



ADULT GUIDE

thirteen
WNET NEW YORK

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David Grubin
PRODUCTIONS

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www.pbs.org

WELCOME TO THE SECRET LIFE OF THE BRAIN

IN THE PAST 12 YEARS, the field of neuroscience has advanced more than at any time in history. In part, this is due to technological breakthroughs in viewing the brain — among them, Magnetic Resonance Imaging (MRI), Computer Assisted Tomography (CAT scans), and Positron Emission Tomography (PET scans). There also have been new insights into how neurons and chemicals create messaging systems more complex and enduring than any computer yet invented.

Because of these advances, new worlds have opened in medicine and education. THE SECRET LIFE OF THE BRAIN, a five-part public television series, co-produced by David Grubin Productions Inc., and Thirteen/WNET New York, will help to expand understanding of the brain's overarching role in our lives, from infancy to old age.

(continued)

These materials are designed to further that goal. You can use them along with the television series in adult education seminars. They will find eager audiences among parents, adults with aging parents, and professionals in related fields. Their modular format utilizes individual cards that can be combined in a variety of ways, depending on the topics you wish to explore. You can use them to learn about a range of fascinating brain-related issues, among them early childhood development, learning problems, cognitive and emotional growth in adolescence, addiction, mood disorders, stroke, degenerative diseases of the brain, caregiving and the development and enhancement of memory and wisdom in aging.

For Facilitators: Using These Materials

We suggest that you preview the television programs and review this guide. Then select segments of the programs and use them with the appropriate topic cards.

The cards have been organized in sets, one set for each of the five programs.

Additional cards address specific issues raised by the programs: the brain's **plasticity**, the debate over **nature vs. nurture**, new understandings of **addiction and cravings**, hope on the horizon for treating **memory disorders** from "senior moments" to Alzheimer's disease, and how-to cards on **caregiving** and on running a **brain-related workshop**. We have also added **Resources** and a **Glossary**.

Mix the cards as you like. If you are giving a workshop to parents, for example, you may wish to use the early childhood

development cards, along with the essay, "Nature, Nurture and the Individual Child."

If you want to study diseases of aging, you may wish to use the program cards for Program Five, "The Aging Brain: Through Many Lives," as well as the essay cards, "Minding Your Memory" and "The Remarkable Plasticity of the Brain." A companion book to the series also has been written by neuropsychiatrist Richard Restak, M.D.

The **Table of Contents** offers you a variety of topics to choose from, all of them written by experts in these fields. The cards include background information, profiles, topics for discussion, and group and individual activities that can be conducted in your workshop sessions or at home.

We suggest that you photocopy the appropriate cards — as well as the Resources, Glossary and illustration of the brain on the back cover of this package — the week before your workshop session and distribute them to participants.

Web Site

Thirteen/WNET New York has also developed a Web site. Go to www.pbs.org/brain, where you will find interactive and educational features such as a 3-D Brain, Mind Illustrations, video clips, links, publicity tools and information on the national outreach campaign. This Guide, as well as one for teens, appears on the site in PDF format, and may be freely downloaded.

We hope that THE SECRET LIFE OF THE BRAIN and these education materials offer you valuable information and new worlds to explore.

This Guide contains 21 double-sided cards, a set of two for each of the five programs, six essay cards, and cards for a workshop, resources and a glossary. These cards may be copied and used as needed.

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by David Grubin, Executive Producer

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Marilyn Webb, a former editor-in-chief of Psychology Today, is the author of The Good Death: The New American Search to Reshape the End of Life. (New York: Bantam Books, 1999.)

PROGRAM SCHEDULING

Programs are scheduled to be broadcast on the dates indicated below. Broadcast times, however, may vary slightly from area to area. Please check your local listings.

PROGRAM BROADCAST DATES

The Baby's Brain: Wider Than the Sky
January 22, 2002
The Child's Brain: Syllable From Sound
January 22, 2002
The Teenage Brain: A World of Their Own
January 29, 2002
The Adult Brain: To Think by Feeling
February 5, 2002
The Aging Brain: Through Many Lives
February 12, 2002

Videotaping Rights

You have the right to tape the programs and play them for instructional purposes for one year after the original broadcast.

Video Ordering Information

THE SECRET LIFE OF THE BRAIN is available from PBS Video by calling
1.800.PLAY.PBS.

The Secret Life of the Brain

by David Grubin

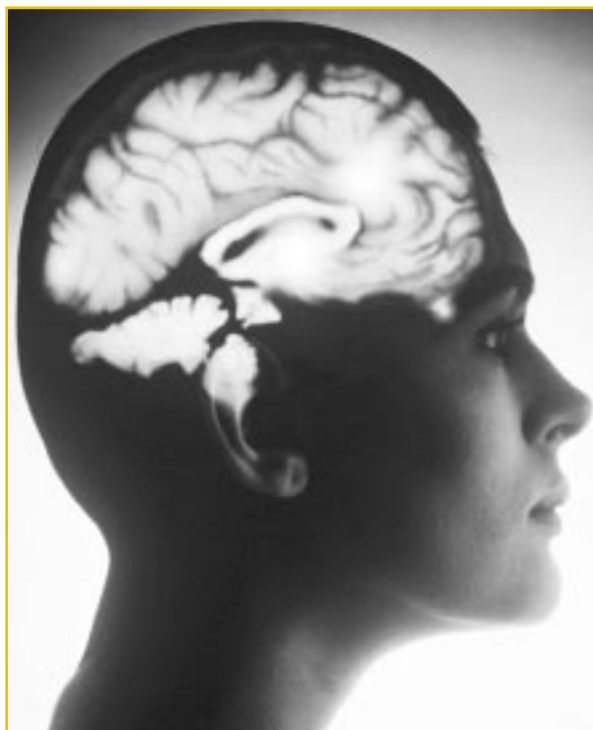
Executive Producer, THE SECRET LIFE OF THE BRAIN

MORE HAS BEEN LEARNED about the brain in the last ten years than in the previous one hundred.

With the help of new imaging technologies, scientists can penetrate the brain's tough protective shell to see the living brain inside. Advances in molecular biology enable scientists to manipulate genes within living cells and map the creation of neurons. New dyes and microscopes offer surreal, beautiful views of brain cells in action, growing connections and firing electrochemical signals. Our goal in producing THE SECRET LIFE OF THE BRAIN was to make this revolution accessible and relevant to a wide audience.

THE CENTRAL CONCEPT,

the theme that we would pursue in every program, emerged slowly. When we began research, exploring brain functions such as memory, vision, and cognition, we were calling the series SECRETS OF THE BRAIN. But we soon learned that many neuroscientists were looking at the brain from the point of view of its development. When we are young, our brains are at their most plastic — a real advantage dur-



PHOTODISC



THE SECRET LIFE OF THE BRAIN

DAVID GRUBIN

ing a period when we have to learn as quickly as we can in order to equip ourselves to survive. But contrary to what was once generally believed, the brain continues to evolve and change over the course of our lifetimes.

AND SO, the brain and its capacity for change became the central theme of our series, and with this theme came a new title, THE SECRET LIFE OF THE BRAIN, with an emphasis on "life." We organized the series into five programs — the brain of the baby, the child, the teenager, the adult and the brain in old age. Each program is framed by a question:

- How does the brain grow from a sperm and egg into the most complex thing in the universe?
- How does a child acquire language?
- Is there a connection between brain development during adolescence, and the onset of schizophrenia and the prevalence of teenage addiction?
- How does an adult find the balance between reason and emotion?
- Why do some people remain energetic and vital in old age, while others do not?

(continued)

THE SECRET LIFE OF THE BRAIN explores the answers to these questions by telling stories about the brain's remarkable life journey. In our first program we meet a baby who was born with a cataract in her eye. In order to develop normally, she needs to have the lens clouding her vision removed as soon as possible. The visual areas of the brain require the stimulation of electrical pulses generated by light striking the retina. If the brain cells responsible for vision do not form the proper connections early on, they never will. Without an operation in the first few months of her life, this baby risks blindness in the clouded eye, even if she has the cataract removed later, regardless of the subsequent health of the eye itself.

The cataract story expresses a large idea: our brains and the world around us are involved in a delicate duet; our brains change and adapt in response to the environment acting upon our genetic endowment. But development doesn't follow a rigid or pre-set course: The brain consists of many different systems, each developing at its own pace and in its own way, evolving gradually throughout our lives.

OF COURSE, THIS IS GOOD NEWS for parents. Eager to encourage the intellectual and emotional development of our children, some parents worry obsessively about providing "developmentally correct stimulation" and earnestly turn to science for guidance. Because of one well-publicized but misconstrued study suggesting the beneficial effects of Mozart on the brain, for example, eighteenth century har-

monies drift sweetly over the cribs of thousands of infants, with no real evidence that music does anything for the baby other than to soothe a well-meaning parent's anxiety.

THE BEST ADVICE scientists have for parents is just to relax. The first years of life are only the beginning of a slow process of growth that fathers and mothers can encourage by simply spending time enjoying their children. What once used to be referred to as "critical periods" of development scientists now call "sensitive periods." We humans could hardly have survived as long as we have if our species were solely dependent upon specific experiences at specific times.

As extreme as the cataract story is, the early years of development are like building a foundation for a house; without the foundation, the house cannot stand, but construction doesn't stop there. During

those first years, the infant brain develops very quickly. Language, cognition, perception, and the major behavioral systems are being put into place. But it is the fine-tuning of these systems over a lifetime that ultimately accounts for who we are.

Now that **THE SECRET LIFE OF THE BRAIN** is finished, what strikes me most of all is not only how much scientists have discovered in just the last decade, but also how much there still is to know. Pondering the immensity and power of this small, crinkled organ weighing less than three pounds, poet Emily Dickinson tells us: "The Brain is wider than the sky ... The Brain is just the weight of God."



Program One A

The Baby's Brain: Wider Than the Sky

WHAT'S GOING ON

Fetal and Infant Development

by Elizabeth Lasley

A baby's brain starts forming soon after conception with a few cells at the tip of the embryo. By the seventh month of gestation there are 100 billion cerebral nerve cells organized into more than 40 systems to direct language, movement, seeing and hearing.

Eighteen weeks: First flutterings of movement.

- The synapses that allow movement begin forming as early as five weeks into gestation. By the eighteenth week, the mother-to-be can feel the fetus in motion.
- The fetus can move its limbs and fingers, hiccup, stretch, yawn, swallow, and suck its thumb by the end of the first trimester. Although these are reflex actions, they set the neural stage for purposeful movement after birth.
- By the second trimester the fetus can move its feet against the walls of the uterus in a walking pattern and touch its hands to its face, body and umbilical cord.

Third trimester: Responsive movement.

- All the sensory pathways are developing. The fetus can respond to its mother's voice, to loud sounds and to bright lights.
- By the last two weeks of gestation it can react — through the amniotic fluid — to the sweet and bitter tastes of the food its mother eats.
- The cerebral cortex, where these stimuli come together into meaningful images, can function only in

a limited way. Some researchers think the harsh lights, loud noises, and bustle of a neonatal unit may contribute to learning difficulties that preemies may have later on (see **ELIZABETH TRAPHAGEN'S** story).



PHOTODISC

Newborns: Babies recognize their mothers' faces and prefer the human face to any other sight.

- Vision is their major source of information. At about a month, babies learn to stare at something.
- By three months, they can watch their hands and follow a moving object.
- Gender differences become apparent. Girls respond more to social stimuli — voices and faces — and they're more prone to sobbing when another infant cries. Boys are fussier; they startle more easily and are more irritable. Emotional centers in the brain develop sooner in girls, while boys show more activity in areas associated with spatial ability and mathematics.

PROGRAM DESCRIPTION

As a human grows from a fetus to a toddler, how does its brain develop? Program One uses two case studies to explore this question and to examine the ways in which brain cells are influenced by genetic and environmental factors. By applying the latest brain research, scientists help the babies in these case studies develop normally.

One year: Babies begin to walk and talk.

- Babies' brains increase in size and complexity, helping them develop greater control over the objects and people in their environment.
- Myelin, a fatty coating that speeds nerve activity, is forming along the nerve cells.
- The frontal cortex of the brain — the area associated with the ability to regulate and express emotion, and to think and plan — is showing increasing activity.
- Motor areas of the brain develop in a head-to-toe fashion. First babies learn to suckle, then to turn their heads and smile, then to reach with their hands, and finally to use their legs to crawl and walk.
- Conversation between babies and others shapes the language areas of the brain.
- By about eight to ten months, babies show signs of understanding words.

ELIZABETH TRAPHAGEN: Portrait of a Cuddled Preemie

by Marilyn Webb

The contractions began on Memorial Day while Kathy Traphagen, her husband Terry and their six-year-old daughter, Allison, were eating hamburgers at a neighborhood picnic. Kathy was only 25 weeks pregnant. Her doctor ordered her hospitalized on complete bed rest. For her, there was mainly fear.

Kathy had already lost three babies to miscarriages. "We'd been going through this for two and a half years," Terry says. "We'd start, you know, and then, the... disappointment. Start. And disappointment." He and Kathy dreaded losing another.

But Elizabeth, born three weeks later, became a "preemie survival miracle." Recent medical advances in neonatal care have given the possibility of life to infants as precarious as 24 weeks old. Elizabeth weighed three pounds and was fourteen inches long — all red, with translucent skin, and unnaturally long fingers and toes.

Just two or three decades ago, babies this young and this small generally died. And yet, while they are now beating those grim odds, preemies often have learning problems that can plague them for years. While immature lungs may no longer be a problem, the immature brain still is.

"We wanted to give Elizabeth a chance to be equal to her peers," Kathy says. So the Traphagens enrolled her in an experimental program — run by Dr. Heidelise Als, at Children's Hospital in Boston — designed to reduce stimuli that might overwhelm her still underdeveloped brain.

Elizabeth spent the nearly three months, until she would have been born, living in an environment that simulated Kathy's womb. Doctors turned the lights down so she could open her eyes, even if she could only barely see. They kept noise at a minimum. They helped her to curl her legs, to pull her arms into a fetal position, and to bring her fingers to her mouth — as she would have in the womb — because all that seemed to soothe her.

And Kathy and Terry held her daily, putting her on their chests, skin to skin, cuddling her as if she were a baby kangaroo. Elizabeth seemed to recognize Kathy. She

turned her little head when Kathy spoke, curled and uncurled her tiny fingers on Kathy's hospital gown, and grew calm as she felt Kathy's heart beat, her breathing, her touch. And soon, when her little body was able, Elizabeth's digestive system began to "rev up" with miniature bottles of breast milk.



THE SECRET LIFE OF THE BRAIN

A premature baby's brain cannot easily coordinate such basic functions as eating, sleeping and breathing. It has neither the ability to focus or sort the important from non-important stimuli of a full term baby, nor the essential myelin coating that allows brain messages to speed along. Preemies continue to be hyperactive throughout life, unless there is an intervention — like this — to normalize brain function early on. A little before what would have been her due date, the Traphagens finally brought Elizabeth home.

A year after Elizabeth's birth, although she would have been only nine months old had she been a full-term baby, Kathy happily notes, "She is performing as a one-year-old. She's starting to take steps and say 'Daddy.'"

Elizabeth still sees a physical therapist. Dr. Als tests her regularly against her one-year-old peers. The good news: She is performing in the accelerated range. "Because she was so early, I think we've acquired some perspective on that 'social pressure for children to achieve.' The important things are her being happy and healthy," Kathy says. "The rest will all come."



Brain Health in the First Years

by Elizabeth Lasley

Don't go overboard. The best way to stimulate your unborn baby is with your own voice, by talking, reading and singing. There are no gimmicks that will increase a child's intelligence while still in the womb. In fact, some neonatal specialists believe that over-stimulation during gestation can send brain development off on a wrong track.

Eat wisely. Good nutrition during pregnancy is important for healthy brain development. Eat a balanced diet containing adequate protein, complex carbohydrates, and 300 calories over your usual intake. Supplementing your diet with the B vitamin, folic acid, has been shown to reduce the risk of neural tube defects (see **Hot Fact** below).

Swear off alcohol. Children born to alcoholic mothers often show a pattern of deformities, known as fetal alcohol syndrome, including low birth weight, slow growth, brain and skull abnormalities, and learning and behavioral difficulties. This condition is perhaps the easiest defect to prevent: Don't drink during pregnancy. No "safe" limits have been determined.

Avoid stress, or try to manage it. The brain manages stress through hormonal responses that ultimately reach

the fetus. Some research shows that if mothers are severely stressed during pregnancy, their babies can be over-reactive. Reaction to stress is individual, though, and pregnancy hormones can also buffer mother and child against the outside world. Don't worry if you have to keep working. Just try to find ways to keep your stress levels low.

Follow your instincts. Despite the plethora of smart toys on the market, the best type of stimulation for your baby is just the type that mothers and adults love to give: cuddling, singing, rocking, touching. Research shows that a mother's singsong, up-and-down "baby talk" helps the child learn language.

Nutrition after birth. When it comes to feeding a newborn, experts agree that "breast is best." But high-quality formulas are also a good choice, and cuddling while bottle-feeding provides the same level of physical comfort. After weaning, make sure that your baby gets an adequate amount of fat in his diet! Babies need fat for their brains to develop properly since it aids the production of myelin, the sheath that surrounds nerve cells and helps them to transmit signals quickly.

Hot Fact:

Vitamin B Helps Prevent Brain Defects

By taking supplements of the common B vitamin, folic acid, women can greatly reduce their chances of having a baby with a brain abnormality called a neural tube defect, which currently affects about 4,000 pregnancies a year in the United States.

This defect occurs when the neural tube, a structure in the developing embryo that becomes the brain and spinal cord, does not close properly. In the most common condition, spina bifida, the spinal cord and back bones are affected; results can include paralysis, lack of bowel and bladder control and learning disabilities. In a condition called anencephaly,

the brain fails to develop; affected babies are either stillborn or die shortly after birth.

Studies throughout the 1980s and 1990s have shown that folic acid can prevent up to 70 percent of neural tube defects, though how it works is still unclear. Folic acid plays a key role in chemical reactions throughout the body including the manufacture of DNA, the genetic material from which all cells and tissues are made.

The U.S. Public Health Service recommends that women of childbearing age take 400 micrograms of folic acid daily. Because the neural tube closes 24-28 days after conception (before most

women even know they are pregnant), and because half of all pregnancies are unplanned, all women of childbearing age should take folic acid whether they are trying to conceive or not. This amount can be found in vitamin supplements or in some very highly fortified breakfast cereals (check the labels).

As of 1998, all enriched grain products in the U.S. have been fortified with 140 micrograms of folic acid per 100 grams of grain. A 2001 study published in the *Journal of the American Medical Association (JAMA)* shows a 19 percent decline in neural tube defects after fortification began.

DISCUSSION QUESTIONS

1. A newborn baby is bombarded with sights, sounds, smells and sensations; yet the cortex — which has to make sense of all this information — has only barely begun to function. Before two to four months of age, babies can't even detach their gaze at will. Can you think of times when nothing you did would get a baby to stop crying? Is it possible that the swing, the music, the jiggling, were actually over-stimulating the baby even more? On the other hand, babies also crave novelty. What's an appropriate level of stimulation, and how does your baby tell you, "Enough already?"
2. In babies, memory equals recognition. What early forms of recognition have you noticed in your child? Have you seen any reactions to music that you played or sang while pregnant? When did your baby first begin looking for dropped toys? This is a sign of object permanence — the baby's awareness that something out of sight still exists — which emerges some time after six months, when the prefrontal cortex has begun to develop. How about the first signs of stranger anxiety — when the baby noticeably shows preference for parents and other familiar folks? This is when true attachment begins, and it means that the baby's frontal lobes are developing as well.
3. Although there are slight differences in brain development between baby boys and girls, cues from the family environment that influence gender differences can't be ruled out even for the most "enlightened" and egalitarian parents. What signals do you give, or plan to give, your children? Does Daddy play more roughly with the boys than with the girls? Does each of you spend more time with a child of the same sex? Have you noticed any differences in memory or in emotional behavior among your children, even in the first year? Are the boys more fussy and more prone to anger? Do the girls hit their "memory milestones" sooner?

ACTIVITIES

While there is nothing as meaningful to a baby as a parent's love, attention and warmth, the following activities may enhance brain development, stimulating the child's senses to form and strengthen neural pathways in the auditory and visual cortexes.

1. **One-and-a-half to three months:** A baby is learning to smile. To help him practice focusing, play tracking games. Move your head slowly from side to side. At first he may be able to follow only large objects moving slowly through a limited range, but soon he will be tracking even small, speedy movements. He uses his vision (and hearing and other senses) to form memorized images. These images create new neural pathways in the brain, which become the foundation for future memory and learning. Recommended: An unbreakable mirror in the crib and mobiles with highly contrasting colors and patterns.
2. **Nine to fourteen months:** A baby is learning to explore. Find an empty container with a lid that she can easily open (cigar box, egg carton) and put a safe household item or toy inside. She will enjoy opening the lid to see what is there. Change the item daily and let her discover the new plaything for the day, rewarding her natural curiosity and encouraging her to keep exploring. This is how she learns.
3. **Six to twelve months:** A baby is industriously exploring the larger world.
 - a. Give him a cabinet he *is* allowed to open, one filled with plastic kitchen food containers, pots and pans.
 - b. Place several different containers (for example, a shoebox, basket, plastic-ware or cardboard milk carton) and several choices of things that can rattle inside a container (blocks, jar lids, tennis balls) on the floor. Help him to put these together as noisemakers. As he shakes his creation, describe in words the sound he's hearing, say "brushing," "jingling," "shuffling." Then help him transfer the contents into a container made of some other material, so he can hear the difference.
 - c. Play games such as peek-a-boo, hide and seek, or dramatic play with animal figures leaving and returning. These focus on the concept of object permanence, reinforcing the idea that objects and people continue to exist even when we can't see them.

The Child's Brain: Syllable From Sound

WHAT'S GOING ON

Childhood Development

by Sandra Ackerman

Dr. Benjamin Spock, the world-famous pediatrician, once called a child's development "the most ordinary and extraordinary on earth." Although it has occurred billions of times before, no two brains develop in exactly the same way.

Twelve to eighteen months: Toddlers begin to develop memory. They love repetition.

- By 12 months, a key memory area has matured enough so that toddlers can imitate — and likely recall — events that occurred weeks, even months earlier.
- Toddlers never seem to tire of hearing the same story or throwing a ball. Repetition strengthens neural connections, helping children reinforce their skills, teaching them to pay attention to what is new and to process more complex information.
- As their synapses grow stronger, the neural pathways become increasingly well trodden so they expend less effort with each attempt.

Eighteen to twenty-four months: I, Me, Mine.

- The child develops a sense of self and, sometimes, selfishness.
- Self-control comes with time as the frontal lobes mature. Before this happens, a toddler can't wait for something he wants and may take it from another child.
- Toddlers are just beginning to learn the concept of sharing.

Two to three years old: Children display independence and take a more active role in everyday tasks.

- Trillions of synapses are now produced as the brain launches a child into two vital projects — to find his place in the world and to become competent at daily life.



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THE IMAGE BANK

- The brain's main job in childhood is to sort out which synapses to keep and which to discard.
- Synapses that are used often grow stronger, while those little used become candidates for elimination.
- Because the child's own experiences help determine which synapses will be strengthened or discarded, every brain is a unique product.

Three to six years old: Children begin to sketch patterns for future adult behavior, including responsibility, self-respect, attitudes about work, even what to expect in a mate.

- These patterns — synapses connecting specific neurons — come directly from what a child sees around her.

PROGRAM DESCRIPTION

Program Two of THE SECRET LIFE OF THE BRAIN explores how experience shapes the remarkably plastic brains of children as they encounter language. First they learn to speak and understand speech and then, when they are slightly older, they tackle the complex skill of reading.

- As she gains experience, the earliest circuits may be modified, reversed, or even overlain by new ones. Nevertheless, the original brain patterns receive enough use to keep them ready to shape reactions to challenges or circumstances that may arise even decades later.

Six to twelve years old: The urge toward independence from parents is joined by an increasing need to be like one's peers.

- The wish to be like "everyone else" represents an important milestone in brain development.
- It is preparing children for a lifetime of groups — family, playmates, schoolmates, co-workers, neighbors — by tuning certain neurons to patterns of speech, appearance, and general attitude. The human brain is keyed to recognize emotions on the human face, which is the foundation for such adult skills as tact and cooperation.

RUSSELL TRAIN: A Portrait of Childhood Dyslexia

by Marilyn Webb

Eight-year-old Russell Train is a beautiful child: tow-headed, with huge blue eyes and an engagingly impish smile. He would prefer to spend his summer watching TV and playing Nintendo. Instead, he is sitting at a table with a reading specialist, moving tiny colored blocks into small rows to build words. The blocks represent what the mouth does with letter-sounds — such as “lip-popper” for the letters ‘B’ or ‘P,’ or “tongue-toucher,” for ‘L.’ Russell is about to go into third grade but he is having trouble reading.



© MARJORY HARDY TRAIN

“I have this thing in my brain that’s called dyslexia,” Russell later explains, “It means... I don’t know... something in the brain. I don’t really know much about it.” What Russell does know is that reading was easy when he first started, because the words were short and simple. But when they started getting bigger, figuring them out became difficult.

After he was diagnosed, Russell’s parents — Bowdoin and Marjory Train — enrolled him in a program called Lindemood-Bell, a center near Washington, D.C. Dyslexia can refer to a number of different processing disturbances in the brain, but specialists said Russell’s problem was auditory.

“Many children who have dyslexia really never understand the concept that there are several sounds in words,” explains Guinevere Eden, a neurologist at Georgetown

University Hospital. “For example, in the word ‘cat,’ the sounds are ‘ca,’ ‘ah,’ ‘t’ and we just blend them all together. When we grow up speaking, we just say them as one sound, but when we have to map that sound into print, there are actually three sounds that make up the word ‘cat.’”

Reading requires the brain to coordinate high-level processes. First, it must recognize visual shapes as meaningful letters. Then, it must assign sounds, then meaning, to these letters; finally, it must make sense of the combined letters as a word. All the while, it must keep these sound-letters mentally “on-line” long enough to decode a full sentence.

Children with dyslexia like Russell’s are otherwise quite smart, but they have a hard time joining the letter-sounds. They also have trouble holding different sounds in their short-term memories long enough to put them together as words.

At Lindemood-Bell, reading is broken into its components. Each of the small, colored blocks that Russell moves on the table represents a different sound-feel in his mouth, giving each letter a specific sound, look and tactile feel. Those sounds, he then learns, represent letters. By arranging them, he can build words by recognizing and connecting the physically separate sound-blocks.

By the program’s end, Russell saw that his reading and writing were improving. At first he resisted going, throwing tantrums at home and dreading that “it’d be really boring and other things,” he says. “Now it’s not really boring. Once I got the hang of it, it was kind of fun and it was pretty helpful.”

Testing showed that his comprehension had improved as well. Dr. Eden predicts that brain scans will show increased activity in crucial areas of his brain, that his brain will actually be altered with this training. “Russell’s a better reader,” Dr. Eden says, but the true test came in the fall. “He still has a tutor,” Marjory Train says, “but the program gave him the push he needed to read in the third grade.”



Brain Health in Childhood

by Sandra Ackerman

Possible Snags in Brain Development:

The vast majority of children are intellectually curious and emotionally resilient, but the course of development does not always run smoothly. Books and charts that give overly detailed timelines for a typical child's behavior can cause needless alarm in parents. Healthy, bright children each have their own paces of development and most achieve the necessary goals in due time. Some problems, however, can interfere and may need professional attention.

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Learning disorders:

Dyslexia and attention deficit/hyperactivity disorders (ADHD)

- Dyslexia refers to, among other things, difficulty in matching printed letters and words with the sounds of spoken language. At present, one of the most effective treatments are programs — like the one Russell Train is in — that teach children to slow down and focus on each sound in a word and then link the sound with its constituent letters. Meanwhile, researchers continue to work on new approaches.
- ADHD has the dubious honor of being a disorder whose very existence is still under debate. Although about five percent of schoolchildren have been diag-

nosed with ADHD, not everyone agrees on a medical basis for the diagnosis. Some experts view ADHD as a behavioral disorder. Other experts use medical imaging to pinpoint three sites where ADHD brains differ from the norm. Another research team recently identified a particular gene in which a minute variation may be linked to the disorder. While it is controversial, the best-known treatment for ADHD today is the anti-hyperactivity drug methylpheniade (sold as Ritalin®). More effective therapies with fewer side effects will likely become available as more is known about the biological and psychological factors of this disorder.

Mood disorders.

Depression and anxiety are serious brain illnesses that can persist for months or years. Until recently, they often went unnoticed in the young. If left untreated they can interfere with crucial periods of brain development by draining a child's energy, scrambling the sustained attention that is so important during the school years, and blocking out both small and large pleasures in life. Nowadays most healthcare professionals are trained to recognize early warning signs, to help worried parents find information, and to discuss possible therapies. Mood disorders respond well to treatment.

Hot Fact:

Empathy is Partly Built-In/Partly Taught

The simple expression "I know how you feel" represents a remarkable achievement. A child must come to realize not only that she is a person, but also that there are other people in the world, and — the real breakthrough — that other people can have the same feelings she has. All this happens by about age three!

The ability to recognize emotions on a face is built into the cir-

cuitry of the brain. It paves the way for the kinds of social grouping that helped shape human evolution and still characterizes human behavior today. Also, the ability to acknowledge and give expression to another person's feelings is probably uniquely human.

Empathy does not emerge full-blown, but must be helped along both by example and instruction. Adults do this unconsciously

when they say, "Remember how you felt a little while ago when Ben wouldn't give up the puzzle you wanted? Well, when you grabbed the truck from Jane, you made her feel sad and angry too." After these early lessons, children grow in empathy more from the examples they observe in the adults around them than from any amount of direct instruction.

DISCUSSION QUESTIONS

1. Think of a child who you know. What are some of the features of her emerging sense of empathy that you can see? How did it develop? How can you recognize it? What can you do to further encourage it?
2. Recent scientific research suggests that boys and girls differ not just physically, but mentally, temperamentally and psychologically. From your own experience, do you think this is true? How is it expressed? No one has yet figured out how much gender differences are built into the brain by the child's genes and how much comes from parental attitudes and cultural norms. How much importance would you assign to each of these two factors? Do you think they work in more or less the same way in all children? What might families do to encourage or discourage gender-specific behavior? And how healthy do you think that would be?
3. Do you think that attention deficit disorder is over-diagnosed or under-diagnosed in children? Does medicating children interfere with their natural development or help them to behave in a more socially appropriate way? Do you think there might be other solutions? What might you suggest?

ACTIVITIES

LANGUAGE DEVELOPMENT

We've all heard the doctors and psychologists say, "Read to your baby! Talk to your baby often!" In addition to the emotional focus and cuddling involved, here are some ideas for stimulating language development in toddlers.

1. Loading and Dumping

How to play: Once a baby knows how to pick up a variety of small toys or blocks (usually starting at about eight months), you can show her how to drop them one by one into a large plastic cup or pail. Offer running commentary: "Now we're putting the blue block in the cup . . ." Next, let her dump them out and start all over again.

What it teaches: Labeling and cause-and-effect. Advancing from chewing on or randomly shaking an object to trying something new with it is an important step toward language development, the beginning of understanding the relationship between actions and objects. Later, toddlers will begin to use two-word "action-object" phrases, for instance "drop ball" or "more milk."

2. Communication

- a. Physically get down to the toddler's eye level instead of looking down at him. Make eye contact when talking. Place yourself face to face with him.
- b. Use every opportunity to label objects and events — in the grocery store, as you drive or ride on the bus, while

you look at picture books — naming the things he is seeing. Point out vehicles or signs of different colors or sizes; label those foods or toys that he is familiar with.

- c. Narrate daily events such as the steps in changing a diaper or in taking a bath. A child will repeat these words, each time becoming more proficient at using and pronouncing them. Expand on what your toddler is saying by labeling actions, feelings and so on.
- d. Between 15 and 18 months, babies will begin to enjoy language games that ask them to identify things, such as: "Where's your ear?" and "Where is Mommy?" Their vocabulary will grow quickly, but their pronunciation isn't likely to keep pace. Resist the temptation to correct pronunciation; most babies mispronounce their words. Instead, emphasize the correct pronunciation in your response.
- e. Often, it can be difficult to understand what young children are trying to express. It is important to convey to a child that you are very interested in what she has to say, but that you are having trouble understanding her. It can be tempting to pretend you understand the child, or to ignore what the child is trying to communicate. This does not result in a learning experience for you or for the child. Simply put, the child has not successfully communicated, and you have not received his or her message.

Program Three

A

The Teenage Brain: A World of Their Own

WHAT'S GOING ON

Adolescent Development

by Sandra Ackerman

In the teenage years — as in the prenatal period — our brains manufacture excessive numbers of brain cells, then prune them to create specific circuits that will set up lifelong patterns. As the mature infrastructure takes shape, the brain begins to show new skills that are critical to healthy adult life.

At about age fifteen, adolescents increase the quest to moderate the powerful effects of feelings on behavior.

- The *amygdala*, important in processing emotions, grows larger and forms new connections with other brain regions, leading to greater emotional integration.
- The frontal lobes launch a host of new connections to the limbic system, or “emotional brain,” a circuit made up of sites that allow us to have feelings, to recognize and think about them, and to produce physical and emotional responses.
- New synapses continue to form, giving teens more expertise in recognizing their feelings and in choosing how to deal with them.

As the brain’s “attention system” matures, adolescents develop sharper mental focus.

- Brain mechanisms for paying attention, filtering out distractions and shifting attention from one topic to another, are housed in the prefrontal cortex, the front part of the frontal lobes.
- The maturing of this structure sharpens focus and sustained attention.

- By adolescence, the brain is carrying on many important functions at once, but not all with the same efficiency. Some developments occur rapidly in early adolescence, while others take more time and experience.

Beginning around their twentieth birthdays, adolescents become better at thinking ahead and anticipating the unexpected.



PHOTODISC

- This important step comes about through reorganization in the prefrontal cortex, the executive center of the brain.
- The hippocampus continues to add new synapses, and the strength of these connections builds. The hippocampus bucks the trend of pruning synapses during adolescence and continues to add rather than eliminate — understandable since its job is memory formation.
- The new synapses boost short-term memory, which allows us to keep in mind several thoughts at the same time, even to see thoughts in relation to one another, for example when we consider various outcomes before taking action.

PROGRAM DESCRIPTION

New research has shown that during puberty, just as the brain begins to teem with hormones, the prefrontal cortex, the center of reasoning and impulse control, is still a work in progress. For the first time, scientists can offer an explanation of what parents already know — adolescence is a time of roiling emotions and poor judgement. As the brain matures, teenagers also face special risks — from addictive drugs and alcohol that can hijack the brain, to the chaos of schizophrenia, which strikes most often during adolescence.

- But when a little-understood predisposition towards schizophrenia exists, this reorganization can go awry (see **COURTNEY HALE COOK**’s story).

By the early twenties, more complex and thoughtful behavior comes into play.

- A wave of growth adds more signaling fibers to neurons in the language centers and to those in the “association” cortex, where the brain translates data from our senses into mental perceptions.
- Both new and existing fibers become more efficient signal transmitters by taking on more myelin, a fatty white insulation. As a result, the speed of signaling among brain sites increases, and thus the amount and the variety of information that contributes to each idea or action.
- Deposits of myelin occur long past adolescence, to an average age of thirty-two — when people begin to exhibit “maturity.”

COURTNEY HALE COOK: A Portrait of Adolescent Schizophrenia

by Marilyn Webb

In the eighth grade, Courtney Hale Cook tried out for King Arthur in *Camelot* in his Iowa school play. He got the part of Lancelot instead. He came to realize that role was better suited to his personality.



THE SECRET LIFE OF THE BRAIN

In becoming Lancelot, Courtney imagined this hero would try wrestling. So, by his junior year in high school, Courtney had not only been a hit in the play, he'd also become the second best wrestler on the school team. "I was looked up to by a lot of people," he says. "I was respected, well liked, seen as a hero." But by his senior year, things had changed.

"When the hallucinations and strange thoughts started, I no longer felt like myself," he says. "My hard work took a plunge. I no longer ran or lifted weights. I didn't do the things I really enjoyed about wrestling. It freaked out my coaches because they knew something was going on with me and nobody knew what. It just got worse and worse."

Courtney couldn't concentrate. His grades plummeted. He saw green halos around people and gnats in the air. Visual images seemed reversed, like a photographic negative. What was in the dark appeared two-dimensional; the rest seemed to pop out, like an other-worldly 3-D. There was a thin line between his dreaming and waking states. And he was terrified to tell anyone.

"I thought that I was an actor in another dimension who was playing the role of a schizophrenic named Courtney Cook," he remembers, "and in actuality I was not living my life but I was portraying another dimension that...ah...in reality, really didn't exist. And that was actually a comforting idea because the things I was going through were so awful that I didn't want to experience reality." His personality suddenly disappeared. Courtney was seventeen and scared.

According to neuroscientist Nancy Andreasen, what he describes is typical of the illness. "Schizophrenia effects the highest human functions," she says, "in the parts of us that are most evolutionarily advanced — our ability to think at high conceptual levels, our ability to talk."

Researchers now believe the illness is caused by damage, malfunction or an abnormal growth pattern in the prefrontal cortex, an important center for the executive mental and physical functions of the brain. It is also the area that experiences the most growth during the teenage years, when adolescents are already in hormonal turmoil.

"The tragedy of schizophrenia is that it typically begins at a time when we're just beginning to discover who we are, to differentiate ourselves from the other kids and from our parents," Dr. Andreasen says. "That's the task of being a teenager. So people with schizophrenia develop this devastating blow. It's a sense of having your identity just slip between your fingers. You know you're not there anymore, you're losing yourself, you're losing your mind, you're losing your connection with your family, your friends. Ultimately, you may be losing your future."

Typically, schizophrenics don't see a doctor for about a year. They are afraid that others will make fun of them or lock them up. But before that could happen, Courtney tried to commit suicide. That's when he finally got help.

Today, after proper medication and extensive psychotherapy, Courtney is finally in college, where he's begun wrestling again. "I'd rather have lived the life I live now," he says, "confusing and painful as it has been, than never to have been born at all." For him, there's hope, since the Courtney Cook he once was has begun the long journey back.



Brain Health in Adolescence

by Sandra Ackerman

Don't go overboard.

Adolescents are known for their attraction to anything new — a trait that serves them well at a time when so many things are new physically, mentally and in their relations with others. This attraction allows them to step up to challenges that daunt many adults, but it may also lead them to experiment in ways that can cause grave physical harm.

The adolescent brain is especially vulnerable to damage, precisely because it is in the midst of a great bout of pruning and rewiring.

- Signaling circuits created at this time or those that are particularly active quickly grow stronger. While the brain is pruning it is also strengthening the synapses that are used frequently. These synapses receive reinforcement and gain a host of connections, making it more difficult to eradicate these connections later if they prove harmful — for instance, if a smoker decides to quit or a heavy drinker swears off alcohol.
- Using tobacco in the teenage years makes the risk of dependence dangerous because substance abuse, food disorders or addictions developed at this age are much harder to break than those acquired later on in life. Likewise, adolescent drinkers face a high risk of long-term alcohol abuse.
- Recreational drugs can hinder the brain's storage of new information.
- The use of steroids in sports not only has powerful and unpredictable effects on physical development but also may interfere with the neuronal circuits that play a key role in the regulation of mood.

The rapid development of the brain can leave adolescents especially vulnerable to mood disorders.

- Scientists have not yet found the causes of schizophrenia or the physical factors that unleash it, but they are learning to spot the early signs and to control its effects more thoroughly and safely.
- Since a predisposition to schizophrenia may appear in adolescence, anything that masks the onset of this illness — for instance, drug or alcohol abuse — may cause delays in treatment, with grave or even life-threatening results.

Of course the highly impressionable adolescent brain offers great opportunities for setting down beneficial long-term patterns as well.

- The “use it or lose it” principle is very much in evidence now, as the synapses that receive the most use will gain the most strength and durability.
- The connections that receive little use wither away.

Hot Fact:

New Images Bring New Insights

For years, scientists believed brain development began in the womb and ended in kindergarten. They thought that while learning continued for many years more, the brain's physical structures were set by about age five.

We now know that brain development is much more dynamic. But this knowledge remained hidden until just a few years ago when magnetic resonance imaging (MRI) began to yield images of a profound, system-wide reorganization of the brain in preparation for

adulthood.

“Before the development of MRI it just wasn't feasible to follow an individual child, so no one had ever been able to watch brain development from childhood through adolescence,” explains neuroscientist Jay Giedd.

“We knew that the process of overproduction and selective elimination [of brain cells and synapses] happened in the womb, maybe even in the first eighteen months of life. But only by following the same children, by scanning

their brains every two years, were we able to see the second wave of overproduction a full decade later. And that was very surprising.

“What our new findings show is that the adolescent brain is far more flexible, far more adaptable than we had ever realized before,” he says, “that there's enormous potential for change even through the teen years.”

These years offer an unsurpassed opportunity for adolescents to build the brain they will want to use throughout their lives.

DISCUSSION QUESTIONS

1. Think about a teenager you know. Do you see signs of thinking before taking action, working toward a long-term goal, perceiving and responding to the feelings of others? What do you think influences that behavior? What do you think interferes with it? How might it be encouraged and reinforced?

2. Think back to your own adolescence in the light of what is now known about brain development. Do any moments or situations in your memory now seem to correspond to the brain processes and transformation that have been featured in this program? What do you do now that you didn't do then? How do you do it?

What might you tell a teenager about the "wisdom" you have gained?

3. Adolescents in stories, films and situation comedies appear all too often as stock characters: the freak, the rebel, the victim of moods, or the nerd. Given what you now know about ongoing brain development in adolescence, can you name an adolescent figure who, in your view, presents a truer picture of the adolescent experience? What makes this character a more accurate portrayal? Why do you think adolescents aren't portrayed this way more often?

ACTIVITIES

1. Just say "No"? Design a hypothetical public-service ad campaign — for TV, radio, magazines, newspapers, public posters, or carried on music videos — to discourage drinking, cigarette smoking, use of drugs, all kinds of risky behavior. Which behavior(s) would you address first and which later, or not at all? How would you best reach different age groups of adolescents — or different interest groups (e.g., television watchers versus Internet surfers)? What would you say? Do you think current prevention campaigns address some of the important developmental issues? How would you change them?

2. As the frontal lobes launch a host of new connections, teens become capable of recognizing the feelings they experience and of thinking about them. In order to help them strengthen these emerging pathways they can be encouraged to examine the process of their own thinking. Keeping a journal is a great way to do this. Here are some other things you might suggest:

- a. Record events or things that happened to you or others during the week.
- b. Write down your objective observations — perceptions only — without using value-laden words.
- c. Notice the feelings these objective events aroused in you — joy, sadness, anger, silliness, embarrassment, threat, insecurity, hurt, happiness, giggles.
- d. Take notice in your journal of what you inferred from both the objective events and from your emotional reactions: e.g., "He doesn't like me."
- e. Ask yourself why you feel that way. What are you assuming?
- f. What options or choices might there be for other ways to think about each event?
- g. What other actions could you have taken?

Patterns are likely to emerge indicating ways a teen responds to typical situations. Once aware of the patterns, he may find it easier to select a wider range of different responses.

The Adult Brain: To Think by Feeling

WHAT'S GOING ON

Adult Brain Development

by Elizabeth Lasley

The adult brain is in its prime. The fully developed cortex allows for reason, planning, analysis and forbearance, with life's emotional color coming from the limbic structures deeper inside the brain.

Adults (ideally) are in charge of themselves and their actions.

- The prefrontal cortex, the area of the cortex behind the forehead, comes into its own, keeping emotional impulses in check.
- Brain circuits linking the rational cortical areas with the emotional centers are now fully myelinated, allowing for better integration of emotion and reason.

Emotions are an important part of decision-making, as our emotional and "rational" selves can now interact, guiding our assessments of situations and our ability to make decisions.

- Confronted with something new, the brain does a quick search: Have we been here before? What did we do? What was the outcome? Memories, emotions, and even physical sensations take form, influencing many decisions we make.
- The hub of this process is the ventromedial prefrontal cortex. People with damage to this area, from injury or stroke, may not be able to recognize their own emotions and may have trouble gauging those of others.

Stress can energize—or debilitate.

- Elsewhere in the brain, the hypothalamus sets off the fight-or-flight syndrome in response to stress.
- This response mobilizes the heart, lungs, endocrine glands, and immune system to deal with sudden emergencies.



RYAN MCAN/PHOTODISC

- But when overactivated — as in times of emergencies or chronic stress — the stress response can lead to illness. High levels of the hormone cortisol are produced, which is linked to depression and to long-term effects — including memory impairment — on the brain.
- In general, depression strikes twice as many women as men — either because of genetic, hormonal, psychological, or social factors (see Profile of **LAUREN SLATER**).

PROGRAM DESCRIPTION

Program Four of THE SECRET LIFE OF THE BRAIN reveals how the thinking and the feeling areas of the brain interact constantly, and how our lives are governed by emotion and the interaction of emotion with our thought processes.

Usually the nervous system and immune system work together, but when this balance is upset, disease can result.

- Multiple sclerosis (MS), a disease in which the immune system mistakenly attacks the myelin sheath, appears in adulthood. Many sufferers believe there is a link between stress and the onset of the disease but among scientists, the jury is still out.
- An estimated 80 percent of new mothers will experience the "baby blues."
- After a stroke, 20 percent of patients will have severe depression, and another 20 percent will experience milder bouts. Depression is associated with decreased survival rate.
- Depression can be linked to heart disease and even to death from a heart attack.

LAUREN SLATER: A Profile of Healing from Depression

by Marilyn Webb

Lauren Slater was only ten when she first crashed, although the darkness had begun much earlier, maybe even when she was just three or four. In truth, she can't remember a time when that dullness wasn't there, when a blackness wasn't her daily shadow.



THE SECRET LIFE OF THE BRAIN

Severe depression, Lauren says, isn't just sadness. It's the terror, the dread, the slowed thinking, the lack of concentration and the numbness. It is absolute aloneness and pain — so much pain that by the age of ten she often couldn't stop sobbing.

"I always had a feeling that my mother hated me," she says. "That I was repulsive. I used to keep elaborate lists of all the things — this is so bizarre, actually — but I had a pad of paper that I would keep in my pocket. I was obviously old enough to write, six, seven, eight. And I would write down all the things I had possibly done wrong — if I could just figure it out, then I could remedy it."

Soon Lauren couldn't eat and she began to cut up her arms. By fourteen, she'd gulped down a near fistful of pills, trying to commit suicide. That's when she was hospitalized — for the first of five times, all before the age of twenty-five.

That year, her doctor prescribed Prozac, the first antidepressant that ever worked for her. It turned Lauren

Slater's life around. Today, twelve years later, she is a clinical psychologist, author of a best-selling book, and a wife and mother. Yet she measures her success only by how long she's stayed out of a mental institution.

"To feel depressed... to me... is to feel... dead," she says, "that all of the normal things — the coffee in the morning, the shoes you put on your feet, the work you go to every day, the child you have, the man you love — all of those things are drained of their meaning, or ability to give comfort. They are no longer even familiar. You look at these things — and they are gruesome. That, to me, is how I experience depression. It's despair because it's as though I have died and I am looking at the world, but I can no longer have access to it, and I can't explain to anybody where I am."

Where does depression come from? Genes? The environment? And what works best to alleviate its symptoms? A pill? Psychotherapy? To Dr. Slater — and to other researchers — today's best answer is biology and environment, chemicals and counseling. "I have a depressed brain," Lauren says. "I think my brain is grooved or 'wired' either to make me depressed or to give me the proclivities towards depression. There is a biochemical basis. But the fact that I had a difficult childhood, well, I think the environment shapes the brain, the same as the brain shapes the environment."

Prozac and drugs like it raise the levels of the chemical serotonin in the brain, which causes depression to lift. Why this is, scientists really don't know. But within five days after she took her first pill, Lauren says, all of her symptoms were gone.

"Depression must do something to your ability to hear, your ability to see, because I could hear things clearly, see things clearly. Colors were different. And there was this sense that I could feel. In some ways, depression is the absence of feeling. Suddenly I could feel pleasure, I could feel happiness, I could feel sadness. It was a whole new range of possibilities." And that was when successful psychotherapy could finally really begin.



Brain Health in Adulthood

by Elizabeth Lasley

Cherish your connections.

Research shows that isolation is a major factor in illness. People with few social connections or who report unsatisfactory relationships with the people in their lives are more likely to develop stress-related illnesses. Studies show impairment of the immune system in people under chronic stress — those caring for a family member with Alzheimer's disease, for example, or those in the middle of a divorce. People who are terminally ill with cancer or AIDS report less severe pain if they are strongly connected to family and friends. In a landmark study in the mid-1990s, women with breast cancer who took part in support groups lived longer than those who did not participate.

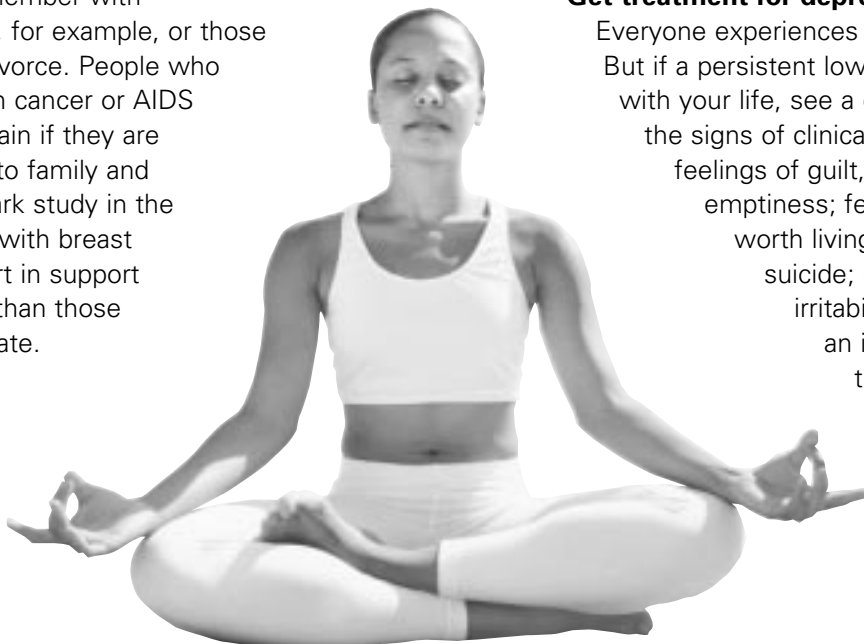
Watch your diet.

What does food have to do with mood? Potentially, quite a bit. A diet high in fat raises levels of the stress

hormone cortisol, which is implicated in depression, stress-related illnesses, memory disturbance, even osteoporosis and mature-onset diabetes. Since cortisol levels are often high to begin with during times of stress, don't compound the problem by choosing ice cream or potato chips as your coping mechanism.

Get treatment for depression.

Everyone experiences highs and lows. But if a persistent low mood is interfering with your life, see a doctor. Some of the signs of clinical depression are feelings of guilt, worthlessness or emptiness; feeling that life is not worth living or thoughts of suicide; restlessness, irritability or anxiety; an inability to enjoy things that used to bring pleasure; and an excessive preoccupation with physical symptoms.



JOAQUIN PALTING/PHOTODISC

Hot Fact:

Experience Can Rewire the Brain

Scientific evidence shows that experience can rewire the brain even in adults. The brains of violinists, for example, have more synapses (connections) representing the fingers of the left hand, which articulate the notes by pressing down on the strings.

Research also shows that when people "practice" mental health — in the form of psychotherapy — they can make very real changes in their brains. In one imaging study, a group of patients with

obsessive-compulsive disorder showed a clear abnormality in a part of the brain involved with movement.

Some of these patients took medication for ten weeks, after which another imaging scan showed that the abnormality was gone. Another group of patients, who received psychotherapy only, showed the same improvement. Whatever changes they had made with their therapists' help had altered their brains for the better!

DISCUSSION QUESTIONS

1. Do you know people who are prone to depression or illness? Do they have any traits in common, such as poor eating habits, a sedentary lifestyle, a large amount of stress coupled with an inability to handle it?

How about those people with high confidence levels and great attitudes — do they tend to be physically healthy as well? Of course, not all illness is our own fault, and severe mood disorders need medical treatment not just lifestyle modifications. But research is showing that by taking basic steps to stay healthy we can reduce our risk of many stress-related illnesses and lighten the emotional load of the illnesses that do occur.

Have you experienced long-term changes in mood, or the relief of depression, after adopting such lifestyle improvements — or do you know someone who has? What did they do that was of most help?

2. The idea that we can influence our own health by attitude and lifestyle has pitfalls. Someone who can't pull out of a serious mood disorder without medical help may feel inadequate or guilty, or — even worse — may neglect medical

treatment in favor of lifestyle and attitude adjustments. How far does the *diet, exercise and attitude* mantra go as sound advice, and when does it do a disservice by carrying an implication of responsibility to the point of blame? Have you known or read about anyone who chose to forgo medications in favor of *taking charge of her own health*, and what was the outcome? What is the best way to achieve a balance?

3. Can you make a purely rational decision? Or do your emotions have the final say in the choices you make?

- Think back on some of the important decisions you have made in the past such as where to attend college, when to have a child, what job offer to accept. Why did you make the decision you did? Did you go on gut-level instinct or was your choice “thought out?” In retrospect, would you qualify this as a good or bad decision?
- Think about your decisions last week, significant and not so significant. When did you think through decisions and when did you choose impulsively? Was it problematic to make decisions based on intuition? On purely rational grounds? What were the differences? And what were the differences in outcome?

ACTIVITIES

STRESS MANAGEMENT

Here are some techniques to help you manage stress:

1. **Exercise** helps to release pent-up energy.
2. **Deep muscle relaxation** techniques (for example, from *Healthwise Handbook: A Selfcare Manual for You*) may reduce stress and its related health problems. Tense each muscle for 4 to 10 seconds and then give yourself 10 to 20 seconds to release and relax. Here is how to tense muscle groups:
 - a. Hands by clenching them.
 - b. Wrists and forearms by extending them and bending your hands back at the wrists.

- c. Biceps and upper arms by flexing your biceps.
- d. Shoulders by slowly shrugging them.
- e. Back of the neck by gently pressing the head back. Be careful not to snap it.
- f. Front of the neck by slowly touching the chin to the chest.

3. There are a number of **self-assessment stress tests** online, including those on the following Web site:

<http://stress.about.com>

The Aging Brain: Through Many Lives

WHAT'S GOING ON

Brain Development in Aging

by Elizabeth Lasley

A mature brain functions differently from a younger one, but the years after “fiftyish” can be a time when mental powers reach their peak.

- The older brain shows a slight decrease in taking in and using new information. It may result from a decrease in cells in an area that regulates our get-up-and-go.
- Once something is learned, however, it sticks.
- The ability to learn new movements (such as t'ai chi), is just as fast and complete in older people as in younger ones.

Other types of memory may decline with age.

- Many of us begin to have moments when we can't come up with names or phone numbers. Although we may have more trouble focusing, we often have better problem-solving skills — thanks to a lifetime's experience.
- In a healthy, older brain, the net loss of brain cells is minimal and the brain retains its structural integrity. Researchers are now looking elsewhere to explain memory impairments that may accompany aging.
- Brain cells send messages using chemicals called neurotransmitters. Some researchers believe that the aging brain loses some of the receptors for a neurotransmitter important in memory formation and that are looking for medications that might reactivate those receptors.

Many people regain functions lost after stroke or traumatic brain injury.

- The brain continues to rewire and reshape itself throughout life — even when damaged — so healthy brain cells may take over and new connections form.

Stanley Kunitz: Poet at age 95



PROGRAM DESCRIPTION

The longstanding belief that we lose vast numbers of brain cells as we age turns out to be wrong. As we grow older, many mental functions remain intact and may even provide the brain with advantages that form the basis for wisdom. The aging brain is also far more resilient than was previously believed.

deposits, known as plaques, especially in areas responsible for memory and spatial navigation (which is why patients forget where they are).

- In Parkinson's, cells die in an area crucial to motor coordination, resulting in tremor and halting movements.
- Scientists believe genes may increase the risk of disease, but they are also researching environmental factors.

The senses can become less reliable and may contribute to a feeling of losing one's “mental edge.”

- About half of those between 75 and 85 suffer from cataracts, but vision can be dramatically improved through surgery.
- As many as one third of people over 75 may suffer from macular degeneration, which can sometimes be treated with laser therapy.
- Hearing loss is common in aging, especially “high-tone” loss, which makes it difficult to hear speech. Hearing aids are the best remedy.

- Some therapists think that much of the disability following a stroke may be due to lack of use, and not to nerve cell death in the brain, and that specific exercises may help patients regain use of their affected limbs (see Profile of **KENT MILLER**).

- The mature brain continues to produce new cells — most notably in the hippocampus, a structure crucial to memory formation.

The older brain is vulnerable to disease, particularly the neurodegenerative disorders (involving death of specific nerve cells), including Alzheimer's and Parkinson's diseases.

- In Alzheimer's, abnormal fragments of a protein called beta-amyloid build up to form sticky

KENT MILLER: A Profile of Stroke Recovery

by Marilyn Webb

During the night, Kent Miller tried to get out of bed to go to the bathroom but he couldn't move. "My left side," he recalls, "was completely paralyzed."

"I'm basically a cripple, is what it boils down to. I decided I didn't want to be crippled for the rest of my life. In this particular sickness, at least you've got the ability to improve yourself." After three frustrating years, Kent enrolled in a study at the University of Alabama, in Birmingham.

According to Edward Taub, the study's director, while the neurons in a stroke's epicenter shrivel and die, those in the surrounding area — called the penumbra — are just in shock. They stop functioning temporarily and then, slowly, they come back to life. The trick for recovery is to prevent the muscles and joints from degenerating in those areas controlled by the penumbra so they can resume motion when the dormant neurons "wake up."

If degeneration occurs, the body can still be retrained, and the brain can grow new connections even years after the initial stroke. Dr. Taub utilizes a method he calls "Constraint-Induced Movement Therapy." Simply put, a functioning limb is physically restrained so the weak limb can slowly learn to function again. Then both limbs can work together again as a team.

Kent trained hard with a physical therapist, each day painful and wrenching. "I was stabbing Play-Doh with a fork with my left hand and I kept missing. I used to be pretty coordinated. Used to be," Kent says. "But, you know, physically stabbing at it, that's not as bad as the mental thing of missing." Describing the experience, he breaks into tears.

After two weeks, Kent could cut his own meat with a knife and fork, hold a roll while eating, open a car door, turn on a light switch with either hand and drink from a glass of water. To him, these were all miracles.

"You take for granted you've got two arms and two legs and two hands. Being able to use the left hand again means a whole lot to me," he says. "I can focus on things other than the fact that I've had a stroke and that I can't use my left side very well. It's the focus on the future. The hope. Being able to do things 'normal.'"



THE SECRET LIFE OF THE BRAIN

Earlier that day, the Oklahoma Tax Commission had tried to get one of his clients — the owner of a convenience store — to pay her sales taxes. Kent was an accountant. "I got in the middle of it, like an idiot," he says. "I should have just told her to pay up."

Kent's wife Sharon called an ambulance. As it took him to the hospital, as he lay on the hospital bed, unable to get up or move half his body, his mind kept churning. "At the time, I was only sixty," Kent says. "I needed to work and make money. What happens to my family, what happens to me? Just a lot of things go through your head. You feel worthless. You can't do the things you used to do. Physically and mentally."

With a stroke, either bleeding or a clot prevents oxygen from reaching a portion of the brain, and the neurons in that area wither and die. The resulting disabilities depend on the location of those neurons. Kent was lucky. His stroke didn't affect his mind, his memory, his speech or his concentration. But the paralysis of his left leg and arm drastically changed the way he thought about himself.



Brain Health in the Later Years

by Elizabeth Lasley

Use tools to sharpen your memory. Probably everyone over fifty who forgets a name worries about Alzheimer's disease. But trouble with names is a normal part of aging. They are difficult to remember because they're arbitrary. You may remember that your new neighbor is dark-haired, burly and outgoing; these are integral parts of who he is. But whether his name is Henry, Willy or Stan has no special relevance, except perhaps to his parents.

- You can train yourself to remember names simply by providing some kind of context. One memory aid involves visualizing each person you meet in a different part of your house—Phil in the armchair, Bob and Katherine sitting next to each other on the sofa.
- Simple organizational changes such as setting up a consistent spot for glasses and keys can simplify things. If you have difficulty concentrating, try setting aside small blocks of time to do one thing and nothing else. For example, don't try to read a new biography while watching TV.

Improve your lifestyle to guard against stroke. Even though many doctors believe that a surprising amount of recovery is possible, strokes account for 30 percent of all deaths. Among women, they are the second leading cause of death (heart disease is the first) and claim twice as many lives as breast cancer. The most common type of stroke occurs when fats and other substances build up in the blood vessels then break off and obstruct the flow of blood to the brain. You can reduce your chances of having a stroke by following a low-fat, low-cholesterol diet, quitting smoking, keeping alcohol consumption minimal, and exercising regularly.

An ounce of prevention. There are no magic charms to ward off Alzheimer's disease, but some comparatively simple measures may reduce your risk of developing the disease.

- Vitamin E acts as an antioxidant, it mops up toxic compounds called free radicals that are produced as a by-product of metabolism. Check with your doctor first to be sure of the right dosage for you and that taking it will not interact negatively with other medications such as blood thinners.
- Physical activity also helps keep memory sharp and may be a factor in long-term brain health (see **Hot Fact**, below). Taking care to avoid falls and head injury is another preventive measure; head trauma increases the risk of Alzheimer's.
- Finally, try to avoid, manage or cope with stress. Long-term exposure to stress hormones, though not linked directly to Alzheimer's disease, has been shown to damage nerve cells, particularly in that memory nexus, the hippocampus.

On the horizon for Alzheimer's disease. The female hormone estrogen has been shown to improve memory. Among postmenopausal women, estrogen replacement lowers the risk of Alzheimer's disease by 54 percent. But don't go on "the Pill" just yet. Because this hormone increases the risk of breast cancer and cannot be given to men without feminizing side effects such as breast enlargement, scientists are working on "designer" estrogens that target brain function without causing unwanted side effects.

Hot Fact:

Exercise Helps the Brain

The easiest way to protect your brain is to maintain a program of regular, moderate exercise. Studies show that exercise improves memory and lifts depression, in addition to being good for the heart, lungs and waistline. Experiments in animals reveal that exercise raises levels of substances called trophic factors, which nourish and protect brain cells.

Other animal studies have shown that exercise also helps raise the number of new cells that the brain produces. A regular exercise routine provides structure to the day and brings people out of isolation — two important boosters of brain health. Physical activity can also protect older people by improving muscle tone and balance, which can reduce the risk of falls and head injury.

DISCUSSION QUESTIONS

1. One research group has studied 1,200 people between the ages of seventy and eighty. After keeping track of these people for ten years, the researchers found that the ones who kept their excellent mental functioning had three traits in common: they were physically active, they were mentally active, and they felt that they were making a contribution to their families and communities. How many “successful agers” do you know? What qualities do they share?

2. At present there is no definitive laboratory test for Alzheimer’s disease and no cure, though some medications can help ameliorate the symptoms. Because scientists have identified many of the genes that confer an increased risk for the disease, it’s possible that a genetic test will become available. Would you want to know whether you were at risk for developing an incurable disease? What if having the gene meant that the disease was a certainty, as is the case

with Huntington’s disease (which causes memory loss, movement problems, and dementia)? Would knowing your fate make you live your life differently, or would you just start carrying the burden of the disease that much earlier?

3. In other cultures, older people are respected and revered because of their wisdom and experience. This was true in our culture too, until recently. Nowadays, however, America glorifies youth, and all too often the elderly are seen as comical, querulous and infirm. As the country’s population ages, what steps could we take as a society to give older people a more active role to play? Raise the retirement age, for example? Have mediation sessions in nursing homes, where minor grievances are aired before a panel of older, volunteer judges? Encourage senior citizens to write articles, stories and plays to share their insights?

ACTIVITIES

MEMORY BOOSTERS

1. Shake up the automatic activities of the day.

Brush your teeth with the opposite hand, take the side streets when you’d normally take the thoroughfare, reorganize your desk at work.

2. Stay involved.

Defer retirement, mentor others in your field, take up challenging causes, travel to exotic lands, step up your role with grandchildren.

3. Fill up your senses and trick them occasionally.

Memory is not just for sights and sounds, but for texture, emotions and even smell. Explore an Indian or Asian market and get to know the spices and unfamiliar foods. Build new memories with different senses.

4. Find hobbies, take classes or do work that uses different parts of the brain.

Even if you have two left feet, ballroom dancing may be just the thing. Reading, from short stories to Tolstoy, is a great brain-builder, as are classes in anything from computers to astrophysics.

5. Replace TV with other forms of stimulation.

Try gardening, playing chess or even memoir writing.

6. Create new associations.

Instead of waking up to the smell of coffee, take a whiff of vanilla extract first thing. It may sound off-the-wall, but creating new associations — even arbitrary ones — is tantamount to brain-building.

7. Talk (and listen) to people you would normally ignore.

Practice memory boosting. Ask the bus driver his name, start a conversation, recall his name on the next occasion. If he tells you his son is taking tuba lessons, make a note to ask him how the boy is progressing. Boosting memory is about not only overthrowing old routines but also about creating new, more dynamic ones.

Adapted from www.myprimetime.com

For more information on improving your memory, visit:

<http://www.premiumhealth.com>

<http://www.memorytalk.com>

The Remarkable Plasticity of the Brain

by Richard Restak, M.D.

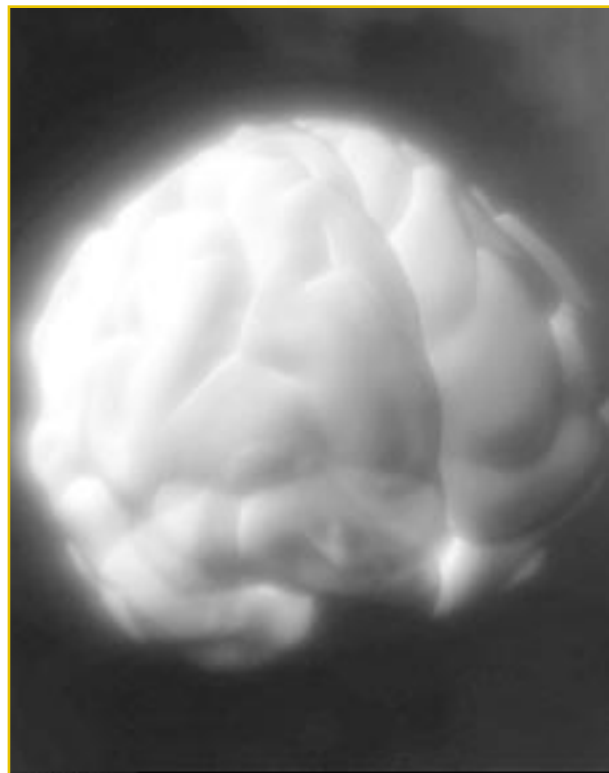
Consider this page of the guide on THE SECRET LIFE OF THE BRAIN that you are now reading. It occupies a certain amount of space: 8 1/2 inches wide by 11 inches long. Over time, the dimensions aren't going to change much (assuming, of course, that you don't tear it up). But you may bring about various minor alterations: Fold it to fit into a briefcase, or crumple it a bit or spill some drops of coffee on it. But this normal wear and tear doesn't bring about any basic modification to the size of the page.

We formerly thought of the human brain in similar terms — that once it reached a certain level of development it remained pretty much the same except for some biological wear and tear (loss of some neurons) accumulated in the interval between infancy and old age. That assumption is turning out to be wrong.

The brain remains a dynamic structure that alters from year-to-year, day-to-day, even moment-to-moment over our lifespan. Thanks to what neuroscientists call *plasticity*, the brain possesses amazing capacities for change. Without plasticity, the brain would be similar to a machine, a structure with strictly limited powers of adaptation to changing circum-

stances and conditions. Instead, the brain continually adapts. Indeed, plasticity underlies everything the brain does. Even as you read these words, your brain is changing.

Plasticity is most evident during infancy. From a tiny ball of cells the brain emerges, grows and organizes itself.



Next come the formation of the major brain regions and a migration of neurons from their original sites of generation to their final positions. Disastrous consequences can ensue whenever one of these processes goes awry. Indeed, most congenital (present

at birth) brain defects result from a disruption of plasticity as expressed in the normal programs of neuronal growth, development and migration.

As they increase in size and complexity inside the womb, the brain's cells interact with one another. Newly formed neurons establish connections with each other that continue to increase on the basis of experience. With each new experience new connections are formed. Change the experience, and you change the brain. For instance, if you deprive the baby's brain of light and sound and human contact, it will not develop normally. Abnormalities will also occur if, because of premature birth, the brain enters the world too soon and is overwhelmed with more stimuli than it is equipped to handle.

During childhood, the second life stage, a new kind of plasticity takes precedence. During gestation, neurons proliferate. At the conclusion of infancy, a sculpting process begins, becoming the dominant force shaping the brain. The brain at this point contains many more neurons than it requires, so excess neurons are pruned away according to the most fundamental tenet of brain operation: "Use it or lose it." In practical terms, this means that the neuronal connections that are used are strengthened and

(continued)

The Remarkable Plasticity of the Brain (continued)

those that are not used fade away. The neurons established during gestation and infancy are thinned out in response to experiences. Unused or rarely used pathways disappear, while heavily trafficked pathways flourish and elaborate. Thanks to this process of forming, reforming and strengthening neuronal connections, young children vastly increase their abilities to pay attention and remember and begin mastering the universe.

During adolescence, plasticity involves a second growth spurt accompanied by a second round of pruning. This time the growth and pruning takes place largely in the frontal lobes — those areas just behind the forehead involved in such eminently human activities as foreseeing the likely consequences of one's actions, planning, reasoning and controlling one's emotions.

Since their frontal lobes are not fully developed, adolescents sometimes exhibit such frontal lobe-based difficulties as impulsiveness, foreshortened attention spans, and failure to realize the possible negative consequences of their actions. Once the growth and pruning process has been successfully completed, adolescents may become more thoughtful.

During adulthood, plasticity continues but without the dramatic level of pruning observed in childhood and adolescence. In the adult, plasticity involves the formation and maintenance of neuronal circuits that can vary in richness and variety depending on one's interests and activities. Learning a new language, improving one's tennis or chang-

ing one's career results in the formation of new networks composed of millions of nerve cells. Conversely, networks are lost or diminished in number and complexity if the adult loses interest in people and events, limits his or her experiences, or fails to learn new things or develop new skills. Most interesting is the finding that important brain changes can occur in extremely short periods of time. For instance, the area of the brain that receives impulses from the

tips of the fingers undergoes measurable changes in blind readers of Braille who have stopped reading for as short a period as a weekend.

Plasticity in the older person involves new challenges and opportunities. Old age was once thought of principally as a holding operation, an attempt to retain past gains while yielding as little as possible to decline or disease. We now know that such a view is unduly pessimistic. The healthy brain of the aged person retains a marvelous plasticity and can change for better or for worse. Indeed, the brain of the older person can continue to function healthily and creatively, or it can slip in its powers due to lack of use or to abuse. Thus the older person has a choice: Accept the stereotypes about aging and sit in a corner, or remain active and vibrant.

While the aging brain may be a bit slower in learning, manipulating and rapidly retrieving new information (one of the reasons most contestants on game shows tend to be young adults), it remains highly plastic and adaptable. For instance, research on elderly college professors shows that they often outpace their younger colleagues when it comes to integrating new knowledge with existing knowledge. But one doesn't have to be a college professor to possess these talents. As Cicero wrote in 44 B.C. in his essay "On Old Age," "Intellectual activity gives buoyancy to the mind."

STEM CELLS: THE FUTURE OF PLASTICITY

Recent research on stem cells offers hope that damaged or destroyed neurons may someday be replaceable.

Essentially, stem cells are primitive unspecialized cells that can "morph" into mature cells while continuing to multiply and provide a constant source of new cells. Think back to the last time you suffered a cut or broke a bone. Stem cells in the skin and bone account for the healing that took place. Stem cells also give birth to the cells in the liver, the lining of the intestines, and all the cellular constituents of the blood. The discovery of stem cells within the brain suggests they are capable of turning into adult neurons.

"Stem cells can divide, move around in the brain, end up in specific locations and then fully differentiate into neurons," explains Fred Gage, Professor of Genetics at the Salk Institute. "It isn't as if a mature brain cell is undergoing cell division but, rather, that the process of development is continuing in the adult brain. And that's really a key feature in understanding the larger picture of what plasticity is all about."

Thus a two-part strategy may soon be in place for the treatment of dementia: the induction of nerve cell multiplication and the replacement of irretrievably lost neurons with stem cells of either adult or fetal origin. Both of these strategies could potentially treat presently incurable diseases and even provide a few more years of enhanced functioning in the normal aging brain.

Nature, Nurture and the Individual Child

by Sandra Ackerman

“She gets that easygoing temperament from her father,” a mother may say, as her two-year-old sits happily dumping sand from one pail into another. Or, applauding an eight-year-old after his first school concert, the parents may say, “Those preschool music classes really made a difference!”

In everyday life we often seek to explain children’s actions as either an inherited tendency or a direct result of learned experience. Perhaps because children keep surprising us with new skills, traits and ever-changing behavior, we try to maintain continuity by tracing new developments back to some familiar source. What parent hasn’t thought, “He didn’t get his sarcastic tongue from my side of the family,” or “What are they teaching her in kindergarten to make her so bossy?”

From generation to generation, the more curious among us have wondered how we can each start out as a single fertilized cell and yet become a unique “I” with our own thoughts, feelings and behavior. This is the ancient debating ground of nature vs. nurture: are we the biological legacy of our parents or blank slates on which our experiences writes our identity?

According to psychologist Eleanor Maccoby, we are neither and we are both. “Children’s genetic predispositions and their parents’ childrearing regimes,” Dr. Maccoby says, expressing the predominant view of developmental experts, “are now seen to be

“The concept of nature versus nurture is so ingrained in our thinking,” says Sharon Ramey, professor of neurobiology, psychology and pediatrics at the University of Alabama, “it’s almost impossible to get beyond.”

Throughout most of the twentieth century, the scientific consensus swung back and forth between two incompatible positions, pointing first to environment and then to heredity as the primary force that determines how a child will think, feel and behave. Only in the 1990s did a school of thought emerge with enough foundation in both genetics and psychology to begin studying how the two forces may work together. The new focus on gene-environment interactions finally allows us to begin answering one of the oldest riddles in child development: Why is it that full siblings, with the same two parents, are often so different from one another?

Although all siblings emerge from the same gene pool, each one receives a unique set of genes: some from the mother and others from the father, some dominant and others recessive, and so on. And these genes do not develop in a vacuum.

As early as the first few months of pregnancy, the fetus’s first environ-



URSULA MARKUSPHOTOSEARCHERS

closely interwoven. They function jointly to affect children’s development.”

But the notion of two interacting influences rather than a single direct one has always met with resistance.

Nature, Nurture and the Individual Child (continued)

ment — the mother's womb — impacts its genetic blueprint. The mother's state of health, her rest and nutrition and her levels of stress during pregnancy affect her growing child.

Then, even in the most stable family, each child's experience will be different. The parents may be new at raising children or old hands at it; the siblings are older, younger, all of one sex or the other, or mixed; household circumstances may be comfortable or difficult; the family may exist in a long-established network of friends and relatives, or may just have settled in a new geographical location. All these factors together form the child's microenvironment, and they produce major and lasting effects.

Genes can set up a tendency or predisposition toward certain likes or dislikes, talents, levels of energy, and even self-image. But these tendencies may fit well or badly into the child's environment — above all his home environment — in ways that further shape the child's traits and view of himself. In a family fond of sports and games, for example, a less actively inclined child may be encouraged to join in, or he may be labeled as lazy or a loner, or perhaps be appointed the storyteller of the group.

**WHATEVER HAPPENED TO
THE MOZART EFFECT?**

The works of Wolfgang Amadeus Mozart are a perennial favorite among music lovers, but in the mid-1990s they received a sudden surge of attention from a group with a completely different focus: parents of young children.

This new popularity arose from a single scientific paper published in 1993, in which a research team showed that listening to Mozart's music improved the performance at certain mental tasks of elementary school students. Gradually, as the story was reported to larger and less specialized audiences, this finding grew in perceived importance, until the so-called "Mozart effect" was said to increase babies' overall ability to learn or even in some way to enhance their brain for life. At the same time, though, further scientific studies did not confirm these results, and soon the exaggerated claims for the Mozart effect began to appear to be just that.

In 1999, a new paper clarified the specific findings of the original study: not only did the students' improved performance on the test fail to carry over to other kinds of schoolwork, but it also proved to be rather short-lived. The furor over the Mozart effect has largely died down, but the story of its popular rise and fall lingers as a warning against trying to generalize from a single isolated effect the tremendously complex process of learning in the developing brain.



PHOTODISC

How the child responds to such a label, and what she has made of her own inherited traits and experiences so far, will have an impact on the way her family perceives and treats her, which may in turn modify her self-image and her dealings with parents and siblings, and so on, in a cycle lasting well into adulthood. Paradoxical as it seems, each child takes part in creating the very environment that helps to shape her as a unique person.

Addictions and Cravings

by Richard Restak, M.D.

Drug abuse is a brain disease. We know this because addictive drugs mimic the action of one or more of the brain's neurotransmitters. And as a result of this successful mimicry, the brain is fooled into responding as it would to the natural neurotransmitter. "The drugs do that," says Steven Hyman, director of the National Institute of Mental Health, "by tapping into the brain-reward system and fooling that system."

The *brain-reward system* is made up of areas of the brain collectively referred to as the *pleasure centers*. Most important is a pathway that starts in the brainstem and extends upward to areas deep within the brain that spring into action whenever we experience pleasure. Dopamine is the neurotransmitter common to structures all along this *mesolimbic reward pathway*. Increasing the level of dopamine in these areas increases their neuronal firing rate; decreasing the dopamine level decreases the firing rate.

As an example of the power of the mesolimbic reward system, imagine yourself biting into and savoring a piece of succulent, tender filet mignon (assuming you're not a vegetarian). As you chew that first morsel of steak, neural messages fire within this dopamine pathway. If electrodes could be inserted safely into those areas of your brain and the results displayed on a monitor, you would be

able to watch the equivalent of an incredibly scintillating game of pinball, as the pleasure centers light up and play off one another in response to the steak.

If you don't fancy steak, think about whatever else "turns you on" — a term, incidentally, that provides an apt description of what is happening



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in your brain when you are experiencing pleasure. Whether it is movies, skiing, travel or parties, the brain's response is the same: activation, the "turning on," of those pleasure centers.

Unfortunately, these same areas are also "turned on" by drugs of abuse.

Scientists learned this from early experiments with rats. When lab rats eat or become sexually aroused, dopamine levels increase in the areas mentioned above. But the same thing happens when rats inject themselves with addictive drugs like cocaine, for example, by pressing a lever or turning a wheel. They will repeat these behaviors hundreds of times to experience the pleasure set off by the cocaine.

Liz, a patient at the Caron foundation in Wernersville, Pennsylvania, which specializes in the treatment of cocaine and other substances of abuse, described a similar craving. "When I started getting high I loved it more than anything," Liz said. "It started to be the most important thing in my life. I didn't feel normal if I wasn't high."

Liz's experience illustrates the key feature of addiction, according to George Koob, professor of pharmacology at The Scripps Institute in La Jolla, California. "In drug addiction your behavioral repertoire has narrowed such that drugs become the focus of your whole life. Your pleasure centers have been usurped, taken over by the drugs. You no longer seek natural pleasures because the drug is driving the system."

When a person takes an addictive drug, a massive surge of dopamine

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Addictions and Cravings (continued)

takes place within the pleasure circuits. This surge is far in excess of what occurs when the person experiences a normally pleasurable event like the aforementioned steak. The surge is so great that it even eclipses the pleasure of orgasm. The message transmitted to the rest of the brain from the pleasure centers is: “This is the most rewarding, exciting, important moment that you could possibly have as a human being.” Indeed the experience is so overwhelmingly significant that it builds within the structure of the brain a powerful desire to repeat it.

Not surprisingly, the treatment of addiction isn’t easy. Why give up the possibility — however elusive — of recapturing the initial “rush” that accompanied the first few drug-taking experiences? How can you “Just say ‘No’” when the drug of abuse has literally taken over the brain’s structure and functioning?

In addition, drugs exact a harsh and painful penalty for the user who decides to quit. As a result of previous use, the brain has become programmed not only for the pleasure initially associated with drugs, but also for the anticipation of drugs, and for the people and events usually associated with the drug experience. Merely returning to the neighborhood where drugs are available sets off an intense craving. Even if the user doesn’t take the drug under such circumstances, he or she experiences many of the actual effects of the drug. The heart rate picks up, tingling can be felt in the head or other body parts, buzzing sensations are experienced along with lightheadedness and, in many instances, even a bit of the drug-associated euphoria.

So powerful is the craving for drugs that 80 percent of those who have completed drug treatment programs

relapse within six months. In the vast majority of those drug treatment failures, a powerful craving precedes the return to drug use. This sequence occurs even among those who are seemingly motivated and highly committed. In essence, craving too often wins out over resolve.

Unfortunately, no drug presently exists that on its own can be reliably depended on to control drug abuse simply by altering dopamine or its effect in the pleasure circuit. Any successful treatment must prepare the addict for the craving that will emerge upon return to the previous environment. Upon completion of a course of treatment, most addicts feel confident that drug use is behind them. But as they will discover upon discharge from their treatment programs, their most difficult challenge lies ahead.

Hot Fact:

Addictive Drugs “Light Up” the Brain

In order to understand the brain-basis of addiction and “peek inside of the brain of the addict during desire,” Roseanne Childress, a University of Pennsylvania psychiatrist, has looked with a positron-emission tomography (PET) scanner at color activity-image recordings of the brains of addicts. After placing her subjects inside the scanner, she projects on a small screen in front of them a videotape of either non-drug associated scenes (Dr. Childress uses pictures of hummingbirds) or scenes of people simulating the buying, using and

exchanging of cocaine.

Dr. Childress not only found that the cocaine-related videotapes induced a craving for drugs in addicts, but also found that she could detect on the PET scan “a clear signature for desire” in tell-tale areas of their brains. The anterior cingulate, the amygdala, and the nucleus accumbens — three key way stations in the mesolimbic pleasure-reward system — lit up on the PET scan image, which meant those areas had become activated. This finding was consistent with previous animal studies that showed a gush of chemical

messengers — principally dopamine — occurring in these sites after cocaine administration.

But no activation occurred when the addicts looked at the hummingbird videos. Nor did Dr. Childress detect any activation when a control group of normal volunteers watched either the hummingbird or the cocaine-related videos. Dr. Childress’s studies provide a scientific demonstration of the powerful forces driving the addict toward continued drug use as well as help her investigate the treatment of drug addiction.

Minding Your Memory

by Marilyn Webb

It's one thing when you can't find your keys. It's quite another when you put them inside the toaster, or worse, try to use them to start it.

Neuroscientists have found that the causes of memory lapses differ between normal, aging adults and people who suffer from Alzheimer's disease. The good news is that both kinds of memory problems may soon be treatable.

Alzheimer's disease creates a patchwork of tangles and plaques within certain sections of the brain, causing brain cells to die in those areas and whole systems to shut down. Although this cell death can first appear as memory lapses, those who are stricken with Alzheimer's disease very soon develop more serious cognitive difficulties, forgetting not only where their keys or glasses are, but even why they use them. They develop dementia — a serious disruption of a broad range of both mental and motor functions.

The brains of those who experience normal aging do not suffer this massive cell death. They experience a decline in the strength of the synapse impulses in very specific memory circuits. Certain crucial receptors on the cells in these circuits — called NMDA receptors — become less sensitive. And nerve impulse transmission —



important for both memory and new learning — weakens.

The treatment and potential cure of Alzheimer's disease will require that scientists learn how to diagnose it early and to slow down and compensate for the death of brain cells. The treatment of normal, age-associated memory lapses lies in learning how to stimulate the neurons just enough, so that they make their proper, appropriately speedy connections. Scientists have made progress on both fronts.

Alzheimer's Disease

Neuroscientists have two theories about plaques and tangles. In both theories, neurons die, thereby reducing electrical and neurochemical transmissions in key areas for cognition in the brain. Some think that a molecule called *tau*, which supports the structure inside the nerve cells, starts to disintegrate, causing the cells to slowly curl up and die. In autopsy and in imaging studies, the twisted cells appear to be full of tangles. Other scientists think a runaway enzyme process makes beta-amyloid, a protein inside the cells, overproduce and break off. Beta-amyloid bits clump together and form congestive plaques.

New medications — such as Cognex, Aricept, Exelon and Raminyl — are currently on the market. They can temporarily slow down cognitive degeneration and memory loss by aiding the fading neurochemical transmission. But these medications only control symptoms, and only for a period of time, rather than treat or cure the cell death or the underlying disease.

However, researchers have developed a new vaccine — proven effective in mice and currently in clinical testing trials with people — that could retard plaque formation and perhaps reverse it completely. But even if it works, the

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Minding Your Memory (continued)

tangles and cell death remain serious problems.

Controversial stem cell research could provide help if scientists can 1) find ways to stimulate the body's normal production of stem cells so they differentiate into the necessary neurons, or 2) learn how to transplant cells from embryo, fetal or adult stem cell tissue that will form the brain cells needed, we will be well on our way to a cure for Alzheimer's disease. But scientists must also learn how to "tell" stem cells where to go in the brain, and how to "know" what cells to transform into to repair or keep up with cell damage or death.

Alzheimer's Disease Hopes

Hope for Cures:

- **Stem Cells**— As soon as political constraints and ethical questions are resolved scientists hope for a fast-paced effort toward a cure.
- **Vaccine**— Scientists now know that a promising vaccine may stop or reverse plaque formation. But they don't know whether or not plaque formation causes Alzheimer's disease or if removing the plaques will be a cure.

Temporary Treatments:

- A group of drugs show some success in boosting a key neurotransmitter, acetylcholine.
- Anti-inflammatory medications may slow down a response that some scientists believe may cause plaques, tangles or both.

Normal Aging

Neuroscientists now know that brain cells are being generated constantly.

These new cells seem to know where to go and how to fit into existing brain circuits. But as we age, synaptic receptors start to flag. The strength of the impulses sent along the neural pathways likewise seems to get weaker.

Why don't the receptors stay in shape? How do we get them to stay in shape? And, if they aren't in tip-top shape, how can we compensate for this loss of memory and/or learning processing speed?

Many other problems besides normal aging may be involved, and many of these can be reversible. The first line of defense is to get a proper diagnosis. Illnesses that can cause memory loss if left untreated include: thyroid disease, diabetes, high blood pressure, infection, depression, stress, alcoholism, vitamin deficiencies and dehydration. It can also be caused by certain medications. Among more serious illnesses, some causing dementia mimicking Alzheimer's disease, are mini-strokes, tumors and AIDS. Currently, there are a range of things neuroscientists are finding helpful for strengthening waning circuits.

Age-Associated Memory Balms (The Reputed, Disputed and Undisputed)

The Reputed

- **Physical exercise** — not only helps sagging stomachs and thighs, but strengthens memory as well, possibly by increasing blood flow or an enzyme or chemical that stimulates the speed with which impulses jump the synapses between neurons. When in doubt, work out.
- **Mental exercise** — crossword puzzles, learning a new language, solv-

ing a puzzle, taking up astronomy or weaving, postponing retirement. All of these stimulate the neurons to stay in the habit of forming new connections and drilling the old ones. Here too, it's use it or lose it.

- **Estrogen** — In studies of post-menopausal women, estrogen has been shown to increase normal memory skills and to slow down the development and progression of Alzheimer's disease.

The Disputed

- **Ginkgo biloba** — Health stores sell it, but the jury is still out on whether and how well it works. It seems to stimulate blood flow.
- **Vitamin E** — Acts as an anti-oxidant and also may stimulate blood flow but — like ginkgo biloba — dosages haven't been studied. Both of them may exacerbate bleeding problems, especially for those who are on blood thinners.
- **Diet** — What you eat — or the vitamins you take — may turn out to be important for mental functioning, especially the B vitamins (particularly B₁₂), folate and vitamin C. Again, correct dosages haven't been determined.

The Undisputed

- **Make lists** — Some sage said: "The best memory is never as strong as the weakest ink."
- **Pay better attention** — What we forgot might be what we never took in to start with.
- **Find one of the hundreds of memory skills books, courses or Web sites.**

Caregivers' Needs Across a Cognitive Lifetime

by Marilyn Webb

In most American families today, someone is receiving at-home, unpaid caregiving. It may be a premature infant or a disabled child, teenager, parent or spouse. This caring is rarely covered by health insurance. Yet, the amount of care required by chronic disability is so vast that it threatens to plunge us into a national health care crisis.

Over the past century, modern medicine has added an extra twenty-seven years to life, giving new hope to parents of premature infants, and life itself to those who would otherwise have died of ailments from typhoid to heart attacks. We live longer, but often with chronic illness or disability as a result.

More Americans now live long enough to develop cognitive afflictions like Alzheimer's disease. Babies born as early as 24 weeks into pregnancy survive. Miracle cures save our lives but they have also launched a widespread need for high-intensity, long-term caregiving, most of it done at home by families.

By conservative estimates, about 26 million Americans are full- or part-time caregivers, 96 percent of them caring for other family members. Seventy-two percent are women: the patients' wives, daughters, mothers or sisters. Together, they put in 24

billion hours of caregiving a year. Their work saves our health care system about \$200 billion a year, but for these caregivers and their families,



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the physical and emotional toll is enormous.

A recent study of 10,000 seriously ill Americans found that the impact of their need for long-term care was devastating. Thirty-four percent of the patients needed large amounts of care, causing more than half the families to suffer crises that included bankruptcy and the loss of their homes, savings or jobs. The main

caregiver's health often suffers as well. Women are trying to juggle child-rearing, job and family, along with the stress of taking care of someone who is seriously ill.

Caregivers are a silent majority — a secret work force that most of us will join. We drive an autistic child or an aging parent to a doctor's appointment. We shop for an ill sibling or friend. We monitor medications. We help with physical therapy. We scrub or bathe or comb. We take the brunt of unintended anger or emotional outbursts. We sit in quiet desperation, torn between love and grief, and battling dark feelings of duty, isolation, fury and guilt.

Caregivers need emotional and physical help. And so, hundreds of organizations now provide publications, on-line resources and illness-specific support groups. Their credo? Take care of yourself, or you won't be able to care for others.

Infancy

Your baby has arrived three months early, so tiny that she needs special care. But you need care too, so start building a team. Here are ways people can pitch in:

- Drive parents to and from the hospital.

(continued)

Caregivers' Needs Across a Cognitive Lifetime (continued)

- Prepare meals or coordinate others to do so.
- Grocery shop or run errands.
- Do laundry, clean the house, shovel the walk, or feed the pets.
- Sit with parents or meet them for lunch. Hospitals can be lonely.
- Baby-sit for other children.
- Set up a telephone information "tree."
- Offer to baby-sit, do chores, or provide meals when the baby comes home.
- Coordinate schedules for support staff, therapy and helpful friends.
- Give yourself time off — to take a walk, get a massage, or do some work of your own.

CAREGIVING TIPS

1. Take charge of your life. Don't let another's ailment always take center stage.
2. Love and value yourself. You're doing a hard job and need quality alone-time.
3. Watch out for signs of depression. Get professional help when you need it.
4. Accept people's offer of help and suggest specific things they can do.
5. Educate — and empower— yourself about your loved one's condition.
6. Be open to ideas that promote your loved one's independence.
7. Trust your instincts. Most of the time they'll lead you in the right direction.
8. Grieve for your losses, and then allow yourself to dream new dreams.
9. Stand up for your rights as a caregiver and a citizen.
10. Seek out other caregivers. There is strength in knowing you are not alone.

from The National Caregiver's Association's
Caregivers Handbook

Adulthood and Aging

About 15 to 21 percent of families are caring for an adult with a cognitive impairment, including Alzheimer's and Parkinson's diseases, stroke and head injury. They may behave in ways that are profoundly changed, making them seem like strangers. Grieving, communication and emotional problems, the poignancy of their condition coupled with guilt and stress can make you feel depressed and alone.

Build a circle of care. Use local resources to find adult day care. Consider using home health care programs and local organizational resources such as Meals on Wheels. If you need to, talk with a professional counselor or chaplain. Look for disease-specific or caregiver-oriented support groups. Find things that friends or family members might do to help you take breaks, small vacations and long weekends. Eat a balanced diet. Get enough sleep. Exercise or find another way to reduce stress. Plan for your own future.

As time goes on, you may find that there is a spiritual side to caregiving for someone you love, a poignant softness and intimacy that can grow between the two of you. Find enjoyments you still share: music, singing, outings, Scrabble™, movies, telling jokes, writing memory books or playing cards.

Childhood and Adolescence

With an ill child, you need to plan for the long haul. Explosive or irrational behaviors can be disruptive or cause embarrassment, even chaos for the rest of the family. And then there are the overwhelming feelings of failure and grief. The support of family and friends is a must, as is taking time for yourself.

While caring for your offspring, guard against your own isolation, depression and exhaustion. The goal is to keep it all in balance. Family and friends can help with the following:

- Research diagnoses and treatments at local libraries or online.
- Help keep track of medical bills and manage paperwork.

Addiction: The compulsive use of a substance or activity that can cause harm to thinking, emotions and behavior.

Adrenaline: A hormone that arouses and heightens emotional responsiveness.

Alcoholism: A chronic disease characterized by excessive or compulsive use of alcohol.

Alzheimer's disease: A progressive, neurodegenerative disease — and the most common cause of dementia — that results in the death of nerve cells in the brain and gradually destroys the ability to remember, learn, reason and imagine.

Amyloid plaque: Clusters of dead and dying brain cells and amyloid protein fragments, that are one of the characteristic structural abnormalities found in the brains of those with Alzheimer's disease.

Amygdala: A part of the brain — shaped like an almond and located deep inside, near the inner surface of each temporal lobe — involved in our emotions, emotional learning, and memory.

Anencephaly: The lack of brain formation due to a congenital defect in neural tube closure.

Attention-Deficit Disorder/Attention-Deficit Hyperactivity Disorder (ADD/ADHD): A disorder that involves attention and focusing problems, most commonly (and controversially) treated with the drug Ritalin.

Autism: A complex disability that typically appears during the first three years of life and affects the normal development of the brain in areas of learning, social interaction and communication skills.

Axon: A branch or a nerve cell that transmits outgoing signals to other neurons, muscles or glands of the body, and may be as long as 1.3 yards in length.

Brainstem: The lower part of the brain that controls basic bodily functions; directs our reflexes, vital signs, and automatic control of the eye, face and head; and helps us interpret sensations of taste, hearing, vision and balance.

Brain imaging: By the use of new electromagnetic techniques physicians can take highly detailed pictures of the brain. Three examples of this technology are positron emission tomography (or PET scans), magnetic resonance imaging (or MRIs), and computerized tomography (or CAT scans). Analysis of the electroencephalogram (EEG) is another, different way to study brain activity.

Brain (neuronal) plasticity: The ability of intact brain cells to take over the functions of damaged cells. The human brain remains plastic (or pliable) throughout life (which is how we are able to learn at any age), but it is massively more so in early life.

Cerebellum: The portion of the brain — located at the back of the head — that helps coordinate movement, posture, balance, coordination and rhythmic movements, and is important in aspects of learning and memory.

Cerebral cortex: The outer layer of the brain that covers the cerebrum and manages most high-level functions, including thought processes and controls the lower, older, more automatic parts of the nervous system.

Cerebrum: The largest area of the brain, consisting of two hemispheres or halves — the right and left cerebral hemisphere, which are in constant communication.

Cortisol: A hormone produced by the adrenal glands that increases resistance to stress.

Dendrites: Tree-like branches or "cables" of nerve cells that receive and process electrical signals to other neurons. Typically each neuron possesses tens of thousands of dendrites, seldom longer than a hundred thousandth of a meter. (Compare this with the 1.3 yards of an axon!)

Depression: A serious mood disorder marked by a combination of symptoms that affect one's ability to work, eat and enjoy once pleasurable activities.

Dopamine: A chemical in the brain that acts as a neurotransmitter, stimulating receptors on adjacent nerve cells and producing in them a cascade of chemical

reactions. Deficiencies of dopamine arise in Parkinson's disease.

Dyslexia: A disorder manifested by difficulty in learning to read, particularly when a significant discrepancy exists between intellectual ability and reading performance without an apparent physical, emotional or cultural cause.

Endorphins: Neurotransmitters in the brain that block pain signals to the nervous system, reducing pain.

Epilepsy: A symptom of neurological dysfunction characterized by seizures or changes in behavior resulting from abnormalities in the electrical activity of the brain.

Frontal lobes: The front parts of the cerebral hemispheres that are involved in planning, reasoning, judgement, organizing, problem solving, selective attention, personality and a variety of higher cognitive functions.

Hippocampus: Part of the limbic system that plays a crucial role in learning, processing and storing long-term memories.

Left cerebral hemisphere: Controls the right side of our bodies, coordinates learned movement patterns, enables language expression and comprehension and processes abstract symbolic thought.

Limbic system: This network of structures, located deep within the brain, just above the brain stem, plays an important role in human emotion, learning and memory.

Lobes: The four parts of the two cerebral hemispheres that are demarcated, front-to-back, side-to-side, and by major grooves in the surface of the brain. The occipital lobes, located in the back of the brain, are primarily responsible for vision. The frontal lobes are involved in movement, complex judgment, emotional regulation, problem solving, decisions, planning and creativity. The parietal lobes are involved in higher sensory-motor coordination and language functions. Temporal lobes located above and behind the ears are involved in memory, hearing, language and emotion.

Midbrain: The portion of the brainstem below the cerebral hemispheres and consisting of the thalamus, hypothalamus and the limbic system.

Motor cortex: The region of the cortex close to the parietal lobes concerned with voluntary muscle movement.

Neurofibrillary tangle: Accumulations of twisted protein fragments inside of nerve cells found in the brains of Alzheimer's disease patients and associated with the demise of brain cells.

Neural pathways: The set of networking connections between neurons, that are responsible for brain activity. There are an estimated ten million pathways in the brain.

Neural plate: The earliest form of brain tissue, present as a sheet of cells, in the developing embryo for just a few days in the third week after conception.

Neural tube: Origin of the entire brain and spinal cord, which forms from the neural plate during the fourth week after conception. First, the neural plate elongates and folds along its midline into a "groove." Then the lips of the fold zipper shut in two directions, beginning in the middle of the embryo and progressing both toward the head and toward the "tail" of the embryo.

Neural tube defect: A birth defect that occurs when the neural tube does not form correctly. The two major types of neural tube defects are anencephaly, or lack of brain formation and spina bifida, in which the neural tube fails to close at its posterior end.

Neurons: Nerve cells, specialized for the storage and transmission of information, make up the central nervous system. They consist of a cell body, a single axon that conveys electrical signals to other neurons and a host of dendrites, that receive incoming signals. There are about 25 types of neurons in a human brain.

Neurotransmitter: A molecule that acts as a chemical messenger for conveying information between neurons at synaptic junctions. Some familiar neurotransmitters are acetylcholine, serotonin, dopamine and glutamate.

Obsessive-compulsive disorder (OCD): A potentially disabling condition whereby a person becomes trapped in a pattern of repetitive thoughts and behaviors that are senseless and distressing but extremely difficult to overcome.

Parkinson's disease: A progressive, neurodegenerative disease characterized by the death of nerve cells in a specific area of the brain. Parkinsonian patients are deficient in the neurotransmitter dopamine and may display such symptoms as tremors, speech impediments, movement difficulties and often dementia later in the course of the disease.

Post-traumatic stress disorder (PTSD): A psychiatric disorder that can occur following traumatic events. Left untreated, symptoms can be severe enough and last long enough to significantly impair the person's daily life.

Prefrontal cortex: Located behind the forehead, the prefrontal cortex is part of the frontal lobe of the cerebral hemisphere. It allows us to make decisions, judgments, and future plans as well as modulates emotional tone. It is involved in such highly abstract functions as personal responsibility, morality and self-control.

Prozac: One medication in a class of drugs called selective serotonin reuptake inhibitors (SSRIs) that may help to correct neurotransmitter imbalances, and to treat depression, panic disorder, obsessive-compulsive disorder (OCD), and post-traumatic stress disorder (PTSD).

Pruning: A process in brain development whereby unused synapses (connections among brain cells), are shed.

Psychosis: A severe mental and behavioral disorder in which a person is unable to distinguish reality from fantasy.

Receptor: A molecular structure on a nerve cell membrane that is specialized to respond to neurotransmitters.

Right cerebral hemisphere: Controls the left side of the body, manages nonverbal processes, gives us our bearings in space, and is important for hand-eye coordination and emotional processing.

Glossary B

(continued)

Ritalin (methylphenidate): A controversial, central nervous system stimulant that has the paradoxical effect of quieting individuals (usually children) who have an abnormally high level of activity or attention-deficit hyperactivity disorder (ADHD).

Schizophrenia: A psychotic mental disorder that interferes with the ability to think clearly, manage emotions, make decisions and relate to others. It may include delusions and hallucinations, alterations of the senses, an inability to sort and interpret incoming sensations, an inability to respond appropriately and an altered sense of self.

Serotonin: A neurotransmitter present in certain regions of the brain that plays an important role in depression and is used in regulating aggressive behavior.

Spina bifida: A condition caused by a neural tube defect that can lead to paralysis and other serious medical conditions.

Stem cells: Relatively undifferentiated cells that can divide and cycle throughout life to become more specialized cells, for example, liver, brain, or skin cells.

Stroke: Occurs when blood flow to an area of the brain is interrupted. It can result from a blood clot blocking a blood vessel, or a blood vessel rupture, either of them causing death or damage to specific brain cells. The type of disability that results (paralysis, loss of speech, etc.) depends on the location of the dead or damaged cells.

Synapse: Gaps in the circuitry of the brain between the junction of an axon of one neuron and the dendrite of another. The passing of a signal across this gap is mediated by neurotransmitter chemicals and causes brain activity to move along specific circuits.

Tau protein: The major protein that makes up the neurofibrillary tangles found in the degenerating nerve cells in the brains of those with Alzheimer's disease.

Thalamus: A large egg-shaped mass at the base of the cerebral hemispheres that is the chief center for the transmission of sensory impulses to the cerebral cortex.

BOOKS

The Secret Life of the Brain
Richard Restak, M.D.

In a companion book to the series, neuropsychiatrist Richard Restak reveals what neuroscience is uncovering about the intricate magic of the brain. Published by The Dana Press and Joseph Henry Press, 2001.

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PROGRAMS

Program One

The Baby's Brain: Wider Than the Sky

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Program Three

The Teenage Brain: A World of Their Own

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Program Four

The Adult Brain: To Think by Feeling

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ONLINE RESOURCES

GENERAL INFORMATION

Dana Foundation

www.dana.org

Mental Health InfoSource

www.mhsource.com

National Institutes of Health (NIH)

www.nih.gov

National Institutes of Mental Health

www.nimh.nih.gov

Society for Neuroscience Brain Briefings

www.sfn.org/briefings

PROGRAMS

Program One

The Baby's Brain: Wider Than the Sky

Talaris Research Institute

www.talaris.org

The Premie Place

www.thepremieplace.org

Zero to Three

www.zerotothree.org

Program Two

The Child's Brain: Syllable From Sound

American Academy of Child and Adolescent Psychiatry

www.aacap.org

Children and Adults with Attention-Deficit/Hyperactivity Disorder

www.chadd.org

International Dyslexia Association

www.interdys.org

National Attention Deficit Disorder Association

www.add.org

Program Three

The Teenage Brain: A World of Their Own

Family Caregiver Alliance

www.caregiver.org

Focus Adolescent Services

www.focusas.com

National Foundation For Depressive Illness, Inc.

www.depression.org

National Institute on Drug Abuse

www.nida.nih.gov

Schizophrenia Home Page: A Not-For-Profit Information, Education, and Support Center

www.schizophrenia.com

Program Four

The Adult Brain: To Think by Feeling

Anxiety Disorders Association of America

www.adaa.org

National Alliance for Caregiving

www.caregiving.org

National Center for Post Traumatic Stress

www.ncptsd.org

National Depressive and Manic-Depressive Association

www.ndmda.org

Well Spouse Foundation

www.wellspouse.org

Program Five

The Aging Brain: Through Many Lives

Alzheimer's Association

www.alz.org

Alzheimer's Disease Education and Referral (ADEAR) Center

www.alzheimers.org

National Family Caregivers Association

www.nfca cares.org

National Institute on Aging

www.nia.nih.gov

National Stroke Association

www.stroke.org

How to Organize a SECRET LIFE OF THE BRAIN Workshop

by Mari Cossaboom

You don't have to be a neuroscientist to organize an educational workshop about the brain. With a little planning, some practical strategies, and content-rich multi-media resources such as videotapes of the series THE SECRET LIFE OF THE BRAIN, this Guide and the www.pbs.org/brain Web site, you can create an informative, interactive workshop. Below are a few steps you can take to ensure success.

PLANNING

- **Identify your target audience.** Are you trying to attract teens, parents, caretakers or senior citizens? Knowing your audience will help you focus the content of the session. Although the brain is a universally fascinating subject, each group has different interests. Teens may be interested in addiction and sexual development, new parents might want information about language development, and seniors might want to know about brain fitness and healthy aging.
- **Establish goals for the workshop.** Keep them realistic and attainable in the time you have allotted. Determine one or two points that you want participants to take away from the session. Consider your target audience and their prior knowledge of the brain. Don't set a goal to teach the group neurochemistry from A to Z if they have never heard of the subject before! Keep these goals in mind as you prepare an agenda, and refer to them frequently to make sure you are staying on track.
- **Enhance the workshop content by involving people from your community.** Invite experts from health care or educational facilities in your community. They can make abstract information more relevant to participants by relating it to programs in your area or to research that is taking place at local institutions. Use this opportunity to inform participants about local resources for people with brain diseases or volunteer options.
- **Assess your resources.** There are a few logistical things you need to know before determining the structure and the size of the workshop. Do you have access to equipment such as VCRs and computers? How many people can the room seat comfortably? What materials such as this Guide, other handouts, reference books and videotapes are available?
- **Prepare your space and equipment beforehand.** Check equipment to make sure it is in working order and that you know how to operate it. Cue tapes ahead of time so you are not fumbling to find the right segment. Arrange lighting for the best viewing if you are going to use video. Lights should be left on as much as possible during the video to reinforce the fact that it is a part of an educational activity, not passive entertainment.

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STRATEGIES

- **Preview THE SECRET LIFE OF THE BRAIN.** Select short segments that are most relevant to the focus of your workshop. Using carefully selected, brief video segments can make abstract scientific concepts come alive. The series' use of dynamic visual imagery and cutting-edge technology allows you to take participants on impossible "field trips" inside the human brain that will make neuroscience accessible to virtually everyone.
- **Prepare participants for viewing the segments.** Begin with an introductory activity that engages participants and lets them know what to expect. You might introduce new vocabulary or a new idea or conduct a related hands-on activity. Check out the detailed activity plans based on video clips from THE SECRET LIFE OF THE BRAIN on the project Web site at www.pbs.org/brain.
- **Provide participants a focus for viewing.** This can be a specific task or responsibility to keep in mind while the video is on. Ask them to listen for a definition of a particular word, to watch for a specific event or even to take note of their reactions to the segment. This keeps everyone attentive and directs the learning experience to the workshop objectives.
- **Use the Pause and Rewind buttons for reinforcement of key messages or to assess the audience's level of comprehension.** Stop the video to find out if participants understand the scientific concept just described. If they don't, rewind and play it again. Sometimes, it may take two or three viewings to process the information fully.
- **Encourage interaction among the group.** Arrange seating so that people can see each other and speak comfortably. Build in time for questions and discussion. Stimulate conversa-

tion by posing open-ended questions that invite dialogue. Each section of this guide includes questions designed to encourage discussion by groups.

- **Summarize.** At the end of the session, briefly review the topics covered and the activities the group has done. Ask participants to share with the group something they have learned. This gives you another opportunity to elicit questions and fill in any information gaps. It may also give you clues about topics for a follow-up session.



RESOURCES

- THE SECRET LIFE OF THE BRAIN will be one of your most useful resources.
- A fully-illustrated companion book, by Richard Restak, M.D., has been published by the Dana Press and the Joseph Henry Press.
- The five one-hour programs may be taped off the air for educational use for one year after the last broadcast.
- The full set of videotapes is also available for purchase through PBS Home Video. Call 1.800.PLAY.PBS.
- This guide may be reproduced for use in educational groups. Additional copies can be ordered through guiderequest@thirteen.org. It also can be downloaded from the Web site.
- THE SECRET LIFE OF THE BRAIN Web site (www.pbs.org/brain) is an excellent resource for detailed activity plans based on the series, video clips and tools for publicizing your workshop.