Marianne J. Legato, Why Men Never Remember and Women Never Forget – Quotes

ISBN-13 978-1-57954-897-1

The differences between males and females are dramatic and incontrovertible to anyone who's even casually observed animals. My male pug is bigger, stronger, and much more active than his sister. While she spends hours quietly wrapped around my feet and hides if she knows it's cold or raining outside,he wanders through the house in search of a favorite toy, nips at her leg to encourage her to get up and play with him, and loves to go out for walks, taking on every pigeon in his path.

Why are they different? Over the past decade, there has been a crescendo of interest in exploring the precise nature and importance of the differences between men and women. The new science of gender-specific medicine is producing an amazing appreciation of how our biological sex modifies the way we operate in the world – and even our experiences of disease. We are different, and vastly so, in *every system of the body*, from the skin that covers us, to the hearts that beat within our chests, to the guts that process the food we eat.

Nowhere is this more true than in the brain, the 3-pound organ that houses all that makes us human: our passions, our insights, our appreciation of the created world, our entire intellectual and emotional lives. (XIV)

[During an argument, woman's' body is in full battle readiness. As she processes each new stressor – the untidy house, the unmade cookies, the errant e-mail – her brain signals for hormones to help her cope with the stress, by raising her blood pressure and pushing her heart to beat at a rate almost twice what's normal. In women, the amygdala, the part of the brain that receives and responds to stressors, has extensive connections to the parts of the brain that control blood pressure and heart rate. Men on the other hand side, have a less extensive network. [...] [Woman] releases a very important hormone called oxytocin that motivates her to make and preserve connections with other people, especially those who can help her with [her children]. Levels of this hormone are especially high when women are under stress – making oxytocin a gender-specific and powerful tool that helps women to meet challenges by recruiting others. [...] [A woman] has more gray matter in the frontal cortex of her brain, the area just behind the eyes. [...] This is the executive center of the brain, the CEO that controls our complex behaviors. [She] also has more connections between the two sides of her brain, which may explain how she processes several different streams of information at the same time. [A man], for the most part, activates only one side of his brain when processing information. This means that he deals with one thing at a time: He identifies a problem, comes up with a solution, and moves on. [...] women have higher levels of the hormone estrogen that men do, and estrogen does two things when women are under stress. First, it prolongs the secretion of the stress hormone, cortisol, so a woman feels more stressed in the moment than a man in the same situation. Estrogen also activates a larger field of neurons in the brain than is the case with men; these activated cells provide women with the network needed to form a much more detailed memory of the sequences of events. [...] [Woman's] left brain, the seat of our ability to process language, has more gray matter than [man's] does, and she uses both sides of her brain for speech while [man] uses only one. [...] Women have to be better at reading the subtle and nuanced language of human expression than men, so that they can better determine the needs of their highly dependent, wordless infants. And [...] the bonding that takes place between the two women is a good example of a female behavior pattern in the face of stress; it serves as a better form of self-protection than the typical male "fight of flight" response. (XV-XVII)

If a female blue-headed wrasse is the largest in her group, and there are no males wrasses around, she will change her behavior to that of a male fish within minutes of the discovery. Her female reproductive organs change more slowly but will become male within days after the behavioral change. We humans have a hormone called vasopressin, an analog of the brain chemical in the fish that instigates the behavioral change. (XIX)

... much of the pressure not to investigate innate differences between men and women come from the women who most valiantly fight for and defend the rights of women. (2-3)

Although our sex is determined at the moment of our conception, and we stay that sex for the rest of our lives, we actually become *more or less* female or male over the course of our lives. (6)

Men's brains are bigger than those of womens and weight 10 percent more. [...] Women have more gray matter in certain parts of their brains and more intricate and extensive communications between brain cells than men, particularly in the frontal cortex. This is the area involved in judgment and decision making. (9)

... baby's brain [...] has twice the number of working connections between cells as an adult's does. (9)

One of the most important ways in which our brains are shaped is not through growth, but the *programmed* death of a large number – about half – of the neurons originally produced as the brain forms. This pruning process goes on from the final month of pregnancy and continues long after birth. Synapses, or connections between cells, that don't get reinforced by stimulation from the outside world atrophy and eventually disappear. The connections that are stimulated grow stronger and become permanent. You have to use it, or you lose it, and practice makes perfect. [...] This brain tailoring process is part of what makes us unique: Our experiences – the stimulation we're exposed to, or protected from – have a very real impact on who we become. If we don't have appropriate input during these times, the systems can be impaired forever, and there are all too many examples of abused and neglected children who are cut off from interaction during crucial developmental windows and will never develop normal language skills as a result. Less tragically, it's what makes the differences between siblings and even identical twins who carry the same genetic information. [...] [H]ow and when this brain tailoring occurs between the ages of 6 and 17 is different for boys and girls. (11-12)

There is evidence that men and women solve spatial problems differently. For example, precisely how men and women find their way through new and even familiar environments was tested in an interesting experiment done in Canada using a virtual reality maze. Not only did men and women activate completely different areas of their brains to negotiate the space, but they used *different strategies* to find the exit. Women used landmarks to guide them, while men used what was called "Euclidian information" to place themselves within the structure and navigate through it. (13)

Men excel in their ability to imagine, for example, how a figure would appear if rotated in a space of two or three dimensions. (14)

[H]igher testosterone levels in men correlated with men's enhanced spatial ability. However [...] those levels correspond with their *diminished* ability for verbal expression – an area in which women excel. (14)

Baby girls placed near a male fetus in utero seem to benefit from the additional boost of testosterone to which their brothers expose them: They have enhanced ability, for example, to solve three-dimensional problems compared with their singleton sisters. (14-15)

Many researchers believe that women search for partners who can provide emotional and financial security – in other words, someone who will be a good parent and a good provider. Men, on the other hand, are looking for someone who is young and healthy enough to reproduce: indeed, many of the physical characteristics that men find most attractive in women are ones that connote youth and good health. [...] men [...] seek young, physically attractive partners, while women [...] look for economically advantaged mates. From an evolutionary point of view, it makes perfect sense. (19-20)

People choose mates with physical characteristics similar to their own. (22)

... the bowerbirds of Australia collect brightly colored objects that they display for the female's consideration in a cleared area called a court. (24)

Although men are fertile much longer than women, they are in their sexual prime in their late teens and 20s, and impotence begins to be an issue at about 40. In contrast, women can enjoy sexual exchanges for decades longer and sometimes even more after menopause, when the worries of conception aren't a factor anymore. (25-26)

There's considerable evidence to suggest that we're drawn together by our sense of smell. [...] Women do have a better sense of smell than men, possibly because of [the] estrogen levels. [...] There's evidence that your odor type is linked to genes that determine your immunity. (26-27)

Researchers believe that pheromones [chemical signal that one party sends to another to influence its are behavior] are why the menstrual cycles of women who live together (in a college dormitory, for instance) become synchronized, and why men's beards grow bushy and full when they're in the company of women, but straggly when they're in the company of other men or are alone. (28)

Love is one area where men and women become very much alike, if only for a period of time. (34)

Other activities [besides love] that trigger dopamine [the "feel-good" neurotransmitter associated with motivation and pleasure] release include cigarette smoking and the use of cocaine. The drug comparison, incidentally, is explicit: In the British study, there was a great deal of overlap between the activity of the brain in love and the brain on euphoria-inducing drugs. The toleration for sleeplessness, lack of appetite, feeling of exhilaration and focus – these all characterize the first phase of an infatuation, but they're also very similar to what happens when you do a line of cocaine. (35)

Both obesity and drug and alcohol abuse run in the families, suggesting that the disturbance in the pleasure-seeking portions of the brain that causes these addictions can be, at least in part, inherited. (36)

When we fall in love, our brains modulate the release of two other chemicals that may be responsible for many of the emotions we associate with the early phases of an infatuation. The first is phenyethylamine (PEA), a natural amphetamine that elevates our moods [it's one of the chemicals released when we eat chocolate]. (In fact, it's the release of PEA that triggers dopamine.) [...] The other chemical [...] is norepinephrine, or noradrenaline. Usually associated with a state of emergency,

this neurotransmitter is the one responsible for your elevated blood pressure and heart rate, your sweaty palms, and your intense focus on your beloved. (37)

When you fall in love, levels of another chemical called serotonin may be *reduced* – often to a level as low as someone with obsessive-compulsive disorder. (38)

Testosterone is the primary hormone that drives sexual appetite in both sexes, and both sexes show an elevation in testosterone levels during periods when they're sexually active. (40)

An interesting study that looked at the areas of the brain that were activated when men and women viewed erotic films showed that the patterns of activity were different for the two sexes. Men in particular had increased action in the hypothalamus, which plays an essential role in sexual arousal. We have known for years that the hypothalamus has gender-specific structural differences, but these investigators saw that it behaves differently in response to pornography in men and women. This structural difference may explain men's greater interest in visual stimulation. (44)

[...] gay men are aroused by images of men, and heterosexual men by those of women. [...] women – whether straight or gay – have a bisexual arousal pattern and enjoy both male and female erotica. (44)

[M]en almost always (although not invariably) report subjective feelings of arousal when they have an erection. But newer research shows that even when women are apparently *physically* sexually aroused, with clitoral engorgement and a lubricated vagina, they may not *feel* sexually aroused – a disconnected that simply doesn't exist for a man. Just as important, women can feel interested in sex and aroused, even with very little or no vaginal lubrication. (46)

Rosemary Basson, FRCP, suggested that the biological drive to have sex is not nearly as strong in females as is that to nourish and protect offspring and that women go to bed as much out of a desire for an intimate connection to another human being as for simple lust. She further proposed that the sexual exchange for women doesn't begin with sexual arousal, but with a desire for *increased emotional intimacy*. It is this desire that persuades women to engage in sex. (47)

If men's visual sense is more developed than that of women, it's fair to say that all the other senses are more finely tuned in females, especially smell, taste, and touch. (48)

[Advice to females:] If you're feeling lackluster about sex, allow yourself to be seduced. (It goes without saying that this requires a sensitive and responsive partner – one who will stop, without fal of question, if this experiment fails.) The word *seduction* comes from the Latin, meaning to lead one away from oneself. Physical touch – unfortunately, it has to be someone else's touch! Stimulates the production of a very powerful and intoxicating hormone called oxytocin, also called the love hormone because of the feelings it engenders. It's this hormone that prompts female rats to crouch and raise their hindquarters high in the air, which signals they are receptive to interested males. (49)

Both men and women can experience orgasm without having a sense of sexual gratification. And there are women who don't always have to have an orgasm to feel sexually satisfied. Comfort, reassurance, tenderness, and a sense of being protected are as important – or more so – as an orgasm for these women. The word *intercourse* comes from the Latin words *inter currere,* meaning "to run between" or

"to exchange something between two individuals." That always seemed to me to be the essence of the activity, and it seems to be borne out by this new research. (51)

[M]en's ability to process language and understand what's said to them begins to diminish as early as age 35, while women preserve this function until they're menopausal. At that point, the playing field evens out a bit, with an interesting twist. A study published in the *Journal of speech, language, and Hearing Research* showed that women lose their ability to access cues from the tone of someone's voice for a period of time after menopause. This is part of the cognitive dissonance that comes from an estrogen dip, the same dip that can also make it difficult for menopausal women to remember details and make decision. Like those lapses, it has an impact on [women's] ability to navigate the world. (61)

There's some evidence that men, no matter what their age, actually process the information they hear differently than women do because of fundamental differences in their brains. In general, humans use the left part of the two symmetrical halves of our brains to produce language and understand speech, and the right for dealing with tasks that involve our physical position and other spatial relationships.

Some of the differences between men's and women's brains that may cause differences in the way we process and produce information include the following:

- Women have *more nerve cells* in the left half of the brain, the seat of our ability to process language.

In the brain, quantity of cells often does correlate with quality. In the brain of a gymnast, for instance, the part of the brain that controls balance and motor skills is larger than it is in other people, and the more she practices, the larger it gets.

- Women have a *greater degree of connectivity* between the two parts of the brain.

The thick network of fibers that connect the two halves of the brain, called the corpus callosum, is larger in women than it is in men. This may lead to greater traffic between the two halves of the brain in women. For example, men and women appear to process single words in a similar fashion, but when they're interpreting full sentences, men tend to use a single specific area in the brain, while women mobilize the same area, *but in both sides*. A study at Indiana University in 2000 showed that women used an area of the brain just above the ears in both halves of their brains in listening to an excerpt from a John Grisham book, while men used the same region, but only on the left side. [...]

- Women have more dopamine in the part of the brain that controls language.

Nerve cells don't talk to each other by touching; they release chemical messengers called neurotransmitters, which are picked up and "read" by other nerve cells. Women have higher concentrations of the neurotransmitter called dopamine in the part of the brain responsible for language and memory skills. In other words, their cells have more messengers at their disposal, and more messengers means more information delivered more efficiently. Researchers believe that women score higher on tests of verbal learning than men, particularly if they are younger, in part because of this higher dopamine availability in their brains. (61-63)

Men can identify straightforward emotions in others – like rage and aggression – sometimes even better than women can. They need to be able to assess aggression in other males to that they can speedily arrange a defense. But they don't score as high as women on the more subtle nonverbal cues that telegraph sadness and fear. Researchers believe that women's facility with understated cues is an evolutionary adaptation, designed to help women do the job of taking care of infants. A baby can't tell you that he's hungry or sick. To make sure he gets what he needs, his primary caretaker (usually the mother) must become very skilled at interpreting nonverbal cues, like a facial expression of the particular tone of a cry. (The word *infant* actually comes from the Latin for "without speech.") (64)

The difference in the way we respond to emotional expressions seems to be connected to a functional difference in the brain. One study showed that when women saw a fearful expression of someone's face, their amygdalas, the brain's warning center, the area that controls fear and our recognition of it, engaged more rapidly than men's did. Another brain study done in Japan showed that men and women used different parts of the brain to identify whether faces had happy, sad, or neutral expression. The differences were greatest when the study participants were shown sad expressions, which women identified much more accurately than men. [...] In [one] study men had a higher overall accuracy in identifying sad expressions, but they were far less accurate if the sadness was on a female face! Women were more accurate in identifying a wide range of emotions on male faces than they were with those in women's faces. (65)

Men tend to be more interested in how things work, while women are more empathic. People suffering from autism, a childhood developmental disorder without a known cause or cure, are characterized by their detachment from other people and the physical environment and by their difficulties in communicating or relating emotionally to other people. Dr. Baron-Cohen believes that autistics have an "extreme male brain," potentially caused by exposure to high levels of testosterone in utero. Autism, then, takes the standard male lack of empathy to an extreme. (66)

Women have a higher rate of blood flow to certain parts of the brain, including those that control language. This is one of the reasons researchers give for the overwhelming evidence that women have better immediate and delayed recall of the spoken word. (68)

There is a real difference in brain development between the sexes: Girls' brains mature earlier than those of boys, including the centers that generate speech. This may set girls up for verbal superiority during development. Other investigators found that the higher the testosterone levels in normal males, the less verbal ability they had. In a fascinating series of experiments, Sally Shaywitz, MD, at Yale University showed that when men and women did an identical word-rhyming task, men activated only one area in the left side of their brains, while women used the same part, but in both hemispheres rather than in just one. (75)

What happens in your brain when you're angry is actually remarkably similar to what happens after an orgasm, and if I had a dime for everyone who'd said something they wish they hadn't after a passionate embrace, I'd be writing this from my own private island. In both situations, our brains are working *against us*, in a sense: Our emotions are high, and the logic center is dimmed. (I certainly wouldn't want to argue before the Supreme Court after really great sex – would you?) (79)

Lust is the spark that ignites between two people, and romantic love is the kindling. These drives begin the bonding process, and both presumably exist so that we can make babies and thereby continue to propagate the species. But once the wining and dining is over, and the seed for a new life planted, what is it that drives us to settle down?

One thing is for sure: That first flush of love – and the chemicals associated wit it – don't last. Donatella Marazziti, a professor of psychiatry at the University of Pisa in Italy, and the researcher who discovered that men's and women's testosterone levels tend to converge when they fall in love, found 2 years later that although subjects were in the same relationships, their testosterone levels had returned to normal.

Thankfully, it doesn't have to be "game over" once those sexy hormones fade out. For some couples, of course, it is; about a third of all marriages fail in the first 4 years. That may be because a

great many people are unable to navigate the transition into the next phase of love, which anthropologist Helen Fisher calls attachment.

This attachment phase, which also sees the abatement of the infatuation cocktail (dopamine, phenyethylamine, and noradrenaline), is accompanied by an increase in other chemicals, which work to strengthen the couple's bond, as well as the feelings of contentment and comfort that we have in the relationship. While these may not give us the speedlike rush of the infatuation chemicals, they are happy drugs in their own right. Foremost among the chemicals released during this phase are endorphins and oxytocin. (103-104)

Jokes aside, endorphins are pleasure-enhancing chemicals, and they have a powerful effect on our mood. We release them when we laugh, and when levels are high, we're social and friendly and relaxed. They're also released when we have an orgasm, and they share responsibility (with oxytocin) for the hazy euphoria we often experience after sex. (105)

[Oxytocin] stimulates sexual desire in men and women, and the body releases even more of it during the sexual act and after an orgasm. But oxytocin doesn't just show up when we're getting intimate; it also appears during a number of seemingly unrelated functions. For instance, it's associated with smooth muscle contraction during labor. Pitocin, the drug administered to induce labor, is an artificial form of oxytocin; the word *oxytocin* itself is derived from the Greek, meaning "rapid birth." Oxytocin stimulates the milk letdown reflex in a nursing mother, and it's released anytime we're under stress. (105)

Here are some good ways you can increase your hormone levels (107-109):

- Exercise
- Have lots of good sex
- A cuddle a day keeps the doctor away
- Bond with others

As someone once said, if you want to be happy for a day, have a good meal. If you want to be happy for a month, fall in love. If you want to be happy for a year, get married. If you want to be happy for a lifetime, make a friend. (109)

The estrogen in the woman's blood magnifies and intensifies the effects of the oxytocin. [After sexual intercourse] her blood pressure drops, she feels dreamy and relaxed, and she has an intense desire to continue bonding through cuddling, stroking, and talking. By contrast, the testosterone in the man's bloodstream (further elevated by the sexual activity, incidentally), neutralizes the oxytocin – and with it, the impulse to cuddle. In Dr. Light's study of oxytocin and blood pressure at University of North Carolina, men showed no increase in oxytocin production after stroking, probably because of the testosterone block. (109-110)

A team of anthropologists from Harvard University tested testosterone levels in a variety of men and found that married men had significantly lower levels than single men. When their marriages ended in divorce, levels rose again. As the researchers noted, this makes sense: Lowered levels of testosterone make it more likely that a man will spend time at home, as opposed to tomcatting around. (111)

A study published in the *Journal of Personality and Social Psychology* sought to answer the question of how a secure marriage – one based on mutual knowledge, respect, and trust – could grow out of a

courtship relationship, which is fundamentally based on putting your best foot forward in an effort to convince the other person to commit. It's a fascinating paradox, isn't it?

The researchers found that the self-reflection people wanted from their partners changed as the relationship moved from one phase to another. People who were still dating, in the courtship phase of a romance, were most intimate with partners who evaluated them favorably. They wanted someone who would tell them they were great. By contrast, married people in the attachment phase of the relationship were most intimate with partners who validated their own opinions of themselves. When they were dating, they wanted someone who would tell them they were great. They wanted someone who would agree with thee way they saw themselves. When their own self-evaluation was negative, they were most intimate with a partner who agreed with that assessment. (112-113)

A long relationship isn't a static, dead thing. Like the brain itself, it's plastic and dynamic and changing all the time. (113)

Researcher Hans Hofmann, PhD, of Harvard found that there are two kinds of a species of fish in which a whole array of genes – as many as 100 – collaborate to make some members of those species particularly attractive to the opposite sex. These extra-studly fish act just like the most popular boys at a suburban high school. They wear bright colors, bully their lesser-endowed peers, and aggressively court the female fish. At the aquatic equivalent of another cafeteria table, there's a different crew: the wimps. These have smaller gonads and spend the majority of their time swimming and feeding with other wimps. (116)

A Canadian researcher found that people with high blood pressure in good marriages could lower their blood pressure by sharing an activity with their spouses. By contrast, the blood pressure of people in bad marriages rose when they were in their spouses' presence. (122)

It's not clear why [a breakup] hurts so much, but one theory, by the great anthropologist Helen Fisher, is that ending a romantic relationship triggers the same feelings of abandonment and terror that we had whenever we were separated from our mothers at a very young age. [...] [A] research that has been done shows that it's not just all in our heads. When we grieve, there is a real change in what doctors call our "vegetative functions." (128-129)

Somewhat more surprising were signs that parts of the brain that had to do with the regulation of the autonomic nervous system – which controls things like our gastrointestinal activity, respiratory rate, blood pressure, and heart beat – had been activated. It seems that the brain actually signals the rest of the body that something painful has happened. This explains the physical responses we experience when we grieve – a loss or increase in appetite, for instance. In some women, menstrual periods stop. (129)

[T]here [is] less activity in the amygdala, the area of the brain that controls emotions and motivation. It's very similar to what happens in people who suffer from anxiety disorders, or what we se when we look at the brain of someone suffering from post-traumatic stress disorder (PTSD). The more intense the grief [...] the less activity the researchers saw. (129-130)

So how can you best weather the loss (130-131):

- Try to get plenty of sleep.
- Don't resume (or pick up) habits that can hurt you.
- Avoid isolation.

- Don't schedule elective surgery.
- Perhaps most important, postpone major life decisions.

During the period immediately after a loss, the dopamine in your brains increases to help maintain our morale in the face of a disaster. This is helpful, but it can give us a false sense of clarity.

[N]ew research shows us that what happens in our brains when we feel both kinds of love [for a partner and an offspring] may actually be more alike than different. (133)

The orbitofrontal cortex, the part of the brain just above the eyes, is active when new mothers see their newborns – even just in pictures. This part of the brain, often known as "the emotional brain," also processes pleasant touch, pleasant smell, unpleasant smell, and facial attractiveness. (Disorders of this part of the brain may be involved in postpartum depression. Impairments to this emotional brain may blunt the normal bonding that goes on between mom and newborn.)

Perhaps most important, the same reward centers are triggered when we look at pictures of our babies and pictures of our beloveds. Love – whether it's for ruggedly handsome Mr. Right or a downy-cheeked 4-year old – feels really, really good. In fact, both kinds of love trigger the very same reward centers that light up when we taste a chocolate hazelnut bombe or get a massive bonus check at work – and help explain why a drug like cocaine is so difficult to kick.

There's another similarity between these two different kinds of love. If you remember, one part of the brain "turns off" when you're looking at a new lover: the social assessment mediator, which might otherwise cause us to note that his pants are too short and his chewing too loud. Our brains, in other words, don't allow us to make judgments that might threaten our love.

The same thing happens when we look at our child. This certainly explains that particular brand of parental blindness that makes our wrinkled, red newborn the most beautiful one on the ward, our toddler the most precocious, and our teenager the most attractive and interesting. (134-135)

In a study done at Boston Children's Hospital, infants relaxed when they were approached by their mothers (their pulse and breathing rates slowed down, and their eyelids lowered). By contrast, when their fathers came into the picture, they began breathing more quickly, they tensed their shoulders, and their eyes widened, as if they knew something exciting was about to happen! (136)

As much as some dispute the existence of the "feminine" and "masculine" brain, we're at a loss to explain how many of these same biases show up in the animal kingdom, if there's no biological imperative. UCLA psychologists Gerianne Alexander, PhD, and Melissa Hines, PhD, did an experiment in which they presented vervet monkeys with six toys. The males played more with the truck and ball, while the females chose the doll and a pot; gender-neutral toys (a book and a stuffed dog) got equal attention. Certainly, socialization didn't influence these subjects!

We see the interaction of socialization and biology in the following research on rats. Mothers rats lick the anogenital area of male pups more than they do those of their daughters. They can detect the smell of the breakdown products of testosterone in the urine of their newborns. It seems that this licking helps neurons survive in an area of the nervous system (the SNB system), which enervates the penis. This nerve cluster is, for obvious reasons, larger in males. If the mother rat cannot smell, she won't lick her pups as much and can't favor her sons with more licks than she does her daughters. Her pups will grow up, whether male or female, with smaller, female-like SNB systems. In other words, the way the rats are treated (licked or not) directly influences the biology of their sex. (137)

Mark George, MD, did a fascinating experiment using brain scans of new mothers, who were exposed to the sound of their babies crying. These results were then measured against the reaction in the brain

when the mothers were played another audio tape – this time, the sound of babies crying, but scrambled so as to be unidentifiable. The same areas lit up; the women's brains could decode the signal, even when the ears could not. (138)

There's a fairly stark difference between a mother rat and a virgin, or nonmaternal, rat. The mother rat will take care of any babies placed into her nest, even if they're not her own, and will choose her pups over food. She is an aggressive defender of her young and will attack anything she perceives as an intrusion on her nest. A nonmaternal rat will not only choose the food every time, but will withdraw from youngsters, in the best-case scenario, and eat them, in the worst. (139)

Oxytocin drives these maternal behaviors. When the natural production of it is blocked (in a sheep and in rats), mothers reject their own young. When oxytocin is injected into nonmaternal rats, they will begin to treat pups as if they were their own.

Oxytocin has a similar effect on humans. As a woman breasfeeds, oxytocin levels rise in her blood, stimulated by her infant's sucking. The oxytocin directs the milk glands to release milk and has a profound effect on her behavior as well. According to a study done by Kerstin Uvnas-Moberg, MD, PhD, at Karolinska Institute in Sweden, a nursing mother will score higher on a psychological test designed to measure her urge to please other people. The higher the levels of oxytocin in her blood, the lower her blood pressure and the more relaxed she is.

Testosterone, if you remember, blocks the effect of oxytocin – the reason that your husband's impulse is to order a pizza after sex (or perhaps worse, fall asleep), while you're still in snuggle mood. Testosterone's blocking effect may also be why women seem to bond so much more intensely with their newborns than men seem to.

Another chemical associated with pleasure increases in a specific part of the brain when rats groom their babies. We've discussed the neurotransmitter dopamine before; it's highly associated with motivation, pleasure and reward (and often addiction). Dopamine increases before the rats begin the grooming session, and the amount of dopamine they release corresponds directly with how long the grooming goes on. For the human equivalent, watch a new mother gently stroking the back of her new baby's hands while she admires his perfect, miniscule fingers. (140)

It's very important for women to get the support they need – not just for their own mental health, but also because maternal behavior does have a strong effect on a child. Depressed mothers smile less frequently and interact less often with their infants. Children of depressed mothers have lower IQs, watch more television, and are more likely themselves to be depressed in adolescence.

Mother mice lick and groom their babies; if they neglect this little piece of parenting, the babies grow up to be terribly anxious. Why? Because the genes that make receptors for the "stress protein," cortisol, which soothes us, is deactivated soon after birth. Without proper care, the receptors are fewer in number and quite possibly not as effective in latching onto cortisol as the normal receptor. When stressed in adult life, these mice become very anxious! Sadly, we know from children who have been neglected, without the usual profusion of parental kisses and cuddles, that there's a human correlation as well. (143)

Canadian research suggests that men go through some of the same hormonal changes that women do in anticipation of, and in reaction to, a new baby. (145)

[...] the most responsive and sympathetic mothers were the ones with the highest levels of cortisol. [...] Although we think of stress as a bad thing, it's really just a signal our body gives us to pay attention to may help a new mother to be alert and attentive to her infant. (145)

Prolactin (as the name would suggest) is a crucial component in nursing and lactation. It also contributes to nurturing and caretaking behaviors. For instance, researchers have found elevated prolactin levels in birds that take care of eggs and nestlings, even when they're just the babysitters, not the parents. The parents had the most prolactin, but the most helpful caregivers were second; the least helpful had the lowest levels. What researchers don't know is whether high prolactin levels make for good caregivers, or if there's something about all those hungry baby bird mouths that provokes the release of these hormones. They suspect it's a combination of the two. (146)

Testosterone, of course, is linked to aggressive, dominant behavior and exaggerated territorial defense; the more testosterone a man has, the more apparent these behaviors are. In certain contexts, aggression and violence might be good attributes for a parent to have, but high levels might not be ideal in the first few days and weeks of a new baby's life.

[...] In women, cortisol and prolactin levels naturally increase during pregnancy; according to the study, men's do too! The men's prolactin levels rose approximately 20 percent in the 3 weeks before their partners gave birth. In the same period, cortisol was also twice as high as normal in the expectant fathers. During the 3 weeks after birth, testosterone levels decreased significantly – 33 percent – in the men. (146)

A study published in the *Annals of Internal Medicine* reported that more than 20 percent of men [whose wives/partners experienced pregnancy] had experienced some symptoms, like morning sickness and weight gain. These real-life symptoms may be explained by the real-life change in men's hormonal levels. (147)

When a human being experiences stress (whether the stress is psychological or physical, as in the case of an injury or illness), we release a number of hormones, designed to help our body cope. For instance, we manufacture adrenaline, the "fight-or-flight" hormone. Adrenaline interferes with our perception, so that we feel distanced from our surroundings, and everything seems to happen in slow motion. At the same time, it sends our blood pressure skyrocketing, so that our hearts hammer in our chests, our breathing becomes shallow and fast, and our senses are heightened (which is why a smell or provocative color can later trigger a flashback to a time of great stress).

We also release a hormone called cortisol, colloquially known as the stress hormone. One of cortisol's main functions is to regulate blood sugar. When it's released in stressful conditions, it both encourages your body to dump more energy into your bloodstream, while it encourages your cells to use less. Cortisol's role in regulating blood sugar explains the "I forgot to eat lunch!" phenomena that sometimes happens when you're under a great deal of pressure at work. It also explains why many people who spend their lives under constant stress are often overweight. Their bodies are continually trying to modulate their energy levels around the peaks and troughs in their blood sugar, brought about by cortisol's interference.

A little cortisol is a very useful thing. It helps the body to rise to the challenge of the stressor. But a lot of cortisol – the levels produced when we're under constant stress, for example – is much more debilitating. Cortisol attaches itself to cells in the body's immune system, hampering them from doing their jobs efficiently and weakening the overall system, leaving our bodies vulnerable to infection and disease. Researchers at Ohio State University found that stressors like an upcoming examination period slowed down the speed at which wounds healed in the mouths of students, and that women who were caring for relatives suffering from Alzheimer's disease healed more slowly than women the same age who were not. (160)

Our cortisol levels fluctuate naturally over the course of a day, no matter what's going on in our lives. They're highest in the early morning and decline steadily as the hours wear on, so that they're lowest in the evening while we sleep. (They'll reverse themselves if you work the graveyard shift.) The fluctuations in cortisol that take place over the course of the day explain why many people (me included) do their best work first thing in the morning, when levels are highest, and find themselves fading mentally as the day wears on. (160)

People with insufficient cortisol have difficulty remembering what they hear, and people with too much of it [...] may also experience impaired mental ability. [...] [L]earning is the first step in creating memories, and we use our memories to avoid repeating experiences that cause us stress. [...] [T]here are special receptors for cortisol in the hippocampus, the part of the brain where we store memories, especially those associated with strong emotions. [...] People with hyperfunctioning adrenal glands that produce too much cortisol all the time have smaller brains, and perpetually high levels of cortisol due to constant stress is also destructive to the cells in the brain. [...] [C]hronic anxiety is associated with reduced brain mass in adults of both sexes and may play a role in creating the antisocial personalities of people who were seriously abused during childhood. Additionally, high levels of cortisol damage the part of the brain that stores memory, making it hard to learn new things and to remember old ones. (160-161)

The production of adrenaline, cortisol, and all the other chemicals released by the brain under stress – the ancient systems in the brain so essential to our survival – is controlled by the amygdala, a walnut-shaped cluster of cells at the base of the brain. The amygdala also helps us to store emotionally charged experiences as memories, so that we're able to avoid or defend ourselves appropriately when the situation recurs. The hippocampus organizes a system of neurons that form a circuit that actually embeds a memory of the experience into our brains. In other words, the amygdala helps us to make the rich series of calculations that determine whether or not we should be afraid – and what we should do if we are. (161-162)

There are two basic ways to react to a social challenge like entering a new room: You can "approach" the new environment [...] or you can "retreat".

It was very interesting to learn that the two types of people actually have functional differences in the way their brains respond. People who reacted to social challenges by approaching the new environment activated the left half of the prefrontal cortex. By contrast, antisocial and shy people - "highly defensive" people – showed predominantly right-sided activation.

Now imagine the surprise of these scientists when they realized that this observation was gender-based. Their conclusion turned out to be true *only of men.* A fascinating new study showed that while shy and withdrawn men activated the *right* side of their frontal brains, shy and withdrawn women lit up on the left. (163)

[W]omen have more gray matter in the fronts of their brains, just behind the forehead. This prefrontal cortex area controls our decision-making processes and regulates our emotional responses to the world. It's this part of the brain that sends the messages to the hippocampus, where memories are made. During a stressful event, estrogen activates a wider field of neurons in this part of the brain, and estrogen levels are higher in women. *This means that women actually experience the unpleasantness in greater and more precise detail.* (164)

Women also produce more cortisol than men do under stress, and for a longer time. Progesterone, one of the sex hormones found in high levels in women, prevents cortisol from turning off. Since

cortisol promotes learning and the formation of memories, these higher levels mean that women not only have a more visceral experience of the unpleasantness, but [they] *remember it better*. By contrast, the male sex hormone testosterone actually blocks the effect of cortisol.

Cortisol is just one factor contributing to [the] memory of an unpleasant event. Another has to do with [the] fear control center, the amygdala. Researchers have found a really interesting variation in the sexes: When making emotionally charged memories, men use only the right amygdala, while women use only the left. We don't know enough about this part of the brain to draw conclusions from this piece of news, but it seems certain from the little we do know that there's something there. For instance, scientists have found that smaller right amygdalae are found in people with a susceptibility to alcoholism.

The two sexes use different areas of the amygdala to influence memory. Women use the areas that connect to other areas in the brain, like the hypothalamus and the brain stem. The brain stem controls respiratory and heart rates. So particular circuitry may explain why women have a more urgent and physical response to emotionally charged memories. Men, on the other hand, use the area of the amygdala that connects upward tot he more cognitive areas of the brain. This may mean that they form the basis for a more "rational," solution-based response to a challenge, like remembering to cancel the credit cards before your muggers get their new stereos. (164-165)

[...] exposure to sex-specific hormones, prenatally and after birth, was a crucial determinant of the impact of stress on learning in rats. Exposure to stress (a painful shock to the tail, for example) actually enhanced the speed at which male rats learned; they benefited from the pressure. The difference in female was vivid and startling: The ability of a female rat to learn was *impaired* when she was exposed to stress. (166)

Further research suggests that these differences [ability to learn under stress, for men and women] are hardwired. If you castrate a male rat at birth, his learning response will still respond positively to stress. On the other hand, giving testosterone to female rats at the time of their birth made their learning behavior exactly like that of males! If this pattern holds true in humans, it raises really important questions, especially for educators. It has long been believed that competition in the classroom prompts students to try harder and to push themselves, a theory that might work in favor of boys, but against girls. (166-167)

Although women experience more stress, and stress is more likely to lead to depression, women are actually more resilient to stress than men are. (168)

When confronted with a threat, men gird their nervous systems with the chemical they will need to do battle or to run: adrenaline, noradrenaline, and cortisol. Their pupils dilate, their respiratory rates increase, and blood moves away from their digestive tracts and into their arms and legs in case they need to run. Their reflexes speed up, and their perception of pain diminishes. (169)

When a woman is under stress, her oxytocin levels rise. This not only calms her, but it prompts her to get help, in the form of bonding with others, especially other women. She has a much better chance of successfully protecting her young if she has access to additional resources – whether we're talking about food, money, childcare, or backup in a physical confrontation. This explains why men's response to danger or a threat is so different from that of a woman. (170)

Of the 19 million Americans who suffer from depression, 12 million are women. (177)

Women often find that reward-seeking behaviors like shopping or eating can lessen depression temporarily. (One teenager, whose mother bought her a blouse she admired in an attempt to lighten her daughter's relentless sadness, became enraged when her mother gave her the gift: "You know that shopping is one of the only things that makes me feel better! If you were going to spend money on me, why didn't you let me do the buying?") Men, on the other hand, are much more likely to pursue antisocial behaviors, such as drinking and violence. (178)

There's quite a bit of evidence to suggest that depression has a genetic component. [...] there is a specific gene with two different forms: one "long" and the other "short." People with the short form are more susceptible to depression after a stressful event than those who have the long type. (178)

The genes that give us our sex also control the release of the hormones that continue to sex us over the course of our lives, making us more or less male or female. For instance, it's the Y chromosome, found only in men, that "tells" the body to produce testes, which in turn produce testosterone and other masculinizing hormones, turning a fetus into a little boy. (179)

[...] *fluctuations* in hormone levels might be the key to why depression is so much more prevalent in women than in men. There's quite a convincing argument to connect depression with these hormonal fluctuations when we look at the times in women's lives when they're most likely to be depressed – before their periods and after childbirth, to name the two. (180)

One of the results of this perpetual monthly cycling [depression-wise] is premenstrual syndrome. Just before menstruation, estrogen concentrations are at their lowest levels, while levels of serotonin, a neurotransmitter involved in the maintenance of mood, decrease in the brain. (Low estrogen and serotonin are both associated with depression). (181)

All [...] addictions are "reward-seeking behaviors" and involve dopamine, the chemical in the brain that stimulates pleasurable feelings through special receptors. To keep feeling the high, an individual has to engage in more and more of the behavior. Lower-than-normal numbers of these special receptors seem to be a common denominator in addictions of all kinds. (190)

The extraordinary youth of the women when the crimes [sexual abuse] were committed against them is appalling: Six out of 10 rape victims were not even 18, and 29 percent of girls were raped when they were younger than 11. (191)

Reproductive hormones [...] make the impact of drug abuse on men and women different. For example, testosterone appears to be protecting against the effect of cocaine. Normal female rats and castrated male rats needed much lower doses of cocaine to exhibit the same changes in behavior that noncastrated males needed for a similar effect, and castrated newborn males and newborn female rats given testosterone at birth both needed higher doses of cocaine than normal animals later in life, in order to produce an effect. (193)

[...] women are 20 times as likely to get lung cancer from cigarette smoking as men (194)

A recent French study found that men needed higher doses of nicotine replacement to quit smoking successfully than women did, and that men who got higher doses of the nicotine were more likely to quit than men on lower doses. Women did not achieve greater success when the dosage was increased. (194)

Aging seems to be a double-edged sword. On the one hand, I don't agonize over every reversal or disappointment the way I did when I was 20; they don't seem to have the same intense weight they used to. A missed telephone call from the man of the hour doesn't precipitate a crisis, and if my son forgets he agreed to have dinner with me, I shrug it off, happy to see that his life is full and busy too. Things don't seem to be as catastrophically important as they once did, either. I find I lend my daughter my favorite clothes and jewelry without even a twinge of anxiety, and a worn spot in a wonderful Oriental carpet merely reminds me of how many times I have happily walked through my beloved apartment.

But that's not all that's changed. I have to pay attention when I put my house keys away, so I won't spend 15 minutes looking for them the next morning. I now have to remind myself to focus on what I'm doing, so I don't get hopelessly distracted by one of the other thousand things that I'm processing simultaneously. It's harder for me to learn a new song at my piano, and I absolutely cannot remember the name of a novel I loved 10 years ago. (200-201)

Many of the "symptoms" of aging – both the good and the bad – have to do with a change in brain function, largely because of the change in the amount of hormones we release at this time in our lives. (201)

We know that men's and women's brains develop on different schedules from the very moment of conception, and much of this has to do with the different schedule that both sexes have for the production and release of the hormones that make us male or female.

For instance, in the male fetus, testosterone secretion is high – levels equivalent *to that of an adult male* – in gestational weeks 8 to 24 and for the first 6 months after birth, after which the levels fall. By contrast, ovarian secretions are low during the intrauterine life of a baby girl, but they are significantly higher during the first 6 to 12 months after birth. (202)

Babies from homes where English is the primary language learn to distinguish the sounds "r" from "l" at around 6 months (to hear the difference between the words "rake" and "lake," for example). All babies – no matter where they are born or what language their parents speak – are both with the ability to differentiate these sounds, *but the connection has to be uses*. Since no such distinction exists between these sounds in Japanese, a Japanese baby's brain will have "pruned" out this skill by the time she is a year old. (202-203)

[G]ray matter in the frontal part of the brain increases just before puberty, but at different ages (at 12.1 years for boys and 11 years for girls), then declines in both sexes. Increase in the gray matter of another part of the brain, the parietal lobe, was also earlier for girls (peaking at 10.2 years, contrasted to 11.8 years for boys). (203)

It's been variously labeled andropause, Androgen Decline in the Aging male (ADAM), and even Partial Androgen Deficiency in the Aging Male (PADAM). [...] The most common complaints of men who felt they had entered andropause were erectile dysfunction (46 percent), general weakness (41 percent), and memory loss (36 percent). As he ages, a man will become more sensitive to pain, which testosterone seems to protect against. His physical strength will decrease unless he works on fitness consistently and carefully. [...] his special senses of sight, hearing, taste, and smell will all become less acute, adding to his general fragility and tentativeness. (206)

The changes in men's brains begin much earlier than in women – and earlier than we had suspected: Between 18 and 45 years of age, men show significant decline in their cognition, while women of the same age (presumably because of the protective effect of estrogen) do not show any change. After 45, the rates of decline seem to be quite similar in both sexes. (209)

Possibly in an effort to compensate for loss of left-brain substance, we know now that men have more active metabolism in the right half of their brains as they grow older, while it stays more evenly distributed in women. (210)

By the ages of 90-100, almost everyone has significant problems with thinking and remembering how to complete even the simplest routines of daily life. Melissa Gonzales McNeal, MS, and her colleagues at the Oregon Health Sciences University found in a study of 100 healthy adults older than 85 that by the time we reach a mean age of 97, 65 percent of us will have what scientists call cognitive impairment (a general term for forgetfulness and the inability to concentrate, solve problems, and deal with the ordinary challenges of self-care). By age 100, almost half of us (49 percent) will have Alzheimer's disease, one of the severest forms of cognitive impairment. (212)

I cannot emphasize enough how important it is to keep your brain well nourished with good music, good art, good conversation, and good ideas. The richer the environment in which you live, the greater the chances of increasing the number of, and connectivity between, your brain cells. (216)

Here are some suggestions to help you keep your brain in tip-top shape (217-218):

- Eat well and exercise (yes, the sweaty kind)
- Learn a new game
- Do brainteasers
- Write your history
- Take a class
- Volunteer