READING 1

The Adolescent Brain: A Work in Progress

Pat Wolfe

One day your child is cheerful, loving and obedient, comes to you for advice, dresses in clothing you picked out together, and gives you a kiss on the cheek before turning in for the night at 10:00 p.m. Homework is done without nagging and you walk out of the parent/teacher conference beaming with pride.

Then somewhere between ages 10 and 12, a strange thing happens. Almost overnight it appears someone has unzipped your child and put someone else inside; you are living with a stranger. No longer could this child be called sweet and loving; surly and antagonistic would be better descriptors. Gone are the days when you are asked for advice and when you chance to offer it, you can be certain it will be ignored. This kid comes to breakfast in the morning dressed in an outfit to which you would like to pin a note stating, "What this person is wearing to school today is not my idea of good taste!" Your teen spends hours on the computer, but homework doesn't get done and you now dread school conferences.

It doesn't take a brain scientist to tell you that living with an adolescent can be a frustrating experience. However, brain scientists are beginning to shed light on why these teens are the way they are. Interestingly, the new information focuses not only on the oft-blamed raging hormones, but on what's going on above the neck as well. Many of the new insights into the adolescent brain have been gained using recently developed brain-imaging techniques that allow scientists to obtain a look at what is going on inside the brain. What they are seeing is that the teen years are a time of significant change in the activity, anatomy, and neurochemistry of the brain.

What Changes Are Going On in There?

Scientists have known for some time that the brain grows by expanding and pruning the connections between cells, keeping the connections that are used the most and getting rid of the unused ones. They have also known that one of the most active periods of reorganization occurs early in life. Around two years of age, a huge buildup of neural connections occurs in the child's brain. This is followed by a massive pruning which allows the strongest and most efficient connections to function more effectively. The often erratic behavior of the child during this period reflects the changes taking place in the brain. The phrase "the terrible twos" sums up the challenges parents face in dealing with the young child.

Until quite recently, scientists assumed that this period of growth and winnowing away occurs only in early childhood and that most, if not all, of the major changes in brain organization and development occurred before adolescence. This view seemed reasonable in the light of the fact that the brain reaches its full size by puberty. The conventional wisdom has been that the adolescent brain is fully developed and functions similarly to an adult brain. This turns out—as many middle school teachers and parents already suspected—not to be the case. Instead, it appears that very complex changes take place in the brain during adolescence and that the brain is not fully "installed" until perhaps age 20. The brain is still developing during the teen years!

The Growth Spurt and Pruning

In what parts of the adolescent brain are the greatest changes occurring? A central area of focus has been the part of the brain located behind the forehead, called the frontal lobes. A long-range study by Jay Giedd and his colleagues at the National Institutes of Mental Health (NIMH) has involved using functional Magnetic Resonance Imaging (fMRI) to scan the brains of nearly 1,000 healthy

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children and adolescents ages 3 to 18. Giedd discovered that just prior to puberty, between ages 9 and 10, the frontal lobes undergo a second wave of reorganization and growth. This growth appears to represent millions of new synapses (connections between the brain cells) that process information. Then, around age 11, a massive pruning of these connections takes place, which isn't complete until early adulthood. Although it may seem like the more synapses the better, the brain actually consolidates learning by pruning away connections. The brain is getting rid of the least-used pathways, a method for ensuring that the most useful synapses are maintained, which, in turn, allows the brain to operate more efficiently.

Myelination During Adolescence

In addition to the winnowing of connections in the frontal lobes of the adolescent brain, another developmental factor is also at play. One of the final steps in developing an adult brain is the coating of nerves with a fatty material called myelin. This myelin sheath wraps around the axons of brain cells (neurons) and allows electrical impulses to travel faster and more efficiently. Before neurons receive their myelin sheath, they are considered immature and don't function well, but after myelination, the neurons are mature and ready to fulfill their designated functions more efficiently. This is one reason why a toddler is less coordinated than a 9-year-old. Myelin develops in the more primitive areas of the brain first, then gradually moves to the higher-level functioning areas. It is not surprising, then, to find that the frontal lobes mature last. Researchers at the University of California at Los Angeles compared scans of young adults, ages 23–30, with those of teens, ages 12–16, looking for signs of myelin, which would imply more mature, efficient connections. As expected, the frontal lobes in teens showed less myelination than those of the young adults. This is the last part of the brain to mature: full myelination is probably not reached until around age 20.

The CEO of the Brain

Why are these changes in the frontal lobes significant? The frontal lobes—specifically the area right behind the forehead, called the prefrontal or orbitofrontal cortex—have been called the CEO of the brain. It is in this part of the brain that executive decisions are made and ethical/moral behavior seems to be mediated. In fact, this part of the brain has been dubbed "the area of sober second thought." Persons with damage to this part of the brain often know what they are supposed to do but are unable to do it. The prefrontal cortex is responsible for many functions, such as the ability to make sound judgments, goal and priority setting, planning and organization of multiple tasks, impulse inhibition, self-control, and emotional control. These functions are practically a laundry list of characteristics that adolescents often lack. Researchers suspect that an unfinished prefrontal cortex with its excess of synapses and unfinished myelination contributes to adolescents' deficits in these areas. Their brains simply aren't ready to take on the role of the CEO, resulting in a lack of reasoned thinking and performance.

Emotion Holds Sway

There is yet another part of the brain that is going through change during the adolescent years. Deep in the center of the brain is a group of structures—sometimes called the limbic area—that mediate emotion. One of the major structures of this area is the amygdala, a small almond-shaped structure that plays a major role in instinctive emotional reactions, including the "fight or flight" response. This is the structure that engages and allows us to react quickly when we are faced with a dangerous situation. It takes precedence over thoughtful reflection—which you don't want when faced with a car speeding toward you or a snarling dog leaping at you!

A team led by Dr. Deborah Yurgelun-Todd at Harvard's McLean Hospital has used functional Magnetic Resonance Imaging (fMRI) to compare the activity of adolescent brains to those of adults. They found that when processing emotion, adolescents have lower activity in their frontal lobes and more activity in the amygdala than adults. Yurgelun-Todd asked teenagers and adults to view photographs of people's faces contorted with fear and to identify the emotion being expressed.

Adults had no difficulty correctly identifying the emotion; many teens, however, were unsuccessful. The images produced by the fMRI during this task showed activity in both the prefrontal cortex and the amygdala of the adult brains. The adolescent brains, on the other hand, showed almost no activity in the prefrontal cortex and a great deal of activity in the amygdala and surrounding emotional centers.

The results of this study suggest two things. One is that adolescents may not be nearly as good as we think they are at reading social signals such as facial expressions—even though they seem to do almost nothing but socialize. This may explain why adolescents often pay little attention to adults' warnings about inappropriate or risk-taking behavior. They may be misunderstanding the emotions of adults, which can lead to miscommunication in terms of what the teen thinks the adult is feeling.

The second thing the research suggests is that in the teen brain, the emotional center often holds sway over the rational prefrontal cortex. Realizing that the prefrontal cortex allows reflection while the amygdala is designed for reaction, we can begin to understand the often irrational and overly emotional reactions of teens. Our oft-asked question when teens engage in irrational behavior—"What were you thinking?"—is difficult for teens to answer because in many cases they weren't thinking reflectively, they were impulsively reacting. The good news is that as they grow older, their brain activity tends to shift to the frontal lobes and theoretically this results in more reasoned judgment and performance.

Substance Abuse and the Adolescent Brain

Now that it has become clear that, in contrast to previously held assumptions, there is a tremendous amount of change taking place in the teen brain, we need to look at the probability that alcohol and perhaps other drugs impact both brains and behavior differently in adolescents and adults. The shaping and fine-tuning of the frontal lobes is, at least in part, mediated by experience. This raises the possibility that drug abuse could alter normal development of the brain. This is an area of critical importance. Current estimates suggest that roughly 50 percent of high school seniors consume alcohol at least once a month while 17 percent regularly smoke cigarettes and nearly 50 percent have smoked some marijuana (Kann et al., 2000; Johnston et al., 2001).

Alcohol's Effects on the Brain

Much of the research on the effects of alcohol has been conducted using animal studies. In studies of rats, Markwiese et al. (1998) found that alcohol disrupts the activity of an area of the brain essential for memory and learning, the hippocampus, and that this area is much more vulnerable to alcohol-induced learning impairments in adolescent rats than adult rats. Rats are not humans; however, there is some evidence that the human hippocampus reacts in a similar manner. A recent study by De Bellis et al. (2000) found that hippocampal volumes were smaller in those who abused alcohol during adolescence and that the longer one abused alcohol, the smaller the hippocampus became.

Research by Sandra Brown and colleagues at the University of California, San Diego has produced the first concrete evidence that heavy, ongoing alcohol use by adolescents can impair brain functioning. They found several differences in memory function between alcohol-dependent and nondrinking adolescents, none of whom used any other drugs. In the study, the 15- and 16-year-olds who had drunk heavily (more than 100 lifetime alcohol use episodes) scored lower on verbal and nonverbal retention of information.

Additional research by Brown and Tappert (2000) is trying to answer whether or not heavy drinking at age 15 is more dangerous for the brain than at age 20. Their preliminary hypothesis is that drinking may be more dangerous because the finishing touches on brain development (myelination and pruning) haven't been completed and alcohol may interrupt or disturb these refining processes. Brown and Tappert point out that more studies will be needed to produce a definitive answer, but at least their work is an important step toward confirming what many scientists have suspected for some time: teenagers who drink may be exposing their brains to the toxic effects of alcohol during a critical time in brain development.

Nicotine

Not only are the frontal lobes of adolescents going through major changes, the molecular and chemical systems are being reshifted as well. Many substances appear to have a heightened effect on teens. Researchers at Duke University found that adolescent brains respond more intensely to nicotine than do adult brains. In rat brains, the levels of dopamine receptors in the pleasure center (the nucleus accumbens) of the brain increase dramatically between 25 and 40 days—the rat's adolescent phase (Spears, 2000). These receptors play a huge role in the pleasure-producing properties of drugs. It is not yet clear if the adolescent brain evidences this same increase, but many researchers think it is highly probable.

Adolescent Sleep Patterns Are Different

A common complaint of parents of teenagers is that their kids insist they can't fall asleep until midnight, but every morning means yelling at them to get out of bed in time to get to school on time. And parents aren't the only ones with complaints about adolescents' sleep habits. Teachers of early morning classes complain that their students seem to be in class in body only, frequently nodding off or, at the least, drowsy and difficult to teach. It may not be the teens' fault; biology may be behind their sleep problems. Recent research has shown that here is yet another area where adolescents' brains move to the beat of a different drummer.

Our sleep cycles are determined by what are called circadian rhythms, a sort of internal biological clock that determines not only how much sleep we need but also when we become sleepy at night and when we awaken in the morning. Sleep researcher Mary Carskadon, in her sleep laboratory at Brown University's Bradley Hospital, has discovered that teenagers need more sleep than they did as children and that their circadian rhythms appear to be set later than those of children or adults.

The conventional wisdom has been that young children need 10 hours of sleep and that as we become adults, the need decreases to 8 hours. Teenagers have been included in the adult group. Carskadon has shown that teens, far from needing less sleep than they did as children, need more. In order to function well and remain alert during the day, they need 9 hours and 15 minutes, possibly because the hormones that are critical to growth and sexual maturation are released mostly during sleep. One survey of the sleep patterns of 3,000 teenagers showed that the majority slept only about 7 hours a night, with more than a quarter averaging 6 hours or fewer on school nights. Given that sleep is a time when brain cells replenish themselves and when connections made during the day are strengthened, sleep deprivation can have a major negative effect on learning and memory.

A second finding from Carskadon's research is that these teens' biological clocks appear to be set later than those of children or adults. They do not get sleepy as early as they did when they were preadolescents and, therefore, tend to stay up later at night and sleep later in the morning. Most teenagers' brains aren't ready to wake up until 8 or 9 in the morning, well past the time when the first bell has sounded at most high schools. Teens who have to get up before their internal clock buzzes miss out on an important phase of REM sleep that is important for memory and learning.

Armed with this research, some school districts are experimenting with later school starts at the secondary level, and the initial results are positive. (The results of a school start time study involving 17 districts in the Minneapolis-St. Paul area can be found on the Internet at http://education.umn.edu/CAREI/Programs/start_time/2001exec_sum.html. Changing the start time is difficult in many communities for various reasons, so what can teenagers do to cope? The National Sleep Foundation offers the following advice:

1. Stay away from caffeine and nicotine after noon. Also avoid alcohol, which can disrupt sleep.
2. Heavy studying or playing computer games before bed is arousing, as is trying to sleep with a computer or TV flickering in the room.
3. Avoid bright light in the evening, but open blinds or turn on lights as soon as the morning alarm sounds, to start the body's awakening cycle.
4. Sleeping more than two or three hours later on weekends than weekdays can disrupt the body clock even more, making getting up on Monday morning harder.

Some Cautions and Implications

Not all scientists agree with the research on the adolescent brain. Giedd's theory that brain changes are responsible for the often erratic behavior we see in teens is speculative. The theory is controversial because the roots of behavior are complex and cannot be easily explained by relatively superficial changes in the brain. However, if the theory turns out to be true, it would underscore the importance of providing careful guidance through adolescence, which isn't a bad idea in any case. Giedd states ". . . unlike infants, whose brain activity is completely determined by their parents and environment, the teens may actually be able to control how their own brains are wired and sculpted."

Adolescents are laying down neural foundations for the rest of their lives. As parents and teachers, we have an opportunity and an obligation to educate adolescents about what is going on in their brains and the role they play in determining the structure and functioning of their brains for the rest of their lives.

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READING 2

What Makes Teens Tick

Claudia Wallis

A flood of hormones, sure. But also a host of structural changes in the brain. Can those explain the behaviors that make adolescence so exciting—and so exasperating?

Five young men in sneakers and jeans troop into a waiting room at the National Institutes of Health Clinical Center in Bethesda, Md., and drape themselves all over the chairs in classic collapsed-teenager mode, trailing backpacks, a CD player and a laptop loaded with computer games. It's midafternoon, and they are, of course, tired, but even so their presence adds a jangly, hormonal buzz to the bland, institutional setting. Fair-haired twins Corey and Skyler Mann, 16, and their burlier big brothers Anthony and Brandon, 18, who are also twins, plus eldest brother Christopher, 22, are here to have their heads examined. Literally. The five brothers from Orem, Utah, are the latest recruits to a giant study that's been going on in this building since 1991. Its goal: to determine how the brain develops from childhood into adolescence and on into early adulthood.

It is the project of Dr. Jay Giedd (pronounced *Geed*), chief of brain imaging in the child psychiatry branch at the National Institute of Mental Health. Giedd, 43, has devoted the past 13 years to peering inside the heads of 1,800 kids and teenagers using high-powered magnetic resonance imaging (MRI). For each volunteer, he creates a unique photo album, taking MRI snapshots every two years and building a record as the brain morphs and grows. Giedd started out investigating the developmental origins of attention-deficit/hyperactivity disorder (ADHD) and autism ("I was going alphabetically," he jokes) but soon discovered that so little was known about how the brain is supposed to develop that it was impossible to figure out where things might be going wrong. In a way, the vast project that has become his life's work is nothing more than an attempt to establish a gigantic control group. "It turned out that normal brains were so interesting in themselves," he marvels. "And the adolescent studies have been the most surprising of all."

Before the imaging studies by Giedd and his collaborators at UCLA, Harvard, the Montreal Neurological Institute and a dozen other institutions, most scientists believed the brain was largely a finished product by the time a child reached the age of 12. Not only is it full-grown in size, Giedd explains, but "in a lot of psychological literature, traced back to [Swiss psychologist Jean] Piaget, the highest rung in the ladder of cognitive development was about age 12—formal operations." In the past, children entered initiation rites and started learning trades at about the onset of puberty. Some theorists concluded from this that the idea of adolescence was an artificial construct, a phenomenon invented in the post–Industrial Revolution years. Giedd's scanning studies proved what every parent of a teenager knows: not only is the brain of the adolescent far from mature, but both gray and white matter undergo extensive structural changes well past puberty. "When we started," says Giedd, "we thought we'd follow kids until about 18 or 20. If we had to pick a number now, we'd probably go to age 25."

Now that MRI studies have cracked open a window on the developing brain, researchers are looking at how the newly detected physiological changes might account for the adolescent behaviors so familiar to parents: emotional outbursts, reckless risk taking and rule breaking, and the impassioned pursuit of sex, drugs and rock 'n' roll. Some experts believe the structural changes seen at adolescence may explain the timing of such major

Source: "What Makes Teens Tick," by C. Wallis, May 10, 2004, *Time, 163*(19), 57–65.

mental illnesses as schizophrenia and bipolar disorder. These diseases typically begin in adolescence and contribute to the high rate of teen suicide. Increasingly, the wild conduct once blamed on "raging hormones" is being seen as the by-product of two factors: a surfeit of hormones, yes, but also a paucity of the cognitive controls needed for mature behavior.

In recent years, Giedd has shifted his focus to twins, which is why the Manns are such exciting recruits. Although most brain development seems to follow a set plan, with changes following cues that are preprogrammed into genes, other, subtler changes in gray matter reflect experience and environment. By following twins, who start out with identical—or, in fraternal twins, similar—programming but then diverge as life takes them on different paths, he hopes to tease apart the influences of nature and nurture. Ultimately, he hopes to find, for instance, that Anthony Mann's plan to become a pilot and Brandon's to study law will lead to brain differences that are detectable on future MRIs. The brain, more than any other organ, is where experience becomes flesh.

Throughout the afternoon, the Mann brothers take turns completing tests of intelligence and cognitive function. Between sessions they occasionally needle one another in the waiting room. "If the other person is in a bad mood, you've got to provoke it," Anthony asserts slyly. Their mother Nancy Mann, a sunny paragon of patience who has three daughters in addition to the five boys, smiles and rolls her eyes.

Shortly before 5 p.m., the Manns head downstairs to the imaging floor to meet the magnet. Giedd, a trim, energetic man with a reddish beard, twinkly blue eyes and an impish sense of humor, greets Anthony and tells him what to expect. He asks Anthony to remove his watch, his necklace and a high school ring, labeled KEEPER. Does Anthony have any metal in his body? Any piercings? Not this clean-cut, soccer-playing Mormon. Giedd tapes a vitamin E capsule onto Anthony's left cheek and one in each ear. He explains that the oil-filled capsules are opaque to the scanner and will define a plane on the images, as well as help researchers tell left from right. The scanning will take about 15 minutes, during which Anthony must lie completely still. Dressed in a red sweat shirt, jeans and white K-Swiss sneakers, he stretches out on the examining table and slides his head into the machine's giant magnetic ring.

MRI, Giedd points out, "made studying healthy kids possible" because there's no radiation involved. (Before MRI, brain development was studied mostly by using cadavers.) Each of the Mann boys will be scanned three times. The first scan is a quick survey that lasts one minute. The second lasts two minutes and looks for any damage or abnormality. The third is 10 minutes long and taken at maximum resolution. It's the money shot. Giedd watches as Anthony's brain appears in cross section on a computer screen. The machine scans 124 slices, each as thin as a dime. It will take 20 hours of computer time to process the images, but the analysis is done by humans, says Giedd. "The human brain is still the best at pattern recognition," he marvels.

Some people get nervous as the MRI machine clangs noisily. Claustrophobes panic. Anthony, lying still in the soul of the machine, simply falls asleep.

Construction Ahead

One reason scientists have been surprised by the ferment in the teenage brain is that the brain grows very little over the course of childhood. By the time a child is 6, it is 90% to 95% of its adult size. As a matter of fact, we are born equipped with most of the neurons our brain will ever have—and that's fewer than we have in utero. Humans achieve their maximum brain-cell density between the third and sixth month of gestation—the culmination of an explosive period of prenatal neural growth. During the final months before birth, our brains undergo a dramatic pruning in which unnecessary brain cells are eliminated. Many neuroscientists now believe that autism is the result of insufficient or abnormal prenatal pruning.

What Giedd's long-term studies have documented is that there is a second wave of proliferation and pruning that occurs later in childhood and

that the final, critical part of this second wave, affecting some of our highest mental functions, occurs in the late teens. Unlike the prenatal changes, this neural waxing and waning alters not the number of nerve cells but the number of connections, or synapses, between them. When a child is between the ages of 6 and 12, the neurons grow bushier, each making dozens of connections to other neurons and creating new pathways for nerve signals. The thickening of all this gray matter—the neurons and their branchlike dendrites—peaks when girls are about 11 and boys 12½, at which point a serious round of pruning is under way. Gray matter is thinned out at a rate of about 0.7% a year, tapering off in the early 20s. At the same time, the brain's white matter thickens. The white matter is composed of fatty myelin sheaths that encase axons and, like insulation on a wire, make nerve-signal transmissions faster and more efficient. With each passing year (maybe even up to age 40) myelin sheaths thicken, much like tree rings. During adolescence, says Giedd, summing up the process, "you get fewer but faster connections in the brain." The brain becomes a more efficient machine, but there is a trade-off: it is probably losing some of its raw potential for learning and its ability to recover from trauma.

Most scientists believe that the pruning is guided both by genetics and by a use-it-or-lose-it principle. Nobel prizewinning neuroscientist Gerald Edelman has described that process as "neural Darwinism"—survival of the fittest (or most used) synapses. How you spend your time may be critical. Research shows, for instance, that practicing piano quickly thickens neurons in the brain regions that control the fingers. Studies of London cab drivers, who must memorize all the city's streets, show that they have an unusually large hippocampus, a structure involved in memory. Giedd's research suggests that the cerebellum, an area that coordinates both physical and mental activities, is particularly responsive to experience, but he warns that it's too soon to know just what drives the buildup and pruning phases. He's hoping his studies of twins will help answer such questions: "We're looking at what they eat, how they spend their time—is it video games or sports? Now the fun begins," he says.

No matter how a particular brain turns out, its development proceeds in stages, generally from back to front. Some of the brain regions that reach maturity earliest—through proliferation and pruning—are those in the back of the brain that mediate direct contact with the environment by controlling such sensory functions as vision, hearing, touch and spatial processing. Next are areas that coordinate those functions: the part of the brain that helps you know where the light switch is in your bathroom even if you can't see it in the middle of the night. The very last part of the brain to be pruned and shaped to its adult dimensions is the prefrontal cortex, home of the so-called executive functions—planning, setting priorities, organizing thoughts, suppressing impulses, weighing the consequences of one's actions. In other words, the final part of the brain to grow up is the part capable of deciding, I'll finish my homework and take out the garbage, and then I'll IM my friends about seeing a movie.

"Scientists and the general public had attributed the bad decisions teens make to hormonal changes," says Elizabeth Sowell, a UCLA neuroscientist who has done seminal MRI work on the developing brain. "But once we started mapping where and when the brain changes were happening, we could say, Aha, the part of the brain that makes teenagers more responsible is not finished maturing yet."

Raging Hormones

Hormones, however, remain an important part of the teen-brain story. Right about the time the brain switches from proliferating to pruning, the body comes under the hormonal assault of puberty. (Research suggests that the two events are not closely linked because brain development proceeds on schedule even when a child experiences early or late puberty.) For years, psychologists attributed the intense, combustible emotions and unpredictable behavior of teens to this biochemical onslaught. And new research adds fresh support. At puberty, the ovaries and testes begin to pour estrogen and testosterone into the bloodstream, spurring the development of the reproductive system, causing hair to sprout in the armpits and groin, wreaking

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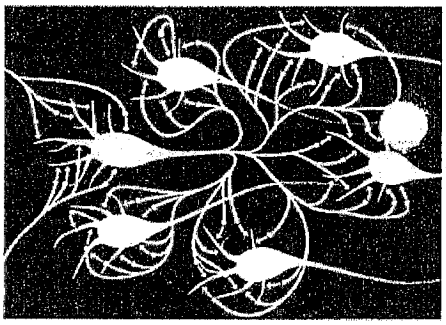
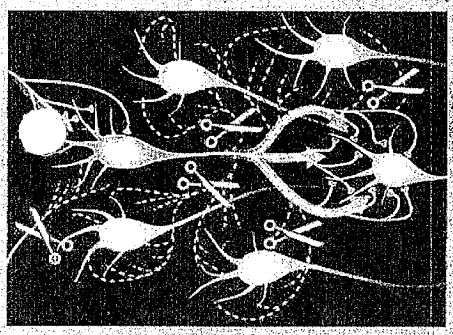
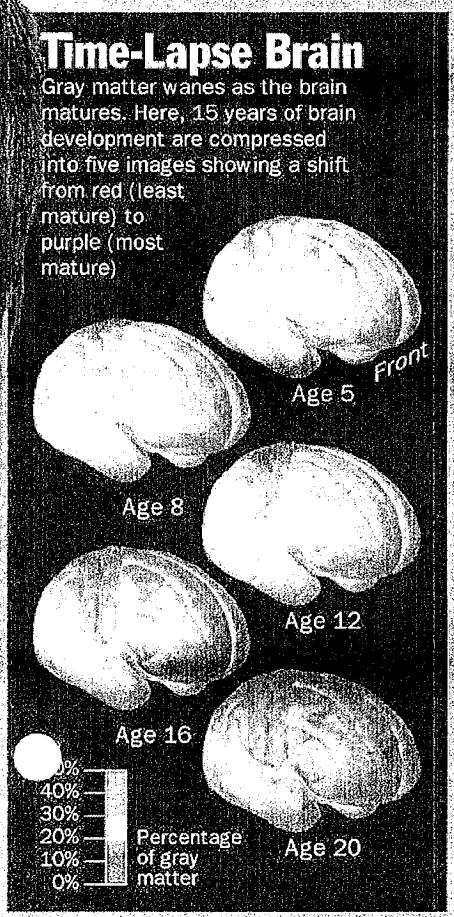



Parietal lobe
Corpus callosum
Basal ganglia
Temporal lobe





havoc with the skin, and shaping the body to its adult contours. At the same time, testosterone-like hormones released by the adrenal glands, located near the kidneys, begin to circulate. Recent discoveries show that these adrenal sex hormones are extremely active in the brain, attaching to receptors everywhere and exerting a direct influence on serotonin and other neurochemicals that regulate mood and excitability.

The sex hormones are especially active in the brain's emotional center—the limbic system. This creates a "tinderbox of emotions," says Dr. Ronald Dahl, a psychiatrist at the University of Pittsburgh. Not only do feelings reach a flash point more easily, but adolescents tend to seek out situations where they can allow their emotions and passions to run wild. "Adolescents are actively looking for experiences to create intense feelings," says Dahl. "It's a very important hint that there is some particular hormone-brain relationship contributing to the appetite for thrills, strong sensations and excitement." This thrill seeking may have evolved to promote exploration, an eagerness to leave the nest and seek one's own path and partner. But in a world where fast cars, illicit drugs, gangs and dangerous liaisons beckon, it also puts the teenager at risk.

That is especially so because the brain regions that put the brakes on risky, impulsive behavior are still under construction. "The parts of the brain responsible for things like sensation seeking are getting turned on in big ways around the time of puberty," says Temple University psychologist Laurence Steinberg. "But the parts for exercising judgment are still maturing throughout the course of adolescence. So you've got this time gap between when things impel kids toward taking risks early in adolescence, and when things that allow people to think before they act come online. It's like turning on the engine of a car without a skilled driver at the wheel."

Dumb Decisions

Increasingly, psychologists like Steinberg are trying to connect the familiar patterns of adolescents' wacky behavior to the new findings about their evolving brain structure. It's not always easy to do. "In all likelihood, the behavior is changing because the brain is changing," he says. "But that is still a bit of a leap." A critical tool in making that leap is functional magnetic resonance imaging (fMRI). While ordinary MRI reveals brain structure, fMRI actually shows brain activity while subjects are doing assigned tasks.

At McLean Hospital in Belmont, Mass., Harvard neuropsychologist Deborah Yurgelun-Todd did an elegant series of FMRI experiments in which both kids and adults were asked to identity the emotions displayed in photographs of faces. "In doing these tasks," she says, "kids and young adolescents rely heavily on the amygdala, a structure in the temporal lobes associated with emotional and gut reactions. Adults rely less on the amygdala and more on the frontal lobe, a region associated with planning and judgment." While adults make few errors in assessing the photos, kids under 14 tend to make mistakes. In particular, they identify

Source: Wallis, C., "What Makes Teens Tick" © 2004 TIME Inc. reprinted by permission.

fearful expressions as angry, confused or sad. By following the same kids year after year, Yurgelun-Todd has been able to watch their brain-activity pattern—and their judgment—mature. Fledgling physiology, she believes, may explain why adolescents so frequently misread emotional signals, seeing anger and hostility where none exists. Teenage ranting ("That teacher hates me!") can be better understood in this light.

At Temple University, Steinberg has been studying another kind of judgment: risk assessment. In an experiment using a driving-simulation game, he studies teens and adults as they decide whether to run a yellow light. Both sets of subjects, he found, make safe choices when playing alone. But in group play, teenagers start to take more risks in the presence of their friends, while those over age 20 don't show much change in their behavior. "With this manipulation," says Steinberg, "we've shown that age differences in decision making and judgment may appear under conditions that are emotionally arousing or have high social impact." Most teen crimes, he says, are committed by kids in packs.

Other researchers are exploring how the adolescent propensity for uninhibited risk taking propels teens to experiment with drugs and alcohol. Traditionally, psychologists have attributed this experimentation to peer pressure, teenagers' attraction to novelty and their roaring interest in loosening sexual inhibitions. But researchers have raised the possibility that rapid changes in dopamine-rich areas of the brain may be an additional factor in making teens vulnerable to the stimulating and addictive effects of drugs and alcohol. Dopamine, the brain chemical involved in motivation and in reinforcing behavior, is particularly abundant and active in the teen years.

Why is it so hard to get a teenager off the couch and working on that all important college essay? You might blame it on their immature nucleus accumbens, a region in the frontal cortex that directs motivation to seek rewards. James Bjork at the National Institute on Alcohol Abuse and Alcoholism has been using fMRI to study motivation in a challenging gambling game. He found that teenagers have less activity in this region than adults do. "If adolescents have a motivational deficit, it may mean that they are prone to engaging in behaviors that have either a really high excitement factor or a really low effort factor, or a combination of both." Sound familiar? Bjork believes his work may hold valuable lessons for parents and society. "When presenting suggestions, anything parents can do to emphasize more immediate payoffs will be more effective," he says. To persuade a teen to quit drinking, for example, he suggests stressing something immediate and tangible—the danger of getting kicked off the football team, say—rather than a future on skid row.

Persuading a teenager to go to bed and get up on a reasonable schedule is another matter entirely. This kind of decision making has less to do with the frontal lobe than with the pineal gland at the base of the brain. As nighttime approaches and daylight recedes, the pineal gland produces melatonin, a chemical that signals the body to begin shutting down for sleep. Studies by Mary Carskadon at Brown University have shown that it takes longer for melatonin levels to rise in teenagers than in younger kids or in adults, regardless of exposure to light or stimulating activities. "The brain's program for starting nighttime is later," she explains.

Pruning Problems

The new discoveries about teenage brain development have prompted all sorts of questions and theories about the timing of childhood mental illness and cognitive disorders. Some scientists now believe that ADHD and Tourette's syndrome, which typically appear by the time a child reaches age 7, may be related to the brain proliferation period. Though both disorders have genetic roots, the rapid growth of brain tissue in early childhood, especially in regions rich in dopamine, "may set the stage for the increase in motor activities and tics," says Dr. Martin Teicher, director of developmental biopsychiatry research at McLean Hospital. "When it starts to prune in adolescence, you often see symptoms recede."

Schizophrenia, on the other hand, makes its appearance at about the time the prefrontal cortex is getting pruned. "Many people have speculated

Rules for Parents

Drawing on the latest scientific studies of adolescents, Laurence Steinberg, a professor of psychology at Temple University, offers this advice for the parents of teens:

1. What you do matters. Many parents mistakenly believe that by the time children have become teenagers, there's nothing more a parent can do. Wrong. Studies clearly show that good parenting continues to help teenagers develop in healthy ways, stay out of trouble, and do well in school.

2. You can't be too loving. Don't hold back when it comes to pouring on the praise and showing physical affection. There is no evidence that adolescents are harmed by having parents who are unabashedly loving—as long as you don't embarrass them in front of their friends.

3. Stay involved. Many parents who were actively involved in their child's life during the early years withdraw when their child becomes a teenager. This is a mistake. It's just as important for you to be involved now—maybe even more so. Participate in school programs. Get to know your child's friends. Spend time together.

4. Adapt your parenting. Many parenting strategies that work at one age stop working at the next stage of development. As children get older, for example, their ability to reason improves dramatically, and they will challenge you if what you are asking doesn't make sense.

5. Set limits. The most important thing children need from their parents is love, but a close second is structure. Even teenagers need rules and limits. Be firm but fair. Relax your rules bit by bit as your child demonstrates more maturity. If he or she can't handle the freedom, tighten the reins and try again in a few months.

6. Foster independence. Many parents erroneously equate their teenager's drive for independence with rebelliousness, disobedience or disrespect. It's healthy for adolescents to push for autonomy. Give your children the psychological space they need to learn to be self-reliant, and resist the temptation to micromanage.

7. Explain your decisions. Good parents have expectations, but in order for your teenager to live up to them, your rules and decisions have to be clear and appropriate. As your child becomes more adept at reasoning, it's no longer good enough to say "Because I said so."

Laurence Steinberg's most recent book is *The 10 Basic Principles of Good Parenting (Simon & Schuster).*

Source: Steinberg, L, "7 Rules for Parents," 2004. Used with permission.

that schizophrenia may be due to an abnormality in the pruning process," says Teicher. "Another hypothesis is that schizophrenia has a much earlier, prenatal origin, but as the brain prunes, it gets unmasked." MRI studies have shown that while the average teenager loses about 15% of his cortical gray matter, those who develop schizophrenia lose as much as 25%.

What's A Parent To Do?

Brain scientists tend to be reluctant to make the leap from the laboratory to real-life, hard-core teenagers. Some feel a little burned by the way earlier neurological discoveries resulted in Baby Einstein tapes and other marketing schemes that misapplied their science. It is clear, however, that there are implications in the new research for parents, educators and lawmakers.

In light of what has been learned, it seems almost arbitrary that our society has decided that a young American is ready to drive a car at 16, to vote and serve in the Army at 18 and to drink alcohol at 21. Giedd says the best estimate for when the brain is truly mature is 25, the age at which you can rent a car. "Avis must have some pretty sophisticated neuroscientists," he jokes. Now that we have scientific evidence that the adolescent brain is not quite up to scratch, some legal scholars and child advocates argue that minors should never be tried

as adults and should be spared the death penalty. Last year, in an official statement that summarized current research on the adolescent brain, the American Bar Association urged all state legislatures to ban the death penalty for juveniles. "For social and biological reasons," it read, "teens have increased difficulty making mature decisions and understanding the consequences of their actions."

Most parents, of course, know this instinctively. Still, it's useful to learn that teenage behavior is not just a matter of willful pigheadedness or determination to drive you crazy—though these, too, can be factors. "There's a debate over how much conscious control kids have," says Giedd, who has four "teenagers in training" of his own. "You can tell them to shape up or ship out, but making mistakes is part of how the brain optimally grows." It might be more useful to help them make up for what their brain still lacks by providing structure, organizing their time, guiding them through tough decisions (even when they resist) and applying those time-tested parental virtues: patience and love.

—With reporting by Alice Park/New York

READING 3

Moving Your School to Brain Compatibility

Wayne Jennings and Joan Caulfield

Three key features characterize this empowering, systems approach to learning:

1. Brain-based curriculum and teaching methods.
2. Advisor programs and personal learning plans.
3. Partnerships with home, businesses, agencies, and postsecondary education.

Each of these is described separately but all work interactively as a system to create a powerful model of schooling for youth.

Brain-Based Curriculum and Teaching Methods

The educational approach is brain compatible. This means that learning accelerates when students receive great amounts of input and mental stimulation and have many opportunities to learn by doing, inquiring, discovering, and performing. Learning must be active and engaging, and provide for immediate application. Brain-based education, a systemic approach, encompasses many practices to advance permanent learning.

Experiential learning and learning by application engage the energy and enthusiasm of youth. Examples include community service projects, working with a mentor from the community, serving apprenticeships, preparing television or theatrical presentations, researching a topic or problem, peer teaching, cross-age tutoring, coaching, adventure and challenge activities, using technology, establishing democratic classrooms and school organizations, and using a curriculum that is interdisciplinary and addresses the academic, career, cultural, and personal needs of every student.

Brain-based learning provides for rapid, deep, and satisfying learning. Its key elements are

1. Providing the brain with massive amounts of input. The brain is starved for input in most classrooms, hence is idle, daydreams, or resists. Input is accomplished by immersing students in issues, using real-world projects, field trips, speakers, and many kinds of media.
2. Giving youth many opportunities and challenges to apply learning or providing experiential learning projects. In most school settings, students are like race cars at the starting line, energized and ready to go. But the flag never falls, so they sit and wait. Students need to be given responsibility, encouraged to tackle new tasks, involved in complex projects and interdisciplinary, life-linked studies—in short, to learn by doing. Teachers need to listen to youth and take into account their ideas and interests as beginning and important points to complex societal issues.
3. Providing feedback to help students understand how they are doing in the course of real-world learning. The feedback must be immediate and helpful. Most classrooms give little individualized feedback beyond test scores and grades. Students need coaching and suggestions. They want to receive peer reactions and see the results of their efforts in important endeavors, such as writing a real letter or teaching a younger child arithmetic.
4. Providing a safe, secure setting free from threat. The brain, in effect, downshifts under threat and overloads from emotional stress. Learning conditions must not result in fear of ridicule, for example. Students must be able to test their skills at real tasks in a safe, noncritical environment.

In short, for maximum and permanent learning, content and methods must be meaningful, provide

Source: From "Moving Your School to Brain Compatibility," by W. Jennings and J. Caulfield, 1997, *The Networker*, 9(2), 5.

for immediate application of learnings, and have an emotional impact (e.g., satisfaction, enjoyment, challenge).

Students can learn how the world works by studying their own family and community structure and their personal and social needs. In doing so, they conduct research on their history and traditions, collect data through surveys, analyze family income and housing figures from census reports, organize information, and devise ways to summarize and report the findings. These processes provide students with exercises in problem solving, thinking skills, information management, research methods, presentation skills, and writing competencies. They learn to examine information, draw inferences, chart or graph data, trace roots of modern issues, and prepare recommendations. They use modern tools of technology to concentrate on the issues and avoid the tedium of typing drafts and devising charts by hand.

These kinds of learning exemplify the meaning, application, and emotional features of brain-based learning. Other examples of brain-compatible content and teaching methods: students using nearby colleges or universities to observe advanced arts activities in dance, painting, photography, drama, music; or students studying airports, transportation systems, television studios, city government, juvenile delinquency, and world events. The topics of interest to youth are endless. In each area, they can receive training in skills, such as interviewing and recording notes. In the process, students learn content in context, such as history, geography, literature, math, and science.

As another example, students can assist in the running of their school. They are immersed in the tough problems of management, finance, discipline, and facility maintenance. They give of themselves in service to the school by handling important tasks. Service in the school and the community provides important growth experiences for students finding their place and has a direct impact on how well they handle responsibility and the faith others have placed in them.

This approach replaces the fragmented day of hourly subjects taught in isolation from each other and from the rest of the world. The approach reduces the dreary reliance on textbooks and worksheets. School becomes an exciting place where students have important tasks to do and do not want to let others down. They exercise academic and problem-solving skills in the crucible of real-life experience. The school becomes a miniature democratic enterprise. Each person contributes and has an important stake in the operation. How different from coming into a conventional school, flopping into a chair, and relying on others to extrinsically motivate and coax students into participating!

Advisor Programs and Personal Learning Plans

Each student has an advisor as an anchor point in the school. The advisor schedules regular meetings with the student and parent(s) to set goals, tailor the program to the student's needs, review progress, and assist with successful advancement in the school. The advisor remains with the student over a period of years, although students may request a change of advisor if personalities clash. The advisory, the small group of students with a common advisor, provides a home-base setting, a supportive team, and an opportunity for social events.

Each student has a personal learning plan (PLP) that takes into account the student's learning style, interests, strengths, and needs. It helps the advisor, parent, and student determine the best program for the student. It can be adjusted as needed. The advisor respects the student and parent for their input, advice, and suggestions on how to capitalize on the student's strengths and interests to create the PLP.

Partnerships with Home, Businesses, Agencies, and Postsecondary Education

Advisors invite parents to participate in designing their child's program. This respect assumes parents know something about life and living and that they know a great deal about their child's interests, history, and strengths. Parents are welcome to visit at any time, to call the advisor with questions, or to inquire about any aspect of the school. It is their school! The school asks about parent contributions to the educational program, whether knowledge,

skills, or in-person support and participation. Parents can share their experiences, assist in the learning process through tutoring or other activities, and help with important governance and committee work.

Businesses are tapped for experiences such as shadow studies (following a person for a day or so), career awareness, apprenticeships, mentorships, and work experiences.

Most youth know little to nothing about how society's work is accomplished. Thus, they don't see the connection between school learning and success in jobs. More than 70 percent of the jobs in the year 2007 will be new or substantially changed from those of 1997. According to the U.S. Department of Labor SCANS report, employers expect far more of employees in terms of skills, knowledge, initiative, and responsibility than in the past. An outreach coordinator can arrange to tap the rich assortment of small and large businesses within easy access of the school.

A myriad of governmental and nonprofit social agencies, museums, and historical and other organizations await tapping to enrich and enliven schooling. Students need to learn about their community and its complicated functioning by getting into the real world, gaining experience, and having the opportunity to reflect about it with teachers and other students.

One student might spend time at the state fish hatchery; another working with a museum curator; another examining the differences between state, city, and county governing bodies; and another assisting the elderly in a nursing home.

Here are some examples of how modern learning principles can be applied to increase learning dramatically for all students through a variety of means:

1. Specifying the skills, knowledge, and attitudes students are to attain—otherwise known as competency-based education or outcome-based education. Example: Students demonstrate writing proficiency by writing letters to the editor.
2. Making learning meaningful to students. Example: Students learn world geography through their interest in shortwave radio.
3. Applying what is learned to real-life tasks. Example: Students use statistics to conduct and analyze a community survey of attitudes about taxes.
4. Recognizing the importance of attitudes and emotions in learning. Example: Studies are made interesting and challenging through projects like building a model of a city of the future.
5. Using interdisciplinary approaches. Example: Students use and learn math, science, writing, and social issues in a study of energy conservation.
6. Making community and service learning activities a part of the school experience. Example: Students understand aging by doing odd jobs for seniors.
7. Using experiential approaches. Example: Students create a miniature society by taking the executive, judicial, and legislative roles.
8. Increasing input to the brain by a factor or ten (through brain-based learning strategies). Example: Schools present material in writing, orally, visually, with speakers, through videos, through simulations, with role-playing, with field trips, by analogies, and with stories.
9. Using real problems to develop thinking skills. Example: Students analyze recent election results and develop other scenarios or projections.
10. Using projects and cooperative learning methods. Example: Students plan a new school playground and work in teams to accomplish the complex task of building it.
11. Empowering learners with the extraordinary technology. Example: Students use desktop publishing to create newsletter reports of their research.
12. Involving students in planning content and learning processes. Example: Students design a school course of providing a consumer complaint service for the community.

Creative teachers use such activities to challenge their students and to energize schooling. Schools organize to ensure a safe setting where every student is known and special.

READING 4

Safe Schools for the Roller Coaster Years

Linda Inlay

Structuring middle schools with adolescents' cognitive and psychological needs in mind creates a secure space for learning.

The "roller coaster years" is an apt descriptor of adolescence. One minute, a 7th grade girl is sweet and cooperative, and the next minute she's immersed in high drama because she doesn't like how she looks. A 6th grader no longer wants to hold her father's hand in public. An 8th grade boy, once a model student, is now more concerned about fitting in with the popular crowd.

As the director of River School, a small middle school in Napa, California, and a mother of two, I have encountered many behaviors like those described above. Changes taking place in adolescents' brains, even more than the obvious physical changes, are the catalyst for such dramatic ups and downs. To give adolescents a safe track to roll through these years undamaged, educators need to look at the emotional and psychological needs that come with this intense brain development. By attending to these needs, we can create safe schools that will enhance students' capacity to learn.

The Need to Experiment

Key parts of adolescents' brains develop at different rates. The brain's emotional centers surge into hyperdrive long before the "judgment seat"—the prefrontal cortex, which mitigates emotional ups and downs—has matured. In terms of their brains, adolescents are still more like children than young adults, although the appearance of physical maturity tricks us into thinking otherwise. It is not until age 25 that humans' prefrontal cortex matures and the capacity to make sound judgments is fully developed. Possibly this is why the highest car insurance premiums are charged to males under age 25.

During adolescence the brain's capacity to make connections nearly doubles, which encourages lots of experimentation between ages 11 and 25 (such as long hair in my generation and green hair today). During this time the brain is "hardwired," as the neural networks for certain tendencies and habits are established. After adolescence, the brain's capacity for connection returns to normal. The neural connections established during the teen years are kept intact and connections that were not used disappear. As Brownlee and colleagues put it,

> Teenagers are choosing what their brains are going to be good at—learning right from wrong, responsibility or impulsiveness, thinking or video games. (Brownlee, Hotinski, Pailthorp, Ragan, & Wong, 1999)

Creating a School That Supports Adolescents

The Need for Autonomy

Keeping in mind what I know of how the adolescent brain develops, I have structured the River School to help our students develop a sense of autonomy and responsibility as well as personal connectedness. In this stage, adolescents are trying on different personas to figure out "who they are." Analytical thinking also starts in adolescence and leads to questioning authority. Teenagers begin to separate emotionally from parents (no more hand-holding and lots of rolling of the eyes) and to develop their own unique identities—a crucial process in becoming psychologically healthy, independent adults.

Source: From "Safe Schools for the Roller Coaster Years," by L. Inlay, 2005, *Educational Leadership*, 62(7), pp. 41–43.

When adolescent students feel safe to be themselves yet also connect to their peers, they are more grounded. This emotional safety provides a foundation that prevents narcissism on the one hand and reduces vulnerability to peer pressure on the other.

Rudolf Dreikurs (1971) wrote about the challenges of educating students during a period when social institutions were moving from a reliance on autocratic relationships to a focus on democratic relationships. I agree with Dreikurs that the old paradigm "Do as I say because I'm the adult" does not produce happy, responsible young people at home or in school. Nor does the permissive model, which produces what Shaw (2003) calls an epidemic of indulged children. When adults follow the autocratic model, children are passive; in the permissive paradigm, children have too much inappropriate power and become selfish and arrogant. Dreikurs offered another way to relate with young people: democratic parenting and democratic education in schools. This approach encourages adults and young people to treat each other with mutual respect and regard.

In keeping with this philosophy, teachers at River School provide a safe place where students can practice making good and poor choices within appropriate boundaries. Middle school students need the chance to make a lot of mistakes; that's part of the experimentation and limit-testing important to adolescence (Mackenzie, 2001). Child psychiatrist Jay Giedd has observed,

> I see kids who are cracking up because of the stress of the workload and because they see only one way to success, to getting a good job. They don't take many real risks because they are afraid. But maybe because of that, they have not learned to make their own decisions. That worries me. I think kids need to learn life's lessons. . . . They need to take risks, to make some mistakes. (quoted in Strauch, 2004)

In an environment that feels safe, mistakes can powerfully teach young people about choices and consequences, about freedom and responsibility. When students at our school lie about bad choices they have made, they invariably tell me they did so because they "didn't want to get in trouble." These students are willing to accept consequences for their mistakes, but they will lie if they fear having someone get angry at them. When human beings feel safe, they use their cerebral cortex rather than the "fight or flight" part of their brain, and they can better reflect on mistakes.

Instead of showing anger and disapproval when adolescents behave in undesirable ways, educators should guide teens to reflect on their behavior. Teenagers can then focus on themselves and the choices they made rather than worry about defending themselves against adult anger. At River School, teachers and student mentors lead students through the following reflective process, which trains them to make better choices and accept responsibility for their mistakes:

- Acknowledge your mistake instead of blaming, lying, or making excuses.
- "Clean it up" with those involved.
- Accept the consequence for the mistake.
- Learn from your behavior so that you are less likely to make the mistake again.
- Forgive yourself for the mistake and move on.

Richard DuFour talks about the "loose-tight" leadership style of principals in successful professional learning communities (DuFour & Eaker, 1998). The same leadership style can be applied to middle schools, with the school climate being "tight" in the sense of having clear expectations and consequences but "loose" in terms of allowing students to make appropriate choices.

As River School has become more democratic and respectful in relating with our students, we have found that some students' parents may be too autocratic while others may be too indulgent. Through parenting classes and conferences, we educate parents about the possibility of shifting more control to teenagers and letting teens learn from their mistakes through trial and error. A partnership of parents, teachers, and students has been

very effective in helping students develop a strong sense of self and display personal and social responsibility.

The Need to Belong—Yet Be Yourself

Adolescents vacillate between two psychological needs—need for a sense of self and need for a sense of belonging (Adler, 1927/1992). Psychologist H. Scott Glenn (1989) believes that all human beings have three needs that help nurture both a sense of self and a sense of belonging: the need to be listened to, the need to be taken seriously, and the need to make a contribution.

At River School we attempt to fulfill these needs by organizing small listening groups, each composed of a teacher advisor and several students who meet regularly to share their concerns and successes. Students look forward to these sessions and often carry on even when the teacher is absent. Besides providing a safe place to vent, listening groups encourage students to speak up for themselves, to think critically and develop opinions, and to engage more in their classes.

We also work hard to develop in students a sense of community and belonging through events that unite 6th, 7th, and 8th graders, such as "The Amazing Race" scavenger hunt in San Francisco. We team each 6th grade class with a group of 7th and 8th graders to form a "family" that meets at least once a month for community-building activities. Before we started this "family" program, many 6th graders were afraid of the 8th graders who tried to connect with them; the 8th graders felt rebuffed and gave up. Now the 6th grade students make friends with the older students and show more confidence, speaking up at school meetings, for example. We do not have a pecking order by grade level.

When our students feel emotionally safe, when they can walk down the halls unafraid of being teased, when they have people they can talk to about their concerns, and when adults nurture that climate of safety, students respond better to academic challenges.

The Need for Personal Meaning

We have learned over the years that unless curriculum is presented in ways that middle school students can connect with personally, they will forget what they have learned within a short time (National Middle Schools Association, 2002). For example, one teacher at River School helped students relate to the history of the American Revolutionary War by comparing the colonists' demands for autonomy and independence to adolescents' need to be heard and to have their rights considered by their parents.

Another way to help students connect to their learning is to have them develop their own questions to investigate within broad parameters set by the teachers. For example, when teachers at River School initiated a unit on cultures that have developed alongside rivers, they posed the overarching question, "How does geography affect culture and how do cultures affect geography?" Students then thought of subquestions that they were eager to investigate:

- How does geography shape the religions and beliefs of a culture?
- Does having less make people care more?
- What comforts do people take for granted that make them less concerned about the earth?

We also help students at River School find meaning by tapping into their need to make a contribution. We encourage 8th graders in particular to contribute to creating a supportive student culture at the school by providing peer mediation, speaking at conferences, participating in a panel at a parenting class, hosting visitors, or mentoring struggling 6th graders. Our 6th and 7th graders act as ambassadors for the school, creating presentations (including one performed with music) to share at local elementary schools. Such activities help students see that they matter at the school, lessen the attitude of entitlement and disdain that adolescents often display, and heighten their confidence and self-esteem.

When middle schoolers relate with adults and peers in mutually respectful ways, when they are not afraid to take intellectual risks, and when they are presented with a challenging and personally meaningful curriculum, they thrive academically and become engaged with their school community, laying the foundation for engagement in the larger community.

I witnessed the results of the culture of safety and engagement we foster at River School on one particular last day of school. After the last bell, the whole school lingered in the courtyard signing yearbooks, saying goodbye, hugging, and crying. Parents entering the courtyard were amazed at students' depth of caring and their uncharacteristic response to the start of summer. Whereas most adults remember middle school as one of the most uncomfortable and awkward passages in their lives, our students recall the River School fondly.

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READING 5

A Case for School Connectedness

Robert W. Blum

Students are more likely to succeed when they feel connected to school.

School bonding, school climate, teacher support, student engagement: Researchers have used these terms over the years to address the concept of school connectedness. School connectedness refers to an academic environment in which students believe that adults in the school care about their learning and about them as individuals.

Klem and Connell (2004) provide a frightening statistic in this regard, noting that

> By high school, as many as 40 to 60 percent of all students—urban, suburban, and rural—are chronically disengaged from school. (p. 262)

Is it possible that half of our high school students may not believe that adults in school care about their learning and about them as individuals? More to the point, what can educators do to reconnect these large numbers of chronically disconnected students?

Although connecting students to school is important at all grade levels, it's especially crucial during the adolescent years. In the last decade, educators and school health professionals have increasingly pointed to school connectedness as an important factor in reducing the likelihood that adolescents will engage in health-compromising behaviors. A connected school environment also increases the likelihood of academic success.

A great deal of research looks at school connectedness. But because this research spans so many fields—medicine, education, psychology, and sociology—and because it tackles so many related concepts, such as student engagement and school climate, the concept of school connectedness does not offer a clearly defined empirical base. In this era of accountability and standards, school connectedness can seem like a soft approach to school improvement. It can, however, have a substantial impact on the measures of student achievement for which schools are currently being held accountable.

In response to the weight of evidence that supports school connectedness, my colleagues and I convened an invitational conference at the Wingspread Conference Center in Racine, Wisconsin. Our goal was to bring together key researchers as well as representatives from the government, education, and health sectors to identify the current state of research-based knowledge related to school connectedness. Using this information, we synthesized a set of core principles about school connectedness to guide schools across the United States.[1] We titled this synthesis the *Wingspread Declaration on School Connections* (see box).

Distilling the Research

When one looks at the research literature across the different fields of inquiry, three school characteristics stand out as helping young people feel connected to school while simultaneously encouraging student achievement: (1) high academic standards coupled with strong teacher support; (2) an environment in which adult and student relationships are positive and respectful; and (3) a physically and emotionally safe school environment. Students who

[1]This work was supported by the Centers for Disease Control and Prevention's Division of Adolescent and School Health (DASH). The proceedings from the invitational conference and the Wingspread Declaration on School Connections are available at www.allaboutkids.umn.edu/Wing fortheWeb/schooldeclaration.pdf. ASCD was a conference participant.

Source: From "A Case for School Connectedness," by R. W. Blum, 2005, *Educational Leadership, (62)*7, pp. 16–20.

feel connected to school (independent of how these students are faring academically) are less likely to use substances, exhibit emotional distress, demonstrate violent or deviant behavior, experience suicidal thoughts or attempt suicide, and become pregnant (Lonczak, Abbott, Hawkins, Kosterman, & Catalano, 2002; Samdal, Nutbeam, Wold, & Kannas, 1998). In addition, when young people feel connected to school, they are less likely to skip school or be involved in fighting, bullying, and vandalism (Schapps, 2003; Wilson & Elliott, 2003). These students are more likely to succeed academically and graduate (Connell, Halpern-Felsher, Clifford, Crichlow, & Usinger, 1995; Wentzel, 1998).

What are the factors that influence school connectedness? Students who experience school connectedness like school, feel that they belong, believe teachers care about them and their learning, believe that education matters, have friends at school, believe that discipline is fair, and have opportunities to participate in extracurricular activities.

Major threats to school connectedness include social isolation, lack of safety in school, and poor classroom management. Social isolation, which is especially risky for adolescents, can result from students being ignored, bullied, or teased (Bishop et al., 2004) and tends to flourish in environments predominated by social cliques. Unsafe or chaotic schools and schools with poorly managed classrooms simply cannot provide a stable environment for respectful and meaningful student learning.

How Schools Can Help

How can schools encourage school connectedness? It does not come about purely as the result of rules, regulations, and zero-tolerance policies, which can actually mold harsh school environments. Connections spring instead from individual action on the part of both teachers and administrators as well as from more elusive factors, such as school environment.

Teachers are obviously central to the equation. Although school connectedness might suggest smaller class sizes, the classroom's culture seems to matter more than its size does. Effective teachers can create connectedness in the classroom in a number of ways. When teachers make learning meaningful and relevant to their students' lives, students develop a stake in their own education. When teachers create a clear classroom structure with consistent expectations for behavior and performance, they provide a healthy setting in which students can exercise autonomy and practice decision-making skills. Teachers build connectedness in the classroom when they encourage team learning exercises. Cooperative learning tends to break down social isolation by integrating student teams across gender, academic ability, and ethnicity. Rewarding a variety of student achievements and recognizing student progress—not only top performance—are also important components.

But teachers cannot create school connectedness on their own. Without a supportive administration, teachers will not be able to effectively support their students. For example, when a school allows a young person to fail—when it doesn't do everything in its power to retain that student—students get the message, "In this school, there are winners and there are losers." This assumption sets up a dysfunctional dichotomy: Those less likely to do well academically will strive to create an anti-academic climate because they know they can't win at the game. The perceived winners—those who are academically proficient—are seen as "nerds," as "dorks," and, ironically enough, as "losers." But when a principal calls home, when he or she follows up every time a student misses school, students get a different message entirely: "In this school, all students are expected to succeed."

A study panel from the National Research Council and the Institute of Medicine (2004) identified a series of factors associated with school engagement. Educators can substantially increase school connectedness in their students when they

- Avoid separating students onto vocational and college tracks.
- Set high academic standards for all students and provide all students with the same core curriculum.
- Limit the size of the school to create small learning environments.

Wingspread Declaration on School Connections

Students are more likely to succeed when they feel connected to school. School connection is the belief by students that adults in the school care about their learning as well as about them as individuals. The critical requirements for feeling connected include students' experiencing

- High academic expectations and rigor coupled with support for learning.
- Positive adult/student relationships.
- Physical and emotional safety.

Increasing the number of students connected to school is likely to influence critical accountability measures, such as

- Academic performance.
- Incidents of fighting, bullying, or vandalism.
- Absenteeism.
- School completion rates.

Strong scientific evidence demonstrates that increased student connection to school promotes

- Motivation.
- Classroom engagement.
- Improved school attendance.

These three factors in turn increase academic achievement. These findings apply across racial, ethnic, and income groups.

Likewise, there is strong evidence that a student who feels connected to school is less likely to exhibit

- Disruptive behavior.
- School violence.
- Substance and tobacco use.
- Emotional distress.
- Early age of first sex.

The most effective strategies for increasing the likelihood that students will be connected to school include

- Implementing high standards and expectations and providing academic support to all students.
- Applying fair and consistent disciplinary policies that are collectively agreed upon and fairly enforced.
- Creating trusting relationships among students, teachers, staff, administrators, and families.
- Hiring and supporting capable teachers skilled in content, teaching techniques, and classroom management to meet each learner's needs.
- Fostering high parent/family expectations for school performance and school completion.
- Ensuring that every student feels close to at least one supportive adult at school.

Best Bets Warranting Further Research

- Programs and approaches that create positive and purposeful peer support and peer norms.
- Strategies that work to promote connection to school among disenfranchised groups.
- Analysis of the costs and effectiveness of different programs for fostering school connectedness.
- Evaluation of new and existing curricular approaches, staff and administrator training, and various institutional structures.
- Effects of school connectedness in students on teacher morale, effectiveness, and turnover.

- Form multidisciplinary education teams in which groups of teachers work with students.
- Ensure that every student has an advisor.
- Provide mentorship programs.
- Ensure that course content is relevant to the lives of students.
- Provide service learning and community service projects.
- Provide experiential, hands-on learning opportunities.
- Use a wide variety of instructional methods and technologies.