

of other attractive females. This brain state is created by the surge of new hormones on top of the ancient female genetic blueprint.

Attracting male attention is a newfound and exciting form of self-expression for my friend Shelly's teenage daughters, and the high-octane estrogen coursing through their brain pathways fuels their obsession. The hormones that affect their responsivity to social stress are going sky high, which is where they get their off-the-wall ideas—and clothing choices—and why they are constantly staring at themselves in the mirror. They are almost exclusively interested in their appearance, specifically whether the boys who populate their real and fantasy worlds will find them attractive. Thank goodness, says Shelley, they have three bathrooms in their home, because her girls spend hours in front of the mirror, inspecting pores, plucking eyebrows, wishing the butts they see would shrink, their breasts grow larger and waists get smaller, all to attract boys. Girls would likely be doing some version of this whether the media were there to influence their self-image or not. Hormones would be driving their brains to develop these impulses even if they didn't see skinny actresses and models on the cover of every magazine. They would be obsessing over whether or not boys thought they looked good because their hormones create the reality in their brains that being attractive to boys is the most important thing.

Their brains are hard at work rewiring themselves, and this is why conflicts will increase and become more intense as teen girls struggle for independence and identity. Who are they anyway? They are developing the parts of themselves that most make them women—their strength for communicating, forming social bonds, and nurturing those around them. If parents understand the biological changes happening in the teen girl brain circuits, they can support their daughters' self-esteem and well-being during these rocky years.

RIDING THE ESTROGEN-PROGESTERONE WAVES

The smooth sailing of girlhood is over. Now parents find themselves walking on eggshells around a moody, temperamental, and resistant

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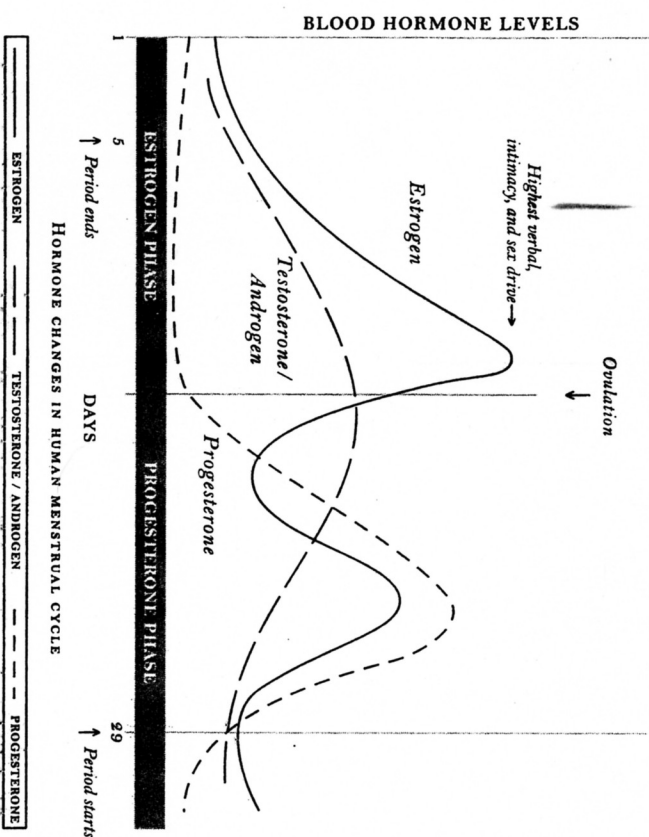
Teen Girl Brain

DRAMA, DRAMA, DRAMA. That's what's happening in a teen girl's life and a teen girl's brain. "Mom, I so totally can't go to school. I just found out Brian likes me and I have a huge zit and no concealer. OMG! How can you even think I'll go?" "Homework? I told you I'm not doing any more until you promise to send me away to school. I can't stand living with you for one more minute." "No, I'm not done talking to Eve. It has *not* been two hours, and I'm not getting off the phone." This is what you get if you have the modern version of the teen girl brain living in your house.

The teenage years are a turbulent time. The teen girl's brain is sprouting, reorganizing and pruning neuronal circuits that drive the way she thinks, feels, and acts—and obsesses over her looks. Her brain is unfolding ancient instructions on how to be a woman. During puberty, a girl's entire biological *raison d'être* is to become sexually desirable. She begins judging herself against her peers and media images

child. All of this drama is because the girlhood or juvenile pause has ended, and their daughter's pituitary gland has sprung to life as the chemical brakes are taken off her pulsing hypothalamic cells, which have been held in check since toddlerhood. This cellular release sparks the hypothalamic-pituitary-ovarian system into action. It is the first time since infantile puberty that their daughter's brain will be married in high levels of estrogen. In fact, it is the first time that her brain will experience estrogen-progesterone surges that come in repeated monthly waves from her ovaries. These surges will vary day to day and week to week.

THE ESTROGEN-PROGESTERONE WAVES



The rising tide of estrogen and progesterone starts to fuel many circuits in the teen girl's brain that were laid down in fetal life. These new hormonal surges assure that all of her female-specific brain circuits will become even more sensitive to emotional nuance, such as approval and disapproval, acceptance and rejection. And as her body

blossoms, she may not know how to interpret the newfound sexual attention—are those stares of approval or disapproval? Are her breasts the right ones or the wrong ones? On some days her self-confidence is strong, and on other days it hangs by a precarious thread. As a child she was able to hear a wider spectrum of emotional tone in another's voice than a boy could. Now that difference becomes even greater. The filter through which she feels the feedback of others also depends on where she is in her cycle—some days the feedback will reinforce her self-confidence, and other days it will destroy her. You can tell her one day that her jeans are cut a bit low and she'll ignore you. But catch her on the wrong day of her cycle and what she hears is that you're calling her a slut, or telling her she's too fat to wear those jeans. Even if you didn't say or intend this, it's how her brain interprets your comment.

We know that many parts of the female brain—including an important seat of memory and learning (the hippocampus), the main center for control of the body's organs (the hypothalamus), and the master center of emotions (the amygdala) are particularly affected by this new estrogen and progesterone fuel. It sharpens critical thinking and fine-tunes emotional responsivity. These enhanced brain circuits will stabilize into their adult shape by late puberty and into early adulthood. At the same time, we now know that the estrogen and progesterone surges start making the adolescent female brain, especially the hippocampus, experience weekly changes in sensitivity to stress that will continue until she passes through menopause.

Researchers at the Pittsburgh Psychobiologic Studies Center studied normal seven- to sixteen-year-olds as they progressed through puberty, testing their stress responsivity and their daily levels of cortisol. The girls showed more intense responses, while boys' stress responsiveness dropped. Females' bodies and brains react to stress differently than do males' once they have entered puberty. Fluctuating estrogen and progesterone in the brain is responsible for this opposite stress responsivity in the hippocampus of females. Males and females become reactive to different kinds of stress. Girls begin to react more to relationship stresses and boys to challenges to their authority. Re-

lationship conflict is what drives a teen girl's stress system wild. She needs to be liked and socially connected; a teen boy needs to be respected and higher in the male pecking order.

The girl's brain circuits are arranged and fueled by estrogen to respond to stress with nurturant activities and the creation of protective social networks. She hates relationship conflict. Her brain's stress response is massively triggered by social rejection. The ebb and flow of estrogen during the menstrual cycle changes this sensitivity to psychological and social stress on a weekly basis. The first two weeks of the cycle, when estrogen is high, a girl is more likely to be socially interested and relaxed with others. In the last two weeks of the cycle, when progesterone is high and estrogen is lower, she is more likely to react with increased irritability and will want to be left alone. Estrogen and progesterone reset the brain's stress response each month. A girl's self-confidence may be high one week but on thin ice the next.

During the juvenile pause of childhood, when estrogen levels are stable and low, a girl's stress system is calmer and more constant. Once estrogen and progesterone levels climb at puberty, her responsiveness to both stress and pain start to rise, all marked by new reactions in the brain to the stress hormone cortisol. She's easily stressed, high-strung, and she starts looking for ways to chill out.

The circuits for social and verbal

connection are more naturally hardwired in the typical female brain than in the typical male. It is during the teen years that the flood of estrogen in girls' brains will activate oxytocin and sex-specific female brain circuits, especially those for talking, flirting, and socializing. Those high school girls hanging out in the bathroom are cementing their most important relationships—with other girls.

Many women find biological comfort in one another's company, and language is the glue that connects one female to another. No surprise, then, that some verbal areas of the brain are larger in women than in men and that women, on average, talk and listen a lot more than men. The numbers vary, but on average girls speak two to three times more words per day than boys. We know that young girls speak earlier and by the age of twenty months have double or triple the number of words in their vocabularies than do boys. Boys eventually catch up in their vocabulary but not in speed or overlapping speech. Girls speak faster on average, especially when they are in a social setting. Men haven't always appreciated that verbal edge. In Colonial America, women were put in the town stocks with wooden clips on their tongues or tortured by the "dunking stool," held underwater and almost drowned—punishments that were never imposed on men—for the crime of "talking too much." Even among our primate cousins, there's a big difference in the vocal communication of males and females. Female rhesus monkeys, for instance, learn to vocalize much earlier than do males and use every one of the seventeen vocal tones of their species all day long, every day, to communicate with one another. Male rhesus monkeys, by contrast, learn only three to six tones, and once they're adults, they'll go for days or even weeks without vocalizing at all. Sound familiar?

And why do girls go to the bathroom to talk? Why do they spend so much time on the phone with the door closed? They're trading secrets and gossiping to create connection and intimacy with their female peers. They're developing close-knit cliques with secret rules. In these new groups, talking, telling secrets, and gossiping, in fact, often become girls' favorite activities—their tools to navigate and ease the ups and downs and stresses of life.

I could see it in Shana's face. Her mother was complaining that she couldn't get her fifteen-year-old to concentrate on work, or even a conversation about school. Forget keeping her at the table for dinner. Shana had an almost drugged look sitting in my waiting room while she anticipated the next text message from her girlfriend Parker. Shana's grades hadn't been great, and she was becoming a bit of a behavior problem at school, so she wasn't allowed to go over to her friend's. Her mother, Lauren, had also denied her use of the cell phone and the computer, but Shana's reaction to being cut off from her friends was so over the top—she screamed, slammed doors, and started wrecking her room—that Lauren relented and gave her twenty minutes per day on the cell phone to make contact. But since she couldn't talk in private, Shana resorted to text messaging.

There is a biological reason for this behavior. Connecting through talking activates the pleasure centers in a girl's brain. Sharing secrets that have romantic and sexual implications activates those centers even more. We're not talking about a small amount of pleasure. This is huge. It's a major dopamine and oxytocin rush, which is the biggest, fastest neurological reward you can get outside of an orgasm. Dopamine is a neurochemical that stimulates the motivation and pleasure circuits in the brain. Estrogen at puberty increases dopamine and oxytocin production in girls. Oxytocin is a neurohormone that triggers and is triggered by intimacy. When estrogen is on the rise, a teen girl's brain is pushed to make even more oxytocin—and to get even more reinforcement for social bonding. At midcycle, during peak estrogen production, the girl's dopamine and oxytocin level is likely at its highest, too. Not only her verbal output is at its maximum but her urge for intimacy is also peaking. Intimacy releases more oxytocin, which reinforces the desire to connect, and connecting then brings a sense of pleasure and well-being.

Both oxytocin and dopamine production are stimulated by ovarian estrogen at the onset of puberty—and for the rest of a woman's fertile life. This means that teen girls start getting even more pleasure from connecting and bonding—playing with each other's hair, gossiping,

and shopping together—than they did before puberty. It's the same kind of dopamine rush that coke or heroin addicts get when they do drugs. The combination of dopamine and oxytocin forms the biological basis of this drive for intimacy with its stress-reducing effect. If your teenage daughter is constantly talking on the phone or instant-messaging with her friends, it's a girl thing, and it is helping her through stressful social changes. But you don't have to let her impulses dictate your family life. It took Lauren months of negotiation to get Shana to sit through a family dinner without text-messaging the world. Because the teen girl's brain is so well-rewarded for communication, it's a tough habit for you to curb.

Boys Will Be Boys

We know that girls' estrogen levels climb at puberty and flip the switches in their brains to talk more, interact with peers more, think about boys more, worry about appearance more, stress out more, and emoter more. They are driven by a desire for connection with other girls—and with boys. Their dopamine and oxytocin rush from talking and connecting keeps them motivated to seek out these intimate connections. What they don't know is that this is their own special girl reality. Most boys don't share this intense desire for verbal connection, so attempts at verbal intimacy with their male contemporaries can be met with disappointing results. Girls who expect their boyfriends to chat with them the way their girlfriends do are in for a big surprise. Phone conversations can have painful lulls while she waits for him to say something. The best she can often hope for is that he is an attentive listener. She may not realize he's just bored and wants to get back to his video game.

This difference may also be at the core of the major disappointment women feel all their lives with their marriage partners—he doesn't feel like being social, he doesn't crave long talks. But it's not his fault. When he is a teen, his testosterone levels begin soaring off the charts, and he "disappears into adolescence," a phase used by one psychologist

friend of mine to describe why her fifteen-year-old son never wants to talk to her anymore, takes refuge with his buddies in person or online gaming, and visibly cringes at the thought of a family dinner or outing. More than anything, he wants to be left alone in his room.

Why do previously communicative boys become so taciturn and monosyllabic that they verge on autistic when they hit their teens? The testicular surges of testosterone marinate the boys' brains. Testosterone has been shown to decrease talking as well as interest in socializing—except when it involves sports or sexual pursuit. In fact, sexual pursuit and body parts become pretty much obsessions.

So let's not mince words here. Young teen boys are often totally, single-mindedly consumed with sexual fantasies, girls' body parts, and the need to masturbate. Their reluctance to talk to adults comes out of magical thinking that grown-ups will read between their spoken lines and the look in their eyes and know that the subject of sex has taken them over, mind, body, and soul.

A teenage boy feels alone in and ashamed by his thoughts. Until his buddies start to joke and comment about girls' bodies, he thinks he is the only one consumed by such intense sexual fantasies and the constant fear that someone will notice the erections over which he seems to have no control. Compelling masturbatory frenzies overwhelm him many times a day. He lives in fear of being "found out." He's even more wary of verbal intimacy with girls, though he dreams of other kinds of intimacy with them day in and day out. For a few of the teen years, the teen girl brain and the teen boy brain have seriously different priorities when it comes to being close.

Studies indicate that girls are motivated—on a molecular and a neurological level—to ease and even prevent social conflict. Maintaining the relationship at all costs is the female brain's goal. This may be especially true in the teenage female brain.

I remember when my friend Shelley's oldest teenage daughter, Elana, had sleepovers nearly every night with her best friend, Phyllis—and on the nights they didn't, they talked on the phone until they had to go to sleep. They planned their outfits, talked about crushes on boys, and watched TV together over the phone. One day Phyllis started bad-mouthing a less popular girl in class, who had been close friends with Elana in grade school. Her meanness made Elana uncomfortable and angry, but as she thought about confronting Phyllis, her mind and body were seared by a wave of anxiety. It became real to her that if she made even a hint of criticism to Phyllis's face, a fight that would spell the end of the friendship could result. Instead of risking the loss of her friendship with Phyllis, Elana decided to say nothing.

This is a tape that plays in the brain of every woman at the thought of conflict, even a small disagreement. The female brain has a far more negative alert reaction to relationship conflict and rejection than does the male brain. Men often enjoy interpersonal conflict and competition; they even get a positive boost from it. In women, conflict is more likely to set in motion a cascade of negative chemical reactions, creating feelings of stress, upset, and fear. Just the thought that there might be a conflict will be read by the female brain as threatening the relationship, and bring with it the real concern that the next conversation she has with her friend will be their last.

When a relationship is threatened or lost, the bottom drops out of the level of some of the female brain's neurochemicals—such as serotonin, dopamine, and oxytocin (the bonding hormone)—and the stress hormone cortisol takes over. A woman starts feeling anxious, bereft, and fearful of being rejected and left alone. Soon she begins to jones for that good intimacy drug, oxytocin. She gets a feeling of closeness from the flood of oxytocin, which is boosted by social contact. But the minute that social contact is gone and the oxytocin and dopamine bottom out, she's in emotional trouble.

Teen girls begin automatically bonding and practicing these friendship connections during their intimate talks in the school's bathrooms. Biologically, they are reaching optimal fertility. The Stone Age brains within them are flooded with neurochemicals telling them to connect with other women so that they can help protect the young. The primitive brain is saying, "Lose that bond, and both you and your offspring are toast." That's a powerful message. No wonder girls find it unbearably hard to cope with feelings of being left out.

THE BRAIN MARCHES TO THE BEAT OF ESTROGEN'S DRUM

By the time Shana was ten years old, it was harder for Lauren to wake her up for school. Shana started sleeping until noon on weekends. Lauren was sure this sleep pattern reflected Shana's bad habits—she waited until the last minute to finish big projects, and she liked to stay up watching television. Shana was beginning to feel depressed because her mom was calling her a lazy bum all the time, but Shana couldn't see why. She was tired and wanted to sleep. Mother and daughter were locked in battle when I first saw them.

In reality, the sleep cells in Shana's brain had been reset at puberty by her ovarian estrogen surges. Estrogen affects practically everything that a teen girl experiences, including responsiveness to light and the daily light-dark cycle. Estrogen receptors get activated in the brain's twenty-four-hour clock cells in the suprachiasmatic nucleus. These clusters of cells orchestrate the daily, monthly, and annual rhythms of the body, such as those of hormones, body temperature, sleep, and mood. Estrogen even directly influences the brain cells that control breathing. It turns on the uniquely female sleep cycle as well as her growth hormone.

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THE FEMALE BRAIN

By puberty, estrogen sets the timing of everything in the female brain—the female and male brains end up marching to different drummers.

At around age eight to ten for girls—and a year or more later for boys—the brain's sleep clock begins to change its settings, leading to later bedtimes, later wake-up times, and more sleeping time overall. One study showed that at age nine boys' and girls' brains had exactly the same brain waves during sleep. By age twelve girls had a 37 percent shift in their brain waves during sleep compared to boys. The scientists concluded that this indicated that girls' brains mature faster. The pruning of excess synapses in teen girls' brains starts earlier than it does in boys, thus moving them more quickly toward maturation of all their brain circuits. The female brain, on average, matures two to three years earlier than the male brain. A similar condition develops in boys' brains a few years later, but their sleep phase is pushed even an hour later than girls' by the age of fourteen. And this is just the beginning of being out of sync with the opposite sex. Females' tendency to go to sleep and wake up a bit earlier than do males is a difference that will last until after menopause.

I saw Shana and her mother many times over the years. Things became even rockier as Shana got several years into the new rhythm that estrogen was establishing in her brain. It was day twenty-six of her cycle, and Shana wasn't just screaming. She was shrieking. "I am going to the beach tomorrow and there's nothing you can do about it. Just try to stop me."

"No, Shana," Lauren responded, "you're not going with that group of kids. I told you I don't like the fact that they throw around so much money, and I'm pretty sure they're into drugs."

"You don't know what you're talking about. You're a stupid old prude who just doesn't have a life. You never had one. You were ugly and boring and a goody-two-shoes kid. You wouldn't know cool if it smacked you in the face. You can't stand it that I'm smarter than you and cooler than you, and you just want to keep me down. You're a fucking asshole!"

Lauren lost it. For the first time in her life, she slapped her daughter.

it, they were, as she put it, "sucking face." Since she had allowed Shana to be sexually involved with Jeff, Lauren didn't know what to do. It was clear that Shana's impulses were getting out of control.

A girl's emotional centers become highly responsive at puberty. Her brain's emotion- and impulse-control system—the prefrontal cortex—has sprouted many more cells by the age of twelve but the connections are still thin and immature. As a result, a teenage girl's mood changes, resulting in part from the increased emotional impulses blasting in from the amygdala, are more rapid and dramatic. Her prefrontal cortex is like an old dial-up modem receiving signals from broadband. It can't handle the increased traffic from the amygdala, and it often becomes overwhelmed. Teenagers, therefore, often cling to an idea and run with it, not stopping to consider the consequences. They become resentful of any authority that wants to head off their impulses.

My patient Joan, for example, remained in upstate New York the summer after she graduated from boarding school there. An honors student, she had been involved with a local guy who didn't graduate high school, had been in juvenile detention, and at age sixteen had fathered a child. She ran around with him all summer, and when it came time to leave for college, she thought twice about it. She wanted to stay with him. When her parents threatened to come up, take the car, and drag her off to college, she ran away with her boyfriend. She did come to her senses and go to college, but it was a long time before she spoke civilly to her parents again. It's tough for the teen brain to come up with good judgment in these situations.

Remember Romeo and Juliet? If only the two lovers had known that their brain circuits were under major reconstruction. If only they'd known that their sex hormones were causing brain cells to grow and sprout extensions, and that it would take several years to form structurally sound connections once those extensions were plugged into the correct outlets in mature prefrontal cortices. Juliet's brain would have matured two to three years earlier than Romeo's, though—so she may have come to her senses sooner than he. These unfinished—unmyelinated—extension cords, most prominent in the connections

ter of the prefrontal cortex, need to be coated with a substance called myelin that allows for fast conduction before they can function reliably under stress. This may not happen until the late teens or early adult years. Without the fast connection to the prefrontal cortex, big downloads of emotional impulses often result in immediate, raw behaviors and circuit overload.

When it is upset by an unwanted parental restriction such as, "We know you were drinking at the party, and you're too involved with boys, and your grades are going down, so you are grounded," the teen girl amygdala may not respond with much more than "I hate you." But watch out for the subtle signs of rebellion that can ensue. She'll find another way to undermine you.

CHANGING HORMONAL CONDITIONS in girls' brains through the menstrual cycle add even more volatility to the mix. If estrogen and progesterone simply increased during the teen years and remained at that new, higher level, the female brain would permanently readjust. But, as we have seen, these hormones come in waves. Given the fact that the teen brain is undergoing major changes, especially in areas that are particularly sensitive to shifts in hormones, puberty can be an outrageously impulsive time for many girls. Under no stress on a good week of the menstrual cycle, the teen girl's prefrontal cortex may function normally. At those times she may have good judgment and appropriate behavior. But some stress—like a disappointment or a bad grade—on a PMS day may derail the prefrontal cortex, causing an exaggerated emotional response and out-of-control behavior, such as yelling and slamming doors, what at my house we call a meltdown. Testosterone surges in teen boys may have similar brain effects, but these have not been studied yet. Hormone surges at this age can make a mild stress or a seemingly small event feel like a catastrophe.

Calming down the fired up teen girl amygdala can prove difficult. Many girls turn to drugs, alcohol, and food (either they'll stop eating or they'll binge) when they're under stress. As a parent of teens, you have the job of ignoring much of what they say. Don't take any impulsive or emotional tirades seriously. Stay calm. Teens state their intentions—and feel them—with such passion—that you can be persuaded in spite of yourself. Just remember, your teen daughter's impulse-control circuits can't handle the input. Like it or not, you must provide the control while her brain cannot. Even though Joan hated

TEEN GIRL BRAIN

The most obvious cycle controlled by estrogen is the menstrual cycle. The first day a young girl gets her period can be exciting and bewildering. It is a moment to celebrate, not in a New Age, hippie sense but because each month the menstrual cycle refreshes and recharges certain parts of a girl's brain. Estrogen acts as a fertilizer on cells—exciting her brain as well as making a girl more socially relaxed during the first two weeks. There's a 25 percent growth of connections in the hippocampus during weeks one and two (the estrogen phase), and that makes the brain a little bit sharper. It functions a little better. You're clearer and you remember more. You think more quickly and more agilely. Then at ovulation, around day fourteen, progesterone starts squirting out of the ovaries and reversing the actions of estrogen, acting more like weed killer on those new connections in the hippocampus. During the last two weeks of the cycle, progesterone causes the brain to become first more sedated and gradually more irritable, less focused, and then a little slower. This may be one of the pivotal reasons for the change in stress sensitivity during the second half of the menstrual cycle. The extra connections built during the weeks that estrogen is on the rise are being reversed by progesterone in the last two weeks.

In the last few days of the menstrual cycle, when progesterone collapses, this calming effect is abruptly withdrawn, leaving the brain momentarily upset, stressed, and irritable. This is where Shana was when she screamed at her mother. Many women say they cry more easily and often feel out of sorts, stressed, aggressive, negative, hostile, or even hopeless and depressed right before their periods begin. In my clinic we call them the "crying over dog food commercials" days, because even silly, sentimental things can trigger a tearful response during this short time. At first this abrupt mood change takes girls like Shana by surprise. Teens think that all they need to know about the menstrual cycle is to remember their Tampax and take Advil or Aleve for the cramps on the day the blood flow starts. The idea that even when they're not bleeding there could be brain effects from their cycling hormones takes some getting used to. By adulthood, they know

how to handle it. Most women know what it feels like and they see if they still want to act on them.

It took another few days for Shana to realize she should not have spoken to her mother the way she did. And as her progesterone cycled out and her estrogen came back up, her irritability began to wane. Connections were once again sprouting in the hippocampus, and her brain gears were greased and working to full capacity. Pretty soon she was surprising everyone with her wisecracks and smart-alecky remarks, and they were getting her into a bit of trouble—the boys just couldn't keep up at times, and she was riding the edge with the girls. Brain performance in some females can fluctuate with the hormonal changes of the menstrual cycle. One of the most estrogen-sensitive parts of the brain—the hippocampus—is a major relay station for processing memories for words. This may be one biological reason behind women's increased verbal performance during the highest estrogen week—week two—of their cycles. I often joke with my female grad students that they should take their oral exams on day twelve of their cycles, which is the peak of their verbal performance. Maybe the same should go for teen girls and the SATs—or for wives wanting to win a fight with their husbands.

RISK TAKING AND AGGRESSION IN TEEN GIRLS

The day Shana screamed that she wanted to go to the beach, Lauren had been concerned about her daughter's boyfriend, Jeff. Jeff was from a very wealthy and permissive family, and at fifteen, Shana had already had sex with him. Jeff's parents allowed them to do it in their house, a fact Shana had kept hidden from her parents until she had a pregnancy scare. Since Jeff wasn't going away, Lauren decided it was best to get to know him. And the more she did, the more she liked him. Jeff was lavishing Shana with gifts (something Lauren wasn't thrilled about, but she didn't want to hurt his feelings), and Shana was happy when he was around. She made deals with her parents: "Come on, Mom, I'm really stressed out, and if he comes over for an hour I'll feel better. I promise to finish my work after he leaves." She often snuck him back in, and the two were thick as thieves.

Shana had been seeing Jeff for eight months. The day after she told her mom how much she loved him, Shana showed up at home after school with Mike, a boy she had sworn was just a friend. When Lauren went up to check on them, the door was closed. When she opened

her parents for threatening to come and take her car away, "they did the right thing," she told me years later. It was their job to exercise the good judgment that she lacked at that time.

THE BIOLOGY OF MEAN GIRLS

Hormonal surges can turn nice girls mean at the drop of an egg, and so can sexual competition, which is strong—and pivotal—among teenage girls. This competition, however, plays out with a different set of rules than does that among teen boys. Girls are driven to gather in cliques, but there is another side, in which these cliques are at war. Teen girls, we know, can be devastatingly mean. When females are competing with other females, they often use more subtle tools, such as spreading rumors to undermine a rival. This way, they can cover their tracks—"I wasn't trying to be mean. I'm sorry." Such tactics lessen the risk of destroying the bond that the teen girl brain sees as essential to survival. But also essential to survival is sexual competition.

I can remember when I was in seventh grade, there was one girl who was beautiful, and the other girls were very jealous because she got so much attention from the boys. She was also shy, so others assumed she was a snob. One day the not as pretty girl who sat directly behind her in a class took a wad of bubble gum out of her mouth and stuck it in the pretty girl's hair. Unknowingly, the pretty girl began to twist the gum into such a mess that the only way to get it out was to cut off her seductive locks. The queen of mean who put the gum in this girl's hair felt triumphant. Her biological imperative to compete for sexual attractiveness had a momentary victory.

The hormones usually associated with aggression in both males and females are androgens. They begin to rise early in puberty and continue until they peak at age nineteen in females and twenty-one in males. The three main androgens that women make are testosterone, DHEA, and androstenedione (andro-steen-DIE-own). In a study at the University of Utah, the most in-your-face aggressive teenage girls were found to have high levels of the androgen androstenedione. Acne is a good clue that your teen's androgen levels are high. Girls with high levels of testosterone and DHEA also tend to have sexual intercourse earlier. By the time I saw Shana at age fifteen, she not only had

year.

Aggressive impulses can fluctuate with the hormones of the menstrual cycle. During some weeks of the cycle, the teen girl will be more interested in social connection. During other weeks, she'll be more interested in power—over boys and other girls. This association implies that the higher amounts of androgens made by the ovaries during weeks two and three increase aggression levels in women and teens. Less empathy, social connection, and affiliation have been associated with higher androgen levels in both sexes. We can't know for sure, but Shana's higher androgen levels on certain weeks of her cycle may have been triggering her aggressive outbursts.

Not only is aggression reduced when androgen levels are low but sex drive is decreased, too. Teens taking oral contraceptives have reduced aggression and sex drive because the contraceptive suppresses the ovaries, so they make less androgen. Although both men and women make testosterone, men make more than ten times as much—meaning that their sex drive is much greater than women's. Scientists know that it is probably not just androgens that increase aggressive spirit and ambition in women but estrogen, too. In the same study at the University of Utah, women who were the most outspoken and had the highest self-regard also had the highest levels of estrogen, testosterone, and androstenedione. They also ranked themselves above how their peers ranked them. And these young women were routinely rated by others as the most boastful.

Of course, a hormone alone does not cause a behavior. Hormones merely raise the likelihood that under certain circumstances a behavior will occur. And just as there is no one seat of aggression in the brain, there is no one hormone of aggression. But achieving success and attaining power in the world requires some aggression for both sexes. These hormones change teens' reality and perceptions of themselves as sexual, assertive, and independent beings in the world.

During the teen years a girl's brain circuits go through massive growth and pruning. It's as if she is given a whole new set of extension cords and needs to figure out which one to plug into which outlet. The full power of her female brain circuits can now start to be manifested. And where will they push her? Right into the arms of a man.