been misused: this is the idea that the brain's sex differences—most of which have been demonstrated in adults only—are necessarily innate. Ignoring the fundamental plasticity by which the brain learns anything, several popular authors confuse *brain* with *nature*, promoting the view that differences between the sexes are fixed, hard-wired, and predetermined biological facts.

Psychologist Michael Gurian is perhaps the most prominent of those stressing the nature side as being responsible for boys' and girls' different troubles. Much the same tack is taken by physician Leonard Sax, who trumpets "biologically programmed" differences in his book *Why Gender Matters*. And consider this from psychiatrist Louann Brizendine in her recent book *The Female Brain*:

The female brain has tremendous unique aptitudes—outstanding verbal agility, the ability to connect deeply in friendship, a nearly psychic capacity to read faces and tone of voice for emotions and states of mind, and the ability to defuse conflict. All of this is hardwired into the brains of women. These are the talents women are born with that many men, frankly, are not.

All I can say is "Thank goodness I'm a woman!"

No question, the tide has turned: sex differences in behavior are widely known and well accepted. We no longer pretend that men and women, boys and girls are fundamentally the same. And somehow—reflecting our current infatuation with genetics, as well as the convenient fact that neither sex appears globally smarter than the other—we have become comfortable with attributing these differences to innate, inborn, intrinsic, or hard-wired causes.

But how did we get from accepting the different strengths and weaknesses of each sex to assuming these differences are fixed by nature?

The answer lies in a fundamental misunderstanding of biology. Yes, men and women are different. Yes, their brains are different. (They pretty much have to be, if you take the modern scientific view that the brain is responsible for all thoughts and feelings.) But—and this is the point lost on most popular interpretations of neuroscience—nearly all of the evidence for sex differences in the brain comes from studies of *adult* men and women. Who's to say that such differences are caused by nature and not by learning—by the thirty or so years of experience as a

male or female that any research subject invariably carries into the MRI scanner?

Sex differences in the brain are sexy. You can hardly pick up your favorite newsweekly without coming across some reference to this research. It gives an easy explanation for the bewildering Mars/Venus gaps we find so amusing: why men can't multitask and women can't read maps; why men love *The Three Stooges* and women have their chick flicks. So anytime researchers put a bunch of men and women in MRI machines and find some difference between their brains, we say, "Aha!"—as if that explains everything.

But there are some serious problems with the research on sex differences in adults and many more when this research is extended to children. One problem is what statisticians call the file-drawer effect—the fact that a study finding a statistically significant *difference* between men and women is simply more interesting and, therefore, more likely to be published than a study finding *no difference* (leaving the more boring no-difference result to languish in researchers' file drawers).

Another problem, which is also due to the sexy nature of this research, is that such data rarely get verified before they hit the media. Take one claim that has been widely reported in the popular literature: that the corpus callosum, the major fiber bundle that connects the two sides of the brain, is proportionally larger in women than men. This finding was first published in 1982 in the prestigious journal *Science*, even though it was a tiny study based on five female and nine male brains. No matter. TV talk show host Phil Donahue soon proclaimed it the basis for "women's intuition," a remark echoed in both *Time* and *Newsweek* magazines.

What the news media has not reported, however, is the conclusion of an authoritative 1997 review of fifty such studies, which collectively found no significant sex differences in the corpus callosum of adults. Nor have more recent studies detected any difference between the corpus callosum of boys and girls or between male and female fetuses. The point is: real data don't matter if educators and psychologists can find some nugget somewhere that confirms their preexisting theories. So you can still find Michael Gurian and Leonard Sax talking about the corpus callosum in relation to differences between boys' and girls' learning. For the record: the corpus callosum does *not* differ between boys and girls in any meaningful, statistically significant way.

Also for the record: there is a lot of good research on sex differences in the adult brain—research that has been replicated in different labs around the globe and that may have important implications, especially for treating diseases like depression, ADHD, Alzheimer's, schizophrenia, and drug addiction.

But when it comes to differences between boys and girls, and even most psychological gaps between men and women, the fact is that the gaps are much smaller than commonly believed and far from understood at the level of the brain or neurochemistry.

I promise I won't get too technical in this book, but there is one statistic we cannot avoid if we're really going to tackle this thorny topic. It's called, simply, *d*, for "difference value." You calculate it by subtracting the mean score of females on a given test from the mean score of males and then dividing the result by the standard deviation of both groups (which is basically a measure of the overall spread of abilities, or the width of the curve).

The *d* values range from small positive to small negative numbers: *d* is positive for traits or skills at which males outscore females, and *d* is negative for traits or skills at which females outscore males (a convention that may strike females as offensive). Also by convention, differences are considered small when the *d* value is around 0.2 (either positive or negative), medium when the *d* value is around 0.5, and large when the *d* value is 0.8 or higher.

So how big are the behavioral and psychological differences between males and females? Much smaller, it turns out, than our physical differences are and, notably, quite small compared to the range of performance *within each sex*.

On page 12, for example, are graphs showing the distribution of measures for two traits, one with a *d* value of 2.6, and one with a *d* value of 0.35. The curves on the left show the difference between the sexes in adult height, a gap that is considered very large because the six-inch difference between men's average height (5 feet 10 inches) and women's average height (5 feet 4 inches) is considerably greater than the 2.3-inch standard deviation that describes the spread of each curve.\*

\* In a normal-distribution, or symmetrical, bell curve, the mean, or average, is at the top and middle of the curve, and the standard deviation includes about two-thirds of the population, split evenly on either side of the mean.

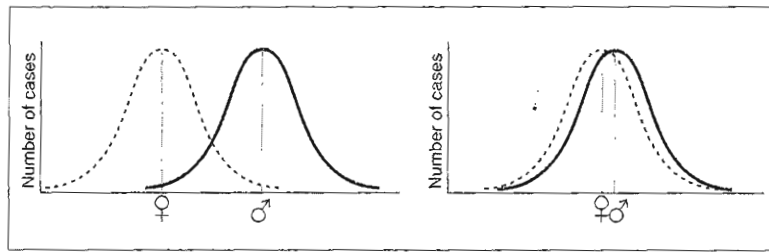


Figure 0.1. Distribution of performance for two traits that differ with  $d$  values of 2.6 and 0.35, respectively. Females are represented by the dashed curve, males by the solid curve. Mean score for each sex is shown by the vertical line at the middle of the curve. The graph on the left shows the sex difference in adult height, which is considered very large and for which there is little overlap between men and women. The graph on the right shows the distribution for a sex difference with a  $d$  score of 0.35, which is actually on the large side for many psychological differences. Note that the curves overlap extensively. Of the many psychological sex differences that have been repeatedly measured, 77 percent are smaller than the difference between the curves on the right.

A very large difference like height is obvious, noticeable, and has predictive value. If I told you that a relative of mine is six feet tall, you'd likely guess that that person is male, and you'd be correct. (My brother and dad are both this height, though come to think of it, I had an aunt who was also six feet tall.) There is not much overlap between the curves of male adult height and female adult height, even though we all somehow manage to drive the same cars and sleep in the same beds.

Now consider the curves on the right, which show a small-to-moderate difference. The  $d$  value of 0.35 in this graph is close to what's seen in measurements of sex differences on standardized science-test scores or (if the male-female curves were swapped) in evaluations of verbal fluency (that is, the speed and accuracy of speech). The curves obviously overlap through most (76 percent) of their range, and the difference between average males and average females is small compared to the ability range within each sex. This means that, in spite of our group differences, plenty of women are better than the average man at science, math, and asserting their opinions, while loads of men outperform the average woman at speaking, reading, and deciphering other people's feelings. More important, the wide range within each sex and the substantial overlap between sexes mean that you can never use these data to make

predictions about individuals—that Johnny will have trouble learning to read or controlling himself in the classroom, or that Susie will struggle with fractions or is too timid to play hockey.

According to Janet Hyde, a psychologist at the University of Wisconsin who's dedicated her career to quantifying the various differences between the sexes, only a limited number of sex differences even make it out of the small range. Out of 124 extensively analyzed psychological traits that show differences between men and women—from self-esteem and moral reasoning to aggression, throwing ability, sex drive, and all types of academic skill—96 were in the small-difference range, with  $d$  values of less than 0.35. Dr. Hyde titled her article "The Gender Similarities Hypothesis" to emphasize the fact that for most psychological traits, sex differences are quite small, and, fundamentally, men and women are more similar than different.

Or as others have succinctly put it: "Men are from North Dakota, women are from South Dakota."

There's no question that small differences can add up, especially at the extreme ends of the curve, where there is much less overlap between the sexes. This distribution helps explain why issues like dyslexia, ADHD, and anxiety disorders affect one or the other sex more profoundly. And at the other end of the curve, it may also explain why so few women make it into the most elite ranks of mathematics and science, an argument former Harvard president Larry Summers famously put forth to explain the limited number of women professors in these fields.

But the problem with focusing on extremes—and the reason Dr. Summers ran into trouble for invoking them—is that it gives a warped sense of the typical differences between the vast majority of boys and girls, and men and women. Sex differences between the *mean* male and female are nowhere near as great as those between the *extremes*, but it's only the extremes that make headlines—an all-girls list of top-ranking students or an all-boys math team or special-education class. These are the noticeable differences that set people off and fuel the idea that children's abilities are limited from the outset by the X or Y chromosomes they inherit.

In other words, focusing on extremes leads to stereotyping. Our big, magnificent human brains love to find categories in the world, and so anytime people see a difference, especially one as emotionally significant as sex, we tend to exaggerate it.

Stereotyping harms both sexes, though women have traditionally been the ones more wary of it. I remember well at the beginning of my own scientific career, during a seminar about the effects of sex hormones on brain cells, some prominent scientists stood up to protest the findings as “dangerous” and “pointless,” given their potential for misuse. Just imagine, the argument continued, what would happen if neuroscientists started publishing articles about differences between the brains of blacks and whites.

But the tide has turned dramatically in the last twenty years, ironically because of the new focus on women’s intellectual strengths: the verbal and relational skills that Louann Brizendine boasts about and which most people agree balance the spatial and analytical strengths of men. When you put these together, it’s clear neither sex beats the other. So what’s all the fuss?

The downside of this emphasis on difference equality has been a brand-new wave of stereotyping, fueled by the careless proselytizing of Brizendine, Gurian, Sax, and others. The true, small size of the differences are ignored, replaced in our categorizing minds with large Mars/Venus chasms, which parents and teachers accept as facts and believe they can do nothing about.

Unlike a generation ago, when parents actually worried about stereotyping their children, the new focus on nature seems to be encouraging parents to indulge sex differences even more avidly. Boys and girls are identified in utero and the nurseries painted to match months before birth. From girls’ preschool ballet lessons and makeovers to boys’ peewee football, hockey, and baseball leagues, our world is in many ways more gender divided than ever. The more we parents hear about hard-wiring and biological programming, the less we bother tempering our pink or blue fantasies, and start attributing every skill or deficit to innate sex differences. Your son’s a late talker? Don’t worry, he’s a boy. Your daughter is struggling with math? It’s okay, she’s very artistic.

Even teachers are now preaching the gospel of sex differences, goaded on by bad in-service seminars, by so-called brain-based learning theories, and, perhaps, by the chance to excuse their own lack of success with one or the other gender, usually boys.

And fueling it further is the massive pink-versus-blue (or make that pink-versus-Nintendo-black) marketing of dolls with ever thinner waists and action figures with ever broader shoulders. While some parents still fight valiantly to avoid stereotyping, the larger culture has embraced it

with a vengeance. In today’s hypermarketed world, what niche is easier to exploit than male or female? We now have magazines, movies, and even entire TV networks dedicated exclusively to men or to women, slicing the culture into ever more gender-segregated pieces. And kids, our most naive consumers, eat it up. They have their own endless TV shows, DVDs, and websites—a round-the-clock indoctrination into the world of brave, cheeky boys and cute, squeaky girls well before they even start kindergarten.

Even today’s college students embrace the differences more than the students of a generation ago. For twenty-five years, sociologist Lloyd Lupton has administered the same survey about sex roles to his classes at the University of Akron. In spite of the dramatic changes in women’s achievement over this period, college students today actually perceive *greater* differences between men and women than students did in the 1970s, especially when it comes to the labels “sympathetic,” “talkative,” “responsible,” “friendly,” and “affectionate.” And although women are arguably more athletic and ambitious than a generation ago, college-age men grant them only greater “decisiveness” while viewing themselves as more “aggressive,” “adventurous,” and “self-confident” than male college students rated themselves in the 1970s. So even though objective measures—such as math scores, sports participation, and graduate-school enrollment—show that many differences between the sexes have decreased over the past several decades, society’s beliefs about male-female differences have actually become more exaggerated.

We love this stuff. It’s fun to be different. It makes romance more exciting and provides endless fodder for late-night comedians. *But there’s enormous danger in this exaggeration of sex differences*, first and foremost in the expectations it creates among parents, teachers, and children themselves. Kids rise or fall according to what we believe about them, and the more we dwell on the differences between boys and girls, the likelier such stereotypes are to crystallize into children’s self-perceptions and self-fulfilling prophecies.

My goal is to do just the opposite: to present the real magnitude and multiple causes of sex differences in children; to better expose the full range of human potential and the many domains of intelligence that merit cultivating in both sexes.

This book takes a chronological tour of sex differences at each stage of development, from conception through adolescence. At each point,



I'll explain what's known about differences in the brains and behaviors of boys and girls, as well as the relative roles of genes, hormones, and environment in creating those differences. Based on this information, I'll suggest specific ways that parents and teachers can help narrow the more worrisome gaps.

Boys and girls do have different interests, abilities, and personalities, which is part of the fun of having children of both sexes. But what boy or girl, or man or woman, wouldn't be more successful with a fuller deck of cognitive and emotional skills? Studies of gifted teenagers confirm that intelligence and academic excellence are associated more with cross-gender abilities and less with stereotypical gender roles. There can be no doubt that success in our world increasingly requires a mixture of male and female strengths—speaking, reading, writing, math, spatial ability, mechanical dexterity, and physical skills, along with equal measures of empathy and ambition, diplomacy and assertiveness. The earlier we can step in and tweak kids' growing neurons and synapses, the better our chances of raising *both* boys and girls with well-balanced sets of skills.

The task is not simple. Some sex differences are most prominent in early life and then fade as they are trained out of children. Others emerge quite gradually and reach their peak in adulthood as boys and girls grow into their different niches. Nature exerts its pull at all ages, but what is most important is how children *spend their time*. The more similar boys' and girls' activities are, the more similar their brains will be. That's why, as we'll see throughout this book, the cognitive and academic differences between boys and girls tend to be much smaller than their interpersonal and recreational differences. Children are explicitly taught how to read and calculate but not how to take risks or express their emotions. While we can't erase—nor would we want to—all the differences between boys and girls, it's clear that the *size* of the gaps depends on what parents emphasize and how teachers teach.

Nor is the pattern of sex differences as simple as most people assume. Hidden among the obvious differences are some surprising exceptions and a lot of underlying similarities. Yes, we can measure average boy-girl differences in activity levels, empathy, reading, and math scores. But these generalities obscure important subdomains that each sex excels at—such as boys' rich vocabularies, girls' talent for arithmetic calculation, and the unique though sometimes troublesome brands of competition and aggression that members of *each* sex engage in.

So it's time to get *specific* in our discussion of sex differences, to move beyond the broad stereotypes to a more precise understanding of how boys and girls differ. Only then can we determine how such differences emerge and decide what best to do about them.

The real story starts in the womb, the topic of chapter 1, where we'll see how a few genes and hormones kick off the sexual differentiation of both brain and body. We'll also consider ways in which boys and girls are detectably different before birth. Chapter 2 looks at sex differences in newborns, the only age at which the differences can unambiguously be attributed to nature, but also the point when powerful social learning begins. Chapter 3 focuses on the toddler and preschool years, when children themselves first become aware of gender. The differences at this age are in some ways more dramatic than at any other time of life. Chapter 4 compares girls and boys at the beginning of formal schooling, a critical time for forging academic identities. In each of these chapters, we'll explore the true magnitude of boy-girl differences, observe the advantages and disadvantages of each sex's interests and play styles, and find ways to capitalize on the nurture side to help both boys and girls develop more fully.

Our developmental trajectory continues in the second part of the book, though with a special emphasis in each chapter. Chapter 5 focuses on language and literacy skills, a dominant factor in children's early school success and an area of special concern for boys. Chapter 6 looks at math, science, and technical skills, which begin diverging between the sexes somewhat later and remain challenging for many girls. Chapter 7 takes aim at the emotional and interpersonal differences between boys and girls, which are not taught in school but arguably factor in even more importantly than all the academic gaps we monitor so closely. Such differences are generally modest in early childhood but grow more dramatic after puberty, an age when nature (hormones) and nurture (peer environment) become inextricably tangled. I end, in chapter 8, with some perspective on how gender gaps have morphed in recent years, as well as an evaluation of the relative advantages of coed versus single-sex schools for dealing with those gaps.

Boy-girl differences have always been fodder for controversy, but in the last two decades, the topic has taken a sour political turn. It started with a girl crisis, back in the *Reviving Ophelia* days, when people worried about

girls' crashing self-esteem and their lack of attention from teachers in school. That movement served a valuable purpose, but all the focus on girls was interpreted by some as a "war on boys" cooked up by feminists. Now we're racked by an epidemic of "boys adrift"—inattentive, unmotivated, and unable to compete with girls academically or to launch themselves beyond their parents' protection.

It's time for a truce. The problem with each crisis is that it has demonized the other sex, pitting boys and girls against each other, as if learning and achievement were zero-sum games. The truth, however, is that neither sex is in serious trouble. Yes, there remain some conspicuous gaps between boys and girls, the causes and remedies of which we'll address throughout this book. But the difference in achievement between the sexes remains much smaller than the gaps in achievement among different racial and economic groups, where we should no doubt be directing more of our energy. Nor have the gender gaps changed precipitously in the last two decades. In fact, both sexes are earning higher grades, graduating from high school at higher rates, and attending college in greater numbers than ever before. Neither sex is sinking into the abyss predicted by each wave of crisis books.

As a mother of both a daughter and sons, I believe we've got to find a better balance. Both sexes have their strengths and vulnerabilities, their easy and troublesome periods while growing up. The reason for studying sex differences is not to tally up who's winning or losing but to learn how to compensate for them early on, while children's brains are still at their most malleable. How can we help boys express their feelings, learn to read and write better, and feel at home in the school classroom? How can we help girls stay confident in math, learn how to read a map, and embrace technology and competition?

A better understanding of sex differences and neural plasticity can help us raise better children—teach us how to make the most of their strengths and help forestall their weaknesses. Piecing together the different influences at each stage is the only way to truly understand them, equalize opportunity between the sexes, and, ultimately, bring out the best in every child.

# 1

## *Pink and Blue in the Womb*

YOUR PERIOD IS ONLY one day late, but you can't wait any longer. You do the test, waking up to pee on a stick at 6 A.M. Then you wait, smiling nervously while your husband stares at the result window that's shaking subtly in your hand. Finally, some faint lines begin to emerge. You flash back and forth between the tester and the instruction diagrams. . . . It's looking good. Yes, it's definitely looking like a positive. Your eyes meet. It's going to happen! You're going to have another baby!

"Oh, please, let it be a boy this time," your husband blurts out; it's still too early in the day for him to keep his deepest wish in check. You share his hope, your two daughters having satisfied all your frilly-dress dreams.

Home pregnancy tests are amazing, but they can't yet tell the sex of a baby. That's partly because the earlier it is in pregnancy, the less difference there is between the sexes. Boys and girls are identical for the first six weeks\* of development. While many expectant parents begin fanta-

\* The sixth week of fetal development is actually the eighth week of pregnancy according to the dating system used by physicians and midwives. Of course, development begins at conception, but clinicians traditionally time a pregnancy from the first day of the last menstrual period, an unambiguous date that typically falls two weeks before ovulation and conception. So there is a two-week discrepancy between the true developmental or *conceptual* age of a fetus and the *menstrual* age; the latter is what medical practitioners use when referring to the forty-week pregnancy. Actual gestation time is therefore thirty-eight weeks.