

Submission

No 40

## INQUIRY INTO CHILDREN AND YOUNG PEOPLE 9-14 YEARS IN NSW

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SUBMISSION

**Scouts Australia – New South Wales**

**Educating young people to play a constructive role in society  
and to create a better world.**

Submitted by

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on behalf of  
Scouts Australia NSW

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**Supporting children through their transition to young adulthood is crucial to life success. Organisations such as Scouts Australia NSW provide this support through challenging, and well managed programs, that develop children beyond the academic focus of the formal education system. Government policy needs to more fully focus on supporting this transition, recognising the holistic needs of children in these formative years.**

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### **Summary**

Over the past 100 years Scouts has taught millions of young Australians resourcefulness, self-reliance, leadership, decision making, and concern for their community and the environment.

With the transition from child to adulthood comes increasing freedom and increased exposure to the world. Children and young people should be allowed to take calculated risks, encouraged to stretch, to embrace new opportunities, to increasingly know themselves and how they can contribute to a fair and just community. Young people need to be equipped to make the right decisions for their own, holistic, well being – a role Scouting comprehensively fulfills.

Investment in opportunities such as those provided by Scouts provides immediate results for participants, but also long term benefits for Australian society including leadership, healthy lifestyles, and community contributions. Ways to offer young people directed risk taking, extension and testing of boundaries within a 'safe' framework are beyond the academic curriculum offered in schools, and should be encouraged and supported by government.

To further support the activities of organisations such as Scouts, consideration should be given to developing programs that provide volunteers with greater recognition, including possible income tax trade offs for volunteer hours 'worked' in registered not-for-profit organisations. This could provide increased incentive for volunteering, beyond personal motivation.

## Introduction

Scouting is the largest youth development organisation in Australia and is a leader in the non-formal education sector. The Scouting Program prepares young people (female and male) aged 6-26 for business and community leadership. Australian Scouting is strong with around 60,000 male and female members, in this it's Centenary Year. Scouts operates through the voluntary efforts of 13,000 Leaders and countless other supporters.

Over the past 100 years Scouts has taught millions of young Australians resourcefulness, self-reliance, leadership, decision making, and concern for their community and the environment. Many of these young people have used the skills and confidence gained in Scouts to achieve success in their careers or make other community contributions. Scouts aim is to help children and young people achieve their full potential in life. This is done through individualised, fun, adventurous, challenging, leadership and teamwork-oriented programs. "Be Prepared" is the well known motto for Scouts, and sums up the essence of what Scouting aims to teach young people.

Scouts regularly reviews and expands its programs for young people, continually changing the activities on offer, to keep up with contemporary interests. From local Scout programs to planning State-wide future development programs, Scouts Australia NSW delivers a wide range of services across New South Wales to enhance youth development and build community through nurturing young people who are self-reliant, supportive, responsible and committed community members. We continually provide our community with young Australians who have a greater range of skills, understanding, knowledge and leadership than normally gained through regular formal education systems. In NSW more than 16,000 young people and adults are members of Scouts, supported by many, many more volunteers.

## Scouting Sections

Scouting is programmed in age-appropriate sections, as follows;

- Joey Scouts - 6 to 7.5 years of age.
- **Cub Scouts - 7.5 to 10.5 years of age.**
- **Scouts - 10.5 to 14.5 years of age.**
- Venturer Scouts - 14.5 to 17.5 years of age.
- Rovers – 17.5 to 26 years of age.
- Adult Leaders and Support Members

Scouts Australia NSW has 100 years of experience involving young people through their formative years in a non-formal educational process, using a specific method that enables each individual to become the principal agent in his/her development as a self-reliant, supportive, responsible and committed person and assisting young people to establish a value system based upon spiritual, social and personal principles. The organisation is well positioned to provide informed comment to the Parliament of NSW Inquiry into Children and Young People 9-14 years in New South Wales.

## RESPONSE TO THE TERMS OF REFERENCE FOR THIS INQUIRY

### 1. The needs of children and young people in the middle years i.e. between about nine and fourteen years of age;

Children and young people aged 9-14 are at an important stage of life, making the transition from primary school to high school, from childhood to becoming young adults. They are beginning to make decisions and take responsibility both for themselves, and often, for others around them. These are formative years.

There are many models used to describe the changes and behaviour of teenagers. Recent research shows that today about 1 in 6 girls show signs of puberty by the time they are 8, a significant change over the last 100 years (in 1905 this figure was 1 in 100). Among boys 1 in 14 are now showing signs of puberty at 8 years of age.

As physical maturity occurs, the human brain continues to develop over the first 20 + years of life<sup>1</sup>. More recent research has had the advantage of functional MRIs that show which part of the brain is active at what times. This provides a very effective means of understanding behaviour.

In teenagers there is high activity in amygdala, the area of the brain responsible for intense emotions such as fear and rage – this is evidenced in teenagers' unpredictable behaviour. The main hormone that affects this change is stronger in males than females hence in males the changes are more pronounced, stronger, and noticeable. Teenage girls tend to be more focused on emotions and teenage males on risk taking. A young person's family and social support is important at this time, with research showing how parents deal with the transition from child to adulthood, and cultural attitudes to male behaviour, greatly influence how the child's different brain pathways develop and function in the future.

In teenagers there is minimal activity in the brain's prefrontal cortex, the area responsible for executive functioning. This deals with making decisions, setting priorities,

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<sup>1</sup> Comment throughout this section is largely based on the work of JN Giedd MD (NIHM, USA) and colleagues. A summary of research is found in the attached article "What makes Teens tick". Further references as follows;

- **Gogtay N, Giedd JN, Lusk L, Hayashi KM, Greenstein D, Vaituzis AC, Nugent TF 3rd, Herman DH, Clasen LS, Toga AW, Rapoport JL, Thompson PM:** Dynamic mapping of human cortical development during childhood through early adulthood. *Proceedings of the National Academy of Sciences USA*, 101: 8174-8179, 2004.
- **Giedd JN:** Structural magnetic resonance imaging of the adolescent brain. *Annals of the New York Academy of Science*, 1021: 77-85, 2004.
- **Vidal CN, Rapoport JL, Hayashi KM, Geaga JA, Sui Y, McLemore LE, Alaghband Y, Giedd JN, Gochman P, Blumenthal J, Gogtay N, Nicholson R, Toga AW, Thompson PM:** Dynamically spreading frontal and cingulate deficits mapped in adolescents with schizophrenia. *Archives of General Psychiatry*, 63: 25-34, 2006.
- **Rose AB, Merke DP, Clasen LS, Rosenthal MA, Wallace GL, Vaituzis AC, Fields JD, Giedd JN:** Effects of hormones and sex chromosomes on stress-influenced regions of the developing pediatric brain. *Annals of the New York Academy of Sciences*, 1032: 231-233, 2004.

organising thoughts, planning and weighing the consequences of one's action and is the last part of the brain to develop at around 16-20 years or later. Early exposure to activities that build these pathways can assist in growing and strengthening them and contribute to a balanced approach to life. The more teenagers are exposed to tasks that will enhance life skills, the more these pathways develop and become stronger, and the more impulsive and unpredictable brain pathways weaken. If not used, these pathways become virtually non functional

### **Scouting's role in meeting these needs**

At the same time as young people are experiencing physical and emotional upheaval, society's expectations of them are also changing. With the transition from child to adulthood comes increasing freedom and increased exposure to the world. Young people need to be equipped to make the right decisions for their own, holistic, well being – a role Scouting comprehensively fulfills.

The background discussed above explains the compulsion young people have to take risks, experience extreme emotions and test their boundaries. However, often children are denied opportunities to grow and extend and test themselves, because of overwhelming societal concerns about safety and security.

The Scouting program is well developed and founded on 100 years experience of providing challenging opportunities within a satisfying, 'safe', tried and tested framework. Children and young people are allowed to take calculated risks, encouraged to stretch, to embrace new opportunities, to increasingly know themselves and how they can contribute to a fair and just community.

Scouts is somewhat unique in providing peer-to-peer support across the transition from childhood to young adulthood, through its Cubs (ages 7-10) and Scouts (10-15 years) programs. On a weekly basis children interact with peers across the relevant age ranges, and so across the transition from primary school to high school. This provides increased linkages and support in community for young people. Peers provide age appropriate role models, and this is especially relevant to children without siblings/family members in the age range. Formal structures within Scouting, such as the 'Troop Council' and Patrol system formalise this support in a systematic way that is managed by the youth members themselves. Young people benefit from exposure to role models from all walks of life – not simply celebrities promoted in the media.

Investment in opportunities such as those provided by Scouts provides immediate results for participants, but also long term benefits for Australian society including leadership, healthy lifestyles, and community contributions. These opportunities are critical to learning beyond the formal school system and should be encouraged and comprehensively supported by government. Social policy should recognise the importance of mentoring for young people who are experiencing the transition from childhood to adulthood and seek to assist organisations such as Scouts that are providing it.

## **2. The extent to which the needs of children and young people in the middle years vary according to age, gender and level of disadvantage;**

As noted above, the age at which young people mature is becoming lower. Their physical, social and emotional needs are governed by development in each of these areas. However, anecdotal evidence strongly suggests that growth does not take place in parallel, and that at any one time a child may be much more mature in one area than another.

Scouts' experience developed over the last 100 years in Australia indicates:

- At or around 10 years children are often ready for more challenging activities. They are beginning to seek the company of older children, are more willing to test themselves physically, and are emotionally ready to begin to look outside the family for their interests.
- All children mature at different rates. One child at 9 years can be as mature and capable as another young person of 14 years. It is imperative to maintain flexibility and the ability to respond at an appropriate level for the individual, rather than be bound by any arbitrary age setting. Scouts achieve this by giving local leaders discretion to transition members from Cubs (generally aged 7.5 yrs – 10.5 yrs) to Scouts (10.5 yrs – 14.5 yrs) at the time they believe it is appropriate, given their knowledge of the young person.
- Both girls and boys in the 9 years to 14 years age range benefit from mixed gender groups. Scouts provides a non-competitive environment where all young people (rather than either girls or boys) are able and expected to lead, and to undertake the same (physical or other) challenges. The concept of 'equal opportunity' truly lives in the Scouting philosophy. Providing this experience and role modeling in the 9-14 years age group can be a formative and life changing experience for many children.
- A strong framework for all activities and interaction remains an important foundation which allows children and young people to extend themselves. The importance of a 'safe' environment cannot be reiterated too strongly – at their best support structures should be robust, consistent and almost unseen. This sense of underlying safety provides enormous freedom for children and young people to express and extend themselves as they transition from childhood to become young adults, regardless of age and gender. It is even more critical to children from disrupted backgrounds.

## **3. The activities, services and support which provide opportunities for children and young people in the middle years to develop resilience;**

Scouts provide a range of challenging physical, and social, opportunities for its Members. Regardless of the age of the participant, Scouts provides fun and exciting programs that promote an active and engaged lifestyle. Whether canoeing, camping, visiting museums or helping the local community, the activities let Members learn about themselves and the world around them.

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Each year, all Sections of Scouts learn to share responsibilities and to live with each other through adventures set in the outdoors. Camping, abseiling, caving, horseback riding, fishing, rock climbing and diving are just a few of the experiences a Scout may take part in his or her time as a youth member. Scouts challenge their minds as well as their bodies. Scouts have challenging activities linked with the internet and amateur radio, performance arts such as singing, dancing, and acting and awards linked to citizenship, community service and personal spiritual development.

Scouts believes such activities are particularly relevant in the middle years, where children are starting to seek new challenges and new horizons. The complex and often confusing emotions young people experience as their brains and bodies develop require guidance and support within structured activities that provide for directed risk taking. In an ever changing world, developing self sufficiency and leadership skills is particularly relevant to building resilience and later life success.

Ways to offer young people directed risk taking, extension and testing of boundaries within a 'safe' framework are beyond the academic curriculum offered in schools, and should be encouraged and supported by government.

**4. The extent to which changing workplace practices have impacted on children and young people in the middle years, including possible changes to workplace practices which have the potential to benefit children and young people in the middle years;**

Although work place practices have generally become somewhat more flexible, evidence suggests most Australians are working longer hours than ever before.

"Average weekly hours worked for full-time and part-time workers have increased over the last two decades. Full-time working hours for men increased by 1.9 hours per week to 43.2 hours between 1985 and 2005 and for women by 1.7 hours to 39.3 hours. Part-time hours worked by men increased 0.7 hours to 16.4 hours over the same period and for women by 1.4 hours to 16.9 hours per week.

More women are working, with 53% of women aged 15 years and over working in 2004, up from 40% in 1979. The growth in women's employment has been mainly in part-time work. In 2004, 24% of women aged 15 years and over were employed part-time, an increase from 14% in 1979." (Media Release July 20, 2006, Australian Social Trends, 2006. Australian Bureau of Statistics)

Increased working hours manifests itself in the ongoing challenge experienced by Scouts and like organisations, to engage parents and other adults in voluntary roles from leaders, to committee members, or helping on an ad-hoc basis. Time poor adults are unable to provide sufficient support to their children, let alone take on additional voluntary responsibilities.

Government initiatives would be most welcome in the following areas;



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- Encourage business to recognise voluntary organisations such as Scouts within the range of corporate social responsibility activities undertaken by companies
- Prioritise 'family' as a mandatory societal and policy decision parameter, thereby making it more acceptable for adults to dedicate time to family activities.
- Encourage businesses to look outside existing practice and reconsider core working hours. Is 9am-5pm (or longer) really appropriate or required? Is it more appropriate for business and school hours to be more aligned? Or, as suggested recently by Federal Government member Maxine McKew, for school and work leave periods to be brought closer together? What are the short/medium/long term economic benefits of prioritising healthy family relationships versus 'productivity' produced by staying in the office longer? Research in this area is needed.
- Recognise and publicly promote high profile individuals who are role models for creative and interesting ways of working that achieve business goals, but as importantly also achieve family goals
- Further develop programs that provide volunteers with recognition, including possible income tax trade offs for volunteer hours 'worked' in registered not-for-profit organisations. This could provide increased incentive for volunteering, beyond personal motivation.

TEENAGERS NEED TO PRACTICE BEING ADULTS.

This means making choices and mistakes.

It means having someone to guide and offer a number of possible solutions for them to consider.

It means NOT telling them what to do but helping them decided among the alternatives.

## ATTACHMENT 1

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Monday, May. 10, 2004

### **What Makes Teens Tick**

By Claudia Wallis; Kristina Dell

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 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 12 1/2, 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 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 identify 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 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 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