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AUTHOR Chambliss, Catherine
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ABSTRACT

This guide for infant day care providers examines the importance of early experience for brain development and strategies for providing optimal infant care. The introduction discusses the current devaluation of day care and idealization of maternal care and identifies benefits of quality day care experience for intellectual development, sleep routines, learning opportunities, the development of empathy, and dealing with frustration. Part 1, "Why Having a Good Start Matters!," examines recent evidence regarding brain development during infancy, the importance of early experience, and the impact of enriched environments. Part 2, "Good Experiences Shape the Brain," presents information on the relationship between verbal stimulation and language development, nurturance and emotional development, enriched environments and intellectual development, and how good day care may enhance development. Part 3, "How Things Can Go Wrong!," discusses damaging experiences, the role of stress hormones in brain growth, research on children with chemical markers for various disorders, and how quality care can prevent later problems by building resilience. Part 4, "Strategies for Enhancing Day Care," delineates direct and indirect strategies for enhancing sensorimotor, social, language, intellectual, and emotional growth. (Contains 14 references.) (KDFB)

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OPTIMIZING INFANT Development

Strategies for Day Care

Catherine Chambliss, Ph.D.
Department of Psychology
Ursinus College

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OPTIMIZING INFANT DEVELOPMENT

Building Better Babies!

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OPTIMIZING INFANT DEVELOPMENT

Catherine Chambliss, PhD.
Department of Psychology
Ursinus College

---The Critical Period of Infancy
Laying the Foundation for Later Learning
Welcoming New Families

---The Child's Evolving Brain
Neuroscientific Evidence of the Effects of Quality Care
Neurons are a little like trees:
Dendritic spines branch out and connect with other neurons.
Experience creates new interconnections that allow more efficient functioning.
Lack of use causes some connections to die.
Together, the building of new useful connections and loss of useless connections produces new abilities to respond to the world.

---Strategies for Providing Optimal Infant Care
The Important Balancing Act: Staying in the "Zone"
Optimal Stimulation
Active vs Passive Learning
Expressive vs Receptive Language
Sensorimotor Stimulation and Experimentation
Responsive Environments Mobilize Mastery (REMM)

---Accommodating Individual Differences in Temperament
Matching the Lesson to the Student: Fine tuning your Approach
Emotionality
Activity
Sociability
Difficult Babies: Avoiding Overpersonalizing and Burnout

---Collaborating Effectively with Parents
Guilty Parents: Helping them join the family!
Anxious, Insecure Parents: Supporting their strengths!
Angry, Overcontrolling Parents: Not fighting back!

---Maintaining Your Enthusiasm
Inspiring One's Colleagues: Making the Invisible Visible
Contributing to Our Understanding of Optimal Infant Care
Participating in Research Projects to Define "cutting edge care"

Fighting Stubborn Myths about Day Care

Decades of empirical investigations have failed to support the myth that maternal employment is generally harmful to children. Yet time and again, the old, negative beliefs about day care surface in the media.

Correcting Biased Popular Perceptions of Caregiving

Neither is day care as bad,
Nor mothers as good,
as we tend to think!

Group day care is still a relatively new phenomenon in the U.S. With the exception of a brief period during WWII when women were needed to work in factories, institutionalized group care of infants and young children has not been the norm. Some of the negative attitudes toward group day care stem from its novelty. We tend to be wary of the unfamiliar, and many people devalue day care simply because they offer something different than what they expect.

Day care centers have an important educational role in our society. It is incumbent on them to help articulate the potential value of what they provide, not only to children and their parents, but to society as a whole. Well-reared children, whose developing brains have been given optimizing stimulation and opportunities for exploration, will become better students in K - 12, and better citizens as adults.

The devaluation of day care is exacerbated by the idealization of maternal care. Actual group day care is not as bad as most people imagine, but the fact that it is often being compared with an unrealistic, fantasy of the experiences provided by a stay-at-home mother alternative, makes it look all the worse. Too often, critics of day care are comparing a reality with a fictional dream. Stay-at-home parents are assumed to provide cheery, enthusiastic, non-stop, loving attention and gratification (they actually don't!), and such continual gratification is assumed to be optimal (it isn't!).

Day care centers can be exciting, positive, highly social settings that provide ongoing opportunities for infants to learn and master their environment. The support that day care providers receive from one another, and the encouragement of excellence that good day care managers provide, combine to keep providers motivated to do their best. Well conducted day care can optimize infants' development by exposing them to a wide variety of caring, positive, enthusiastic adults.

In fact, a study reported in the 1997 Journal of Developmental Psychology found that day care experience was actually associated with higher intellectual skills in children! The Broberg et al (1997) study was a rare longitudinal investigation of the long term effects of day care, that compared center day care, family day care, and home care.

These researchers assessed the verbal and mathematical intelligence of 146 8 year olds, whose parents had all placed their names on a waiting list for a day care center when they were infants. Roughly a third of the applicants were accommodated by the day care center. Another third received family day care. A final third ended up being cared for at home, usually by mothers.

These three groups of children scored significantly differently on the intellectual measures. On both the verbal and mathematical tests, the former day care center children outperformed their counterparts. The lowest scoring group included the children who had been placed in family day care settings.

It may be that a neighborhood family day care setting, often selected because it closely resembles staying at home, may duplicate many of the disadvantages of home-based care. For example, in many family day care settings, the television is turned on throughout the day, fostering passivity among the children.

Intellectual Performance of Children Following Home Care, Family Day Care, and Day Care

Broberg et al (1997)

Standardized cognitive ability scores for six groups of children

(N = 146)

	Verbal	Math
Home Care	Mean = 55.32 S.D. = 17.12	Mean = 19.97 S.D. = 5.90
Family Day Care	Mean = 51.31 S.D. = 15.78	Mean = 19.67 S.D. = 6.96
Center Day Care	Mean = 62.66 S.D. = 19.95	Mean = 23.67 S.D. = 4.06

1997 NICHD Findings

Another recent study provided additional evidence of the beneficial impact of good day care experiences. One of the largest studies examining the effects of day care in the U.S., conducted by the federal government's National Institute of Child Health and Human Development (1997), found that very young children in high-quality day care outperformed others in basic learning skills. These skills included recognizing shapes and understanding relations among objects, often considered the "bedrock of school readiness".

Why might the children with day care center experience have benefitted intellectually? How might day care have helped their brains develop? What is a day care infants' day like? Several factors may contribute to the advantage Broberg documented.

Sleep

Day care infants often awaken in the morning more prepared to cope well with their day, because they've generally gotten a good night's sleep. This good quality nighttime sleep is fostered by two things. First, most parents with infants in day care recognize the need to maintain a regular bedtime routine. Having babies on a schedule where they are consistently calmed and put in bed at roughly the same time each night, helps to stabilize their Circadian rhythms. People pass through sleep stages more productively when their bodies and brains are in a consistent routine. Second, many infants in day care sleep better than they might otherwise because their days are stimulating and challenging, and they are fatigued as the day draws to a close.

Day care providers can help their children by advising parents about the importance of high quality sleep and a regular bedtime routine. Most parents of infants can readily grasp that sleep makes a big difference; their own bleary-eyed struggles with middle-of-the-night feedings and teething pains have affected their adult functioning, too. Often parents of infants in day care miss their children and/or feel guilty about being absent during the day. This sometimes causes them to struggle when it comes time to enforce a reasonable bedtime schedule. Similarly, on weekends, some parents abandon their baby's weekday schedule, and let children become wound-up late at night. Helping these parents appreciate how excessively erratic schedules can make life and learning harder for their children can facilitate their making more optimal choices.

Two Worlds for Learning

After awakening, the day care infant's day involves a transition from home to school. As they move from one set of people and objects to the next, they are challenged to make many discriminations. Day care creates a second world to experience and master. High quality day care can permit twice the learning, when infants are permitted the chance to explore and interact in both an enriching, stimulating group environment at school and

their home base. The attention span of babies is limited; novelty engages their minds. They rapidly soak up new information when new stimuli engage their attention. Babies seem to learn best when life is interesting for the. Day care can help to keep life interesting, and promote the development of enthusiastic learners.

While we often assume that the stress associated with infants' making daily transitions to day care settings has a negative effect on their development, it is important to remember that for decades we have known that certain types of stress actually facilitate development of certain biological systems. In research using rats stressed during infancy, either by simply being picked up once daily and placed briefly in an unfamiliar environment, or by being given shocks for 3 minutes once daily until weaning at 21 days, Levine (1957) found a variety of beneficial effects.

Stressed infant rats grew into adults that explored a new environment more freely, defecated less, and showed more adaptive behavior by learning avoidance conditioning more rapidly. One of the chief consequences of infantile stimulation is to endow the organism with the capacity to make fine discriminations concerning relevant aspects of the environment. This view is supported by evidence that manipulated animals show less adrenal response to a new situation and quicker habituation. Solomon, Levine, and Kraft (1968) extended this work, and demonstrated the beneficial effects of early stimulation on the development of immunological competence.

While we should exercise caution in generalizing from research on other species, since ethical concerns preclude comparable examination of stress in humans, it is interesting to consider these findings and the possibility they raise: that moderate stress during infancy may actually promote later functioning.

Empathy

The communal nature of day care offers special opportunities for adults to teach children lessons about cooperation, sharing, waiting, and empathy. The capacity to experience another person's feelings is deeply rooted in our brains, but benefits from priming by experience. Newborns cry selectively in response

to the sounds of other babies' cries; nonhuman sounds of similar pitch and volume fail to elicit this same response.

Although early on babies display this capacity to "feel another's pain," or to experience vicarious pain, a caregiver's encouragement of caring promotes interpersonal sensitivity and responsivity. A child's long term satisfaction in life is heavily dependent upon their ability to sustain mutual relationships. The ability to attend to others' feelings and to respect others' rights begins in the first year, as infants observe their impact on others. Day care providers can help their students function better socially by helping them learn how to notice and consider others' needs and responses.

Managing Frustration

Group child care requires children to learn how to wait for their turn. Frustrating children may seem a hardship, but in fact, developing the capacity to tolerate frustration is of tremendous psychological significance. By appropriately guiding day care infants, we can help them begin to develop the self calming skills that will serve them the rest of their lives. A balanced exposure to both frustration and gratification is the best preparation for later life. Children denied early experience with sharing and waiting often have more trouble coping socially, which detracts from their eventual happiness.

Summary

Recent developmental neuroscience findings underscore society's need to provide good care to all children in the first years. However, simple, nostalgic thinking obfuscates our understanding of the ideal. Group day care can be best for many children, if we work to optimize it.

Responsive, stimulating experiences for infants are provided by many day care centers and are not provided by some stay-at-home parents. The research actually shows that various care arrangements can optimize brain maturation.

OPTIMIZING INFANT DEVELOPMENT

Why having a good start matters!

Part 1

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A Review of Recent Neurobiological Findings and their implications for Infant Day Care

WHY INFANCY IS KEY!!!

What's happening in an infant's brain?

At the University of Chicago, neurobiologist Peter Huttenlocker has done research using electron microscopes to count the connections between neurons in the brain. He has shown how dramatically synaptic linkages increase during infancy.

Counting Synapses
The Explosion of Neural Connections in Infancy

Huttenlocker found that a small sample of neural tissue, the size of a pinhead, taken from a twenty-eight-week-old fetus, had 124 million connections between the cells; a sample from a newborn, 253 million: and a sample from an eight-month-old had an astounding 572 million connections!

The number of interneuronal connections kept increasing for some time, and then it started to decline. Brain connections start to attenuate toward the end of the first year of life, stabilizing at roughly 354 million per speck of brain tissue by age twelve.

The pruning of less useful synaptic connections helps the brain perform its habitual tasks more efficiently. The connections that remain permit streamlined, sometimes automatic use of behavioral strategies that have worked well in the past. Our brain designs itself by experimenting with different ways of handling challenges presented by our environment. What works is learned and kept through the survival of the related neuronal connections.

The brain is not a static organ; it is a constantly changing mass of cell connections that are deeply affected by experience and hold the key to human intelligence. Our environment teaches our brain what it needs to be. Stimulation is vital for the development of a capable brain.

Critical Periods of Brain Development

The fetal brain and the developing postnatal brain are very different structures from the adult brain, and the developing brain of an infant is really not a small version of an adult brain. In fact, at age 2, the human brain has twice as many synapses and uses twice as much energy as an adult brain.

Enriched Environments Make a Difference!

At the University of Illinois at Champaign-Urbana, a study by William T. Greenough revealed that rats raised in enriched environments with toys and other animals to play with had measurably more connections between brain cells, and were better learners, than those raised in less stimulating surroundings.

The human brain consists of roughly 100 billion neurons and 1 trillion supportive glial cells. Brain cells receive, analyze, coordinate, and transmit information. The brain learns and remembers throughout life by constantly changing its network of trillions of connections between neurons as a result of stimuli from its environment. Researchers now know that some of these connections, or synapses, grow stronger with learning, and weaken or disappear when not used.

During fetal development, the human brain produces twice the number of cells it will eventually need. Before birth about half of these cells die when they fail to find a job to perform.

After birth, a second spurt of growth occurs, as the brain rapidly makes connections between all of its cells, a profusion that happens so fast that it would be easier to count the drops of water in a rainstorm. Another massive die-off occurs as half of the connections disappear by puberty. This time, the death of connections seems to be primary attributable to a lack of interaction with the outside world. Connections that are not strengthened by stimulation from the environment are lost.

The final number of synaptic connections can vary by 25 percent or more, depending upon whether a child grows up in an enriched environment or in an impoverished one.

Stimulation Builds the Brain

Hubel and Wiesel convincingly showed with their research on kittens how vital it is for the developing brain to receive appropriate stimulation from the environment. Sensory experience is essential for teaching brain cells their jobs, and after a certain critical period, brain cells lose the opportunity to learn those jobs. Even if a person's brain is perfect, if it does not process visual experiences by the age of two, the person will never be able to see, and if it does not hear words by age ten, the person will never learn a language.

Laying the Best Foundation

There is a very important time in a child's life, beginning at birth, when he should be living in an enriched environment, because that lays the foundation for development later in life. Visual, auditory, language, and tactile stimulation should be optimal during early childhood, because stimulation during this period primes the brain for all later learning.

Do It Now!

Documenting the times when the brain is biologically best equipped to learn is expected to have a major impact on society. Understanding how the environment tunes up the brain during certain critical periods opens up a new frontier. It gives you a powerful reason to say, "Don't wait. You don't get another window of opportunity like that."

OPTIMIZING INFANT DEVELOPMENT

Good Experiences Shape the Brain

Part 2

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BUILDING LANGUAGE SKILLS

Language Development Requires Stimulation

Language most distinguishes humans from other animals. Our culture and technology is made possible by our capacity for communicating with language symbols. Human language condenses and simplifies a huge amount of information. This permits each generation efficiently to learn the lessons of their parents, and to surpass their wisdom. Optimizing children's verbal abilities is one of the most important ways in which we can contribute to our future world.

Language development helps illustrate how the brain is genetically programmed to respond to stimuli at certain critical periods. The sounds of a word, for example, are received by receptors in the ear and converted into electrochemical signals. The signals travel along nerves to specific parts of the infant brain where they awaken cells to their potential to process language. Millions of language cells swing into action, generating new tendrils to connect with other brain cells.

Without exposure to spoken words, cells that allow the brain to construct meaningful sentences do not develop properly. They die off, or their function is usurped by more aggressive cells in other parts of the brain. In the process, their owner is cheated of the brain's full potential to use language, as has been shown by cases of feral children, who grow up alone in the wild.

Appropriate early stimulation is likewise crucial for the development of vision and other sensory functions. Scientists now believe that everything else that the brain regulates, including learning, memory, emotions, physiological responses like reaction to stress and high blood pressure, are molded in early development when the brain is changing the most rapidly.

Talk It Up!

It has been shown that babies whose caregivers talk to them more have a bigger vocabulary. At twenty months, babies of talkative mothers knew 131 more words than infants of less talkative moms, and at twenty-four months the difference was 295 words. Although it may not seem obvious, the vocabulary they are

exposed to makes a significant impression on their brains.

Can TV substitute for caregivers? Researchers say no.

Mothers tend to talk in very short sentences. They describe the here and now. They point to the things they are talking about and rarely mention objects that aren't around. Early TV watching is words without content; without meaning for infants.

Effective talking is paced to help children absorb what they're hearing. In fact, research indicates that infants whose mothers speak very quickly are often somewhat slower to demonstrate expressive speech.

Nurturance Matters!

Research with animals has shown that increasing nurturance has beneficial emotional effects. When researchers enhanced the level of mothering, newborns grew up calm, cool, and ready to explore. In some of these experiments, rat pups were removed from their cages for fifteen minutes a day, and then immediately returned.

Following these separations, the worried mothers showered attention on the handled rat pups after they were returned to the cage, thereby turning down the amount of stress hormones their young brains would otherwise have been making.

Discoveries in the last five years have revolutionized how scientists think about the impact of experiences on brain development. The right mix of challenging, stressful and nurturing, calming stimuli permits optimal learning. One of the most profound findings is that environmental stress can activate genes linked to depression and other mental problems, if insufficient counterbalancing support is lacking.

Increasing Intelligence

Scientists are finding that they can make the future brighter for many children whose development otherwise would have been stunted, by using new techniques to enhance learning and brain development. Based on preliminary results, they can boost IQ levels by ten to twenty points, reduce mental retardation by 50 percent, and cut school failure rates by much more. The

evidence linking early experience to major biological changes in the brain is so new, that it has been only in the last ten years that the scientific community has come to accept the fact that it really happens.

Formerly it was thought that the brain was hard-wired. IQ was believed to be stable and substantially determined at the moment of conception, when a person's genetic fate was sealed. Now there is clear evidence that environmental experience actually produces physical changes in the developing brain. Genetic factors serve to establish a reaction range, within which the individual's eventual ability will fall. The nature of learning experiences determine where within the general range the individual eventually functions.

One of the first scientists to document the benefits of optimizing environments was William T. Greenough, a pioneering psychologist and cell biologist at the University of Illinois at Champaign-Urbana. When Greenough exposed rats to an enriched environment full of rich toys, food, exercise devices, and playmates, he found, on autopsy, that they had super brains!

The brains of the experience-enriched rats had about 25 percent more connections between brain cells than those of rats raised in standard, drab laboratory cages. Tests showed that the enriched were a lot more capable than the deprived ones. Those with exposure to enriching environments learned new tasks significantly more rapidly then the others.

Enriched Environments Benefit Babies!

Craig Ramey of the University of Alabama assessed the effects of enrichment on human development. Ramey found that he could do the same thing Bill Greenough did with rats with children and produce similar results. Starting with children as young as six weeks, he exposed a group of impoverished inner-city children to an enriched environment -- learning, good nutrition, toys, playmates. A similar group of children were used as controls.

Ramey tested their IQs after twelve years of age, and found that the benefits of early intervention endured. The enriched youngsters had significantly higher Iqs than those in the control group. PET scans, which measure glucose utilization in the brain, showed that he brains of the children exposed to

stimulating environments were more active and efficient than those of the control children. This indicates that the positive changes seen on the behavioral level are, in fact, the result of an increase in synaptic connections between brain cells.

Remarkably, the enriching experiences also prevented mental retardation. Children in the control group, whose environment remained impoverished, had a higher rate of preventable retardation. Many conclude from the research we now have that if we begin early intervention in the first year of life, we can prevent a very substantial number of cases of mental retardation and developmental disabilities.
The brain is highly sensitive to the early environment, and differences in exposure to early experiences are likely to underlie differences in intellectual performance that we see later on.

Why Good Day Care Matters

Not only are more mothers of infants working than ever before, but men are working longer hours. Children are often left to fend for themselves, all too often surrendering to the passive habit of watching TV, instead of interacting with their environment.

Parents in all social classes have less time to put into the management and orchestration of what a child needs during this critical period of time. Day care must be upgraded nationally to provide the best kind of learning environment for children when their parents are unable to do so. High quality day care can help to solve many of these problems, because if offers children the opportunity to interact with other children. People are designed to interact with other people, rather than to be passive.

Improving the Dance!

There is a special kind of "dance" between a mother and her baby that is missing in many families. Infants elicit behavior from their caregivers and the caregivers, in turn, give of themselves. It's not a one-way street. It's a kind of mutually reinforcing dance that unfolds as the infant experiments with different strategies for obtaining gratification. Responsive caregiving during infancy is critical to the unfolding of

competence motivation. Unresponsive environments engender expectations of uncontrollability. The resulting pattern of learned helplessness makes subsequent learning difficult for the child, even when the environment has changed and would now reinforce active, initiating behaviors.

Tactile Stimulation Teaches Love:

Evidence from Preemies Shows the Need for Touch

Infants need to receive appropriate stimulation. In fact, such stimulation may mean the difference between life and death for very premature infants.

Working first with animals and then with human "preemies", Dr. Saul Schanberg of Duke University and Tiffany Field of the University of Miami discovered one of the most biological buttons of all: touch.

Isolated in incubators bearing Do Not Touch signs, preemies struggled to survive. Since they were so tiny, doctors felt that they should not be disturbed. Anything that caused them to cry endangered their breathing.

But no matter how well the preemies were fed and their medical needs tended to, most of them didn't grow. They seemed to be developmentally arrested, and many became physically and mentally retarded or didn't make it at all. In a series of experiments, Schanberg and Field found out why.

Separating newborn rats from their mothers caused pups to go into a survival mode. To conserve food and energy, their bodies stopped growing. Stress hormones, released to subdue the body's need for nourishment, actually turned off genetic activity so that cells could not divide.

When the mothers were returned, the stress hormones in their pups subsided and they began growing again. But when the scientists anesthetized the mothers before returning them, the pups failed to revive.

Eliminating one possible cause after another, the scientists found that it was the mother's licking that kept their newborns happy and the stress hormones in check. Licking was the signal that told the pups that they were not in danger. Simply swabbing

abandoned pups with a wet paint brush could do the same thing, because it mimicked the mothers' licking and allowed the newborns to thrive.

When the researchers looked at preemies, sure enough, the same chemical changes were happening. Cortisol, a major stress hormone, was up and DNA synthesis was down.

Human babies are not licked, but they are held and their backs are rubbed. When Schanberg and Field tried that on the premature babies, the infants started to grow stronger and thrive. Before the touching therapy started, the preemies were growing at the anemic rate of twelve to seventeen grams a day, less than half the rate of growth they would have been experiencing inside the womb.

Touching and rubbing shot their daily growth rates up to thirty grams, about an ounce. They were able to leave the hospital six to seven days earlier than nontouched preemies, at a considerable healthcare savings.

As with the rats, the lack of touching aparently served as a signal that a newborn's mother and food supply are not available, thereby kicking in the cortisol-driven survival mechanism. Touching infants informs them that it is safe to invest energy in growth. It gives them calming reassurance that care will continue, and their needs will be met. It teaches them the world is safe, and that love exists.

Relationship Learning

True intellectual competence depends on the quality of a child's early emotional experiences and relationships, with both parents and caregivers. Children use their feelings in much the same way they use their vision and hearing to get information about their world. Emotions serve as tools to help them understand and become more familiar with their surroundings and the world at large. The intelligence levels of children depend importantly upon how well they are engaged in relationships and how their feelings are part of ongoing interactions.

Even before children can speak, their feelings help them sort out the sensations they experience and figure out what those

sensations mean so that they will be able to draw abstract conclusions later on. Emotional interactions also contribute to forming the pathways that make complex thought possible. When caregivers coo and cuddle with children, play make-believe, or sing while changing diapers, they are laying the foundations for intellectual growth. Human interactions are central to the mind's development.

During the crucial first few years of life, caregivers can do various things to promote later intellectual competence. Initially, the infant is absorbed with the process of making sense of their world. During the first three months of life, babies learn to decipher the countless sensations that surround them, as well as their bodies' responses to these stimuli. A crucial part of the babies' task is learning to stay calm so they can focus on people, objects and events. This ability to pay attention is the foundation for the rest of a child's intellectual development.

Caregivers can help by paying attention to babies as they learn to pay attention to the world around them. Notice what kind of stimulation bring on a look of delighted awareness--soft or loud sounds...slow or jerky movements...bright or soothing colors--and continue to encourage that awareness by doing things the baby enjoys. Your voice, face and gestures will help babies discover their senses more effectively than leaving them alone for long periods with rattles, mobiles or other objects that have no emotional connections for them.

Next, infants invest much of their energy in the development of intimate relationships with others. Between birth and six months, babies begin to take pleasure in relation to others. The capacity for attention developed earlier enables them to notice the people close to them. As they mimic their caregivers' grins and coos, they experience a joy in intimacy that will later develop into empathy and love. This early ability to form positive relationships is a crucial building block for later learning as well.

Caregivers can assist infants by making sure that babies have the opportunity to spend many hours each day with loving people who can form lasting relationships with them. Consistency and continuity of relationships during this period are very valuable. Parents should be encouraged to make some unhurried time to cuddle and play with them when they are at home.

During the next phase, the infant is involved in developing a sense of self. From three to 12 months, babies who have learned to relate to other people learn they can use communication to make things happen. They smile to get others to smile back. They reach their arms up to signal they want to be picked up. They knock food off their plates to show displeasure or to elicit attention. These expressions of will are the first signs of a baby's ability to differentiate between self and other. This emerging sense of self anchors emotional and intellectual development. Caregivers can foster this stage by communicating with infants and being responsive to their early efforts at expression. Infants need to have chances to actively engage those around them.

During the next period of infant development, babies are discovering how to engage in simple social problem solving. From 12 to 20 months, toddlers discover more complicated patterns in their world. They experiment with problem solving, figuring out the steps involved in getting what they want. These steps represent early use of logic an reason. They learn they can get a glass of juice by taking your hand, pulling it to the refrigerator and tapping on the door.

Though toddlers' propensities to get into everything can be maddening for caregivers, it's useful to use their natural inquisitiveness as an opportunity for negotiating and collaborative problem solving. Instead of simply repeating no to keep children away from the electric socket, it's preferable to act as a traffic cop, directing them away from the forbidden target as they try to dodge you. Teach children many different ways of understanding no--by using hand signals, frowns and different tones of voice. Or playfully make pretend errors, like putting the wrong piece in a puzzle, so that the children are encouraged to fix the problem.

During the next period, children are beginning to create emotional ideas. Beginning at 18 months and continuing to two-and-a-half years, children make a profound transition in their cognitive development. They begin to grasp the concept of symbolic meaning, the notion that one thing can stand for another. They are able to imagine doing something before they actually do it, and they can put a name on emotions, such as anger, rather than simply acting on impulses.

At this stage, children learn to enjoy communication for its own sake, rather than as a way to get what they want. Caregivers can stimulate engagement with language and ideas by joining in children's imaginative games. Get them to voice their thoughts by asking lighthearted questions about their play, such as What are the trucks doing? or Do you want to play with the turtle or the giraffe? When you read aloud to children, encourage them to respond to the stories and pictures. Have chats about anything that interests them, form a new toy to a hated food.

The last phase involves the child's learning to think. Children age 30 months and older continue to put ideas together in increasingly complex ways. They start to think about what and why questions. They begin to recognize the difference between the past, the present and the future, and they reflect on experiences.

Caregivers can encourage children to create elaborate scenarios when they play by asking open-ended questions like, Where is that dog going? Whom will he see there? What will they do together? When kids make demands, ask what or why questions, sot hey can translate their goals into words. Try to resist becoming exasperated when they're stubborn. Instead, persistence can be viewed as one sign of independent thinking and future assertiveness. Instead of losing your temper, seize the opportunity to enjoy a spirited debate with children who display the courage of their convictions.

Music Enlivens!

Exposure to music appears to be able to enhance the brain's ability to perform certain functions, possibly by exercising the same circuits employed in memory formation. Psychologist Frances Rauscher of the University of California at Irvine first showed that college students listening to ten minutes of Mozart's Piano Sonata, K 448, increased their spatial IQ scores. Spatial intelligence, the ability to accurately form mental images of mental objects and to be able to recognize variations in their shapes and positions, is important for higher brain function, especially the type of reasoning used in physics, mathematics, and engineering.

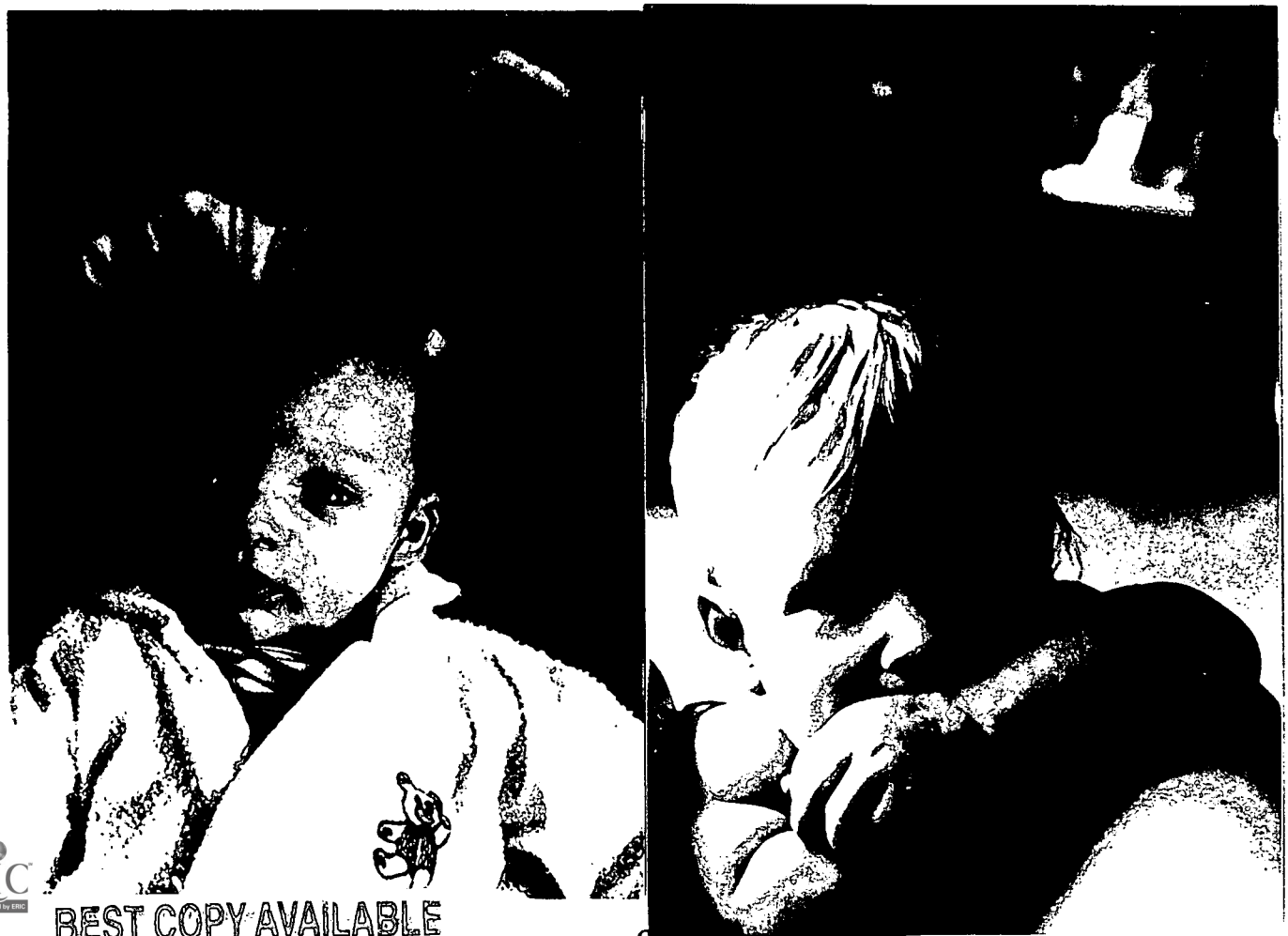
Toddlers also benefit from music lessons, Rauscher found.

Nineteen preschool children taking eight months of music lessons performed far better on spatial reasoning tests than similar children who were not given lessons. Classical music or jazz appears to invigorate the same brain areas used for spatial reasoning. Atonal music or highly rhythmic dance pieces, that clang instead of flow, failed to improve spatial scores.

OPTIMIZING INFANT DEVELOPMENT

How Things Can Go Wrong!

Part 3



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Damaging Experiences

How Stress Is Bad

Poor childcare can increase the risk of developing a wide variety of problems, ranging from aggression, language failure, depression and other mental disorders to asthma, epilepsy, high blood pressure, immune-system dysfunction and diabetes.

Abuse, neglect, lack of good stimulation and too much of the wrong kind of stimulation have negative effects on the developing brain. These kinds of bad experiences, pouring into the brain through the senses, can organize the trillions of constantly active connections between brain cells into dysfunctional networks.

Costs of Neglect

There is a huge social cost if children are not provided with good care early on. Poor care compromises the individual for their lifetime, not only in terms of their behavior and emotions, but poor care also increases their predisposition for disease.

One of the more astounding discoveries is that the stresses caused by bad experiences can actually affect genes, switching them on or off at the wrong times, forcing them to build abnormal networks of brain-cell connections. This results in lasting potential damage to many physical systems.

Stress Hormones Distort the Brain's Growth

Bad experiences affect the brain primarily through the stress hormones such as cortisol and adrenaline. Designed to respond to psychological or physical danger, these hormones prepare the body for fight or flight. Normally such changes are smooth: The brain and body are prepared for action when emergency demands are presented, and equilibrium is reestablished when the threat is no longer present.

However, when these hormones are overactive as a result of persistent stresses encountered during fetal development or early childhood, they can take over genetic regulation in destructive ways. These genes then set up aberrant networks of connections between brain cells, stamping in how the brain has mislearned. The result is a depressive episode instead of a happy thought or a surge of rage instead of a willingness to comprise. The brain can become unstable in the face of continual stressors.

How these bad experiences produce their damaging effects is only now beginning to be understood, and it is not without controversy, especially when genes are involved.

"Many people don't want to hear that your brain may be biologically different if you grow up in one environment or another," said Dr. Saul Schanberg, a Duke University biological psychiatrist. "One of those differences may be that a stressful environment has caused genes important for survival to become overexpressed, making you more aggressive and violent".

How Stress Does Its Damage

Stress or drugs of abuse, like cocaine and alcohol, can turn on a gene called C-fos. The protein made by the C-fos gene attaches to a brain cell's DNA, turning on other genes that make receptors or more connections to other cells. (Receptor sites sit on a cell's surface, selectively letting in hormones and other chemical messengers.) Problems arise when these new connections and receptors are abnormal. They can cause a short circuit in the brain's communication networks that can give rise to seizures, depression, manic-depressive episodes, and a host of mental problems, Post said.

Stress, for instance, through its hormonal intermediaries, turns on genes that leave a memory trace of a bad feeling. When a lesser stress occurs that triggers the same memory trace, reinforcement occurs. Now, instead of a lousy feeling, the person gets depressed. Finally, after repeated reinforcements, the memory trace takes on a life of its own, firing haphazardly and producing depression without the presence of an outside triggering stimulus.

Trouble Starts Early: The Roots of Aggression & Poor Impulse Control

Emotions are rooted in neurotransmitter activity in the brain and are established in the first three years of life. The development of impulse control occurs at a time when sensitivity toward others is also being rooted in the child's personality. The chemical patterns that are established tell a child how to react to his or her environment, whether the child sees the world as a hostile place that has to be fought, or a more peaceful one where social cooperation wins the day.

Research on the Locus Coeruleus

The locus coeruleus serves as the brain's alarm network. Sitting at the base of the brain, it sends out noradrenaline pathways to other brain centers that control heart rate, breathing, blood pressure, emotions, and motivation. When the locus coeruleus find itself in an uncontrollable, threatening environment, it sets its noradrenaline gauge on high. Over the pathways come surges of the stress hormone that keep the body in a constant state of readiness: heart racing, blood pressure high, easy to startle, quick to blow up.

Exposure to excessive stress therefore creates two tandem risks. These children are at risk because they don't have the opportunities to learn the traditional ways that enable people to get along in society, and they are at risk because the brain systems involved in impulsivity are poorly regulated. The increased tendency to act before thinking, combined with language handicaps and poor problem-solving skills, predisposes these children to use aggressive and violent strategies to deal with life's daily challenges.

Quality Care Prevents Later Problems

Many believe that if we don't invest in the early rearing environment of our children, we're going to be paying for our neglect for the rest of their lifetimes. Poor care early in life increases the risks of mental disorders and physical diseases, and can result in individuals' failure to develop self management skills. For some, this will mean long

term dependence on others. For some, the structured confinement of prison will eventually be required.

The Set Point for Aggression

Normal aggression has a set point, like body temperature, which is regulated by brain chemicals. Most people are born with a balance of these chemicals that enables them to react to events in reasonable ways. But changing that set point can either increase aggression or lower it.

Researchers are learning how this set point can be altered, and they have found that the mechanism for change, which involves an imbalance of the neurotransmitters serotonin and noradrenaline, is shared by humans and other animals.

Serotonin is the brain's master impulse modulator for all of our emotions and drives. It especially keeps aggression in line. When serotonin levels fall, violence rises, like some long-restrained monster breaking loose of its chains.

Noradrenaline is the alarm hormone. It organizes the brain to respond to danger, producing adrenaline and other chemicals that prepare the body to fight or flee. Noradrenaline may play a major role in both hot-blooded and cold-blooded violence. When noradrenaline is turned on "high" and left there, impulsive violence of the hot-blooded type becomes more likely.

Low levels of noradrenaline, on the other hand, cause underarousal. To get their thrill, many people with low noradrenaline take calculated risks, sometimes of the type associated with predatory violence--the premeditated or cold-blooded kind that may be found in a serial killer.

Serotonin and noradrenaline may work separately or together in different combinations to produce a spectrum of violent activity. So basic is their teeter-tooter relationship that serotonin increases during sleep and decreases during wakefulness, while noradrenaline decreases during sleep and increases during wakefulness.

At normal levels, serotonin keeps in check primitive drives and emotions that have taken millions of years of evolution to subdue, including motivation related to sex, mood, appetite, sleep, arousal, pain, aggression, and suicidal behavior. Such

control is exerted through the neocortex, the part of the brain that oversees socialization, memory, and judgment and sits like a convoluted crown controlling the deeper parts of the brain that harbor primitive instincts and emotions.

One reason that aggressive youths tend to mellow as they get older, researchers suspect, is that serotonin levels increase with age. And the reason that females generally are less aggressive than males may be because their serotonin levels are 20 to 30 percent higher.

A low serotonin level also can dry up the wellsprings of life's happiness, withering a person's interest in his existence and increasing the risk of depression and suicide. Alcoholism, sleeplessness, sexual deviance, fire-setting, obesity, and other impulse-control disorders also have been laid at the doorstep of low serotonin.

A growing body of evidence indicates that low levels of serotonin are indicated in a lack of control, the kind of behavior that typically manifests itself as irritability, loss of temper, and explosive rage. It is the type of impulsive aggression that is escalating at an unprecedented pace in the United States.

Research on Low Serotonin Children

At the University of Illinois Medical School on Chicago's West Side, researchers are examining the blood of children for low serotonin levels. They know from an earlier study that these children are likely to grow up to be troublemakers and they want to find out why. The study is designed to find out at what point in childhood serotonin levels plummet and what things in a child's early experiences cause serotonin to fall (Kruesi, 1997).

A study of twenty-nine children and adolescents with disruptive behavior disorders found that a low serotonin level was the single most accurate predictor of which youngsters would go on to commit more violent crimes or suicide. These researchers are beginning to conclude that the inappropriate environments that more and more children are being exposed to are in many respects contributing to an epidemic of violence. Certain adverse experiences are causing molecular changes in the brain that make people more impulsive, which increases their likelihood

of responding to frustration with violent solutions.

Other researchers are documenting the effects of bad childhood experiences on the brain's production of noradrenaline. Children who were raised in the Branch Davidian cult provide a striking example. Released during the siege of cult headquarters in Waco, Texas, in 1993, the children were found to have such high noradrenaline levels that their hearts roared in their chests, even at rest. While seated, the children had heart rates of 100 to 170 beats a minute. The average for children that age generally is 84. Their brains, too, were racing, pumping out noradrenaline and other stress hormones in response to their violent and abusive lives with cult leader David Koresh.

Research on High Noradrenaline Children

The high levels of noradrenaline found in the children from Texas were not unique. The same high levels have been observed in inner-city Chicago children (Perry, 1996). In addition, this high level of noradrenaline is the same chemical marker associated with cases of post-traumatic stress disorder, or PTSD, such as that found in some combat-scarred war veterans.

In children, PTSD seems to reset the brain's chemistry to an alarm response. These children tend to be hot-blooded, more quick to react, more impulsive, more aggressive, and more likely to commit violent criminal acts. It is adaptive to be impulsive in an abusive setting. If you wait, very frequently you will be victimized. This makes it highly adaptive to be hypervigilant, to be overly reactive and impulsive, to actually act before you're acted upon.

Building A Sense of Specialness

Combatting Helplessness and Pessimism

The antidote to these toxic experiences involves giving children a sense of self-worth and teaching them that they are not helpless. If there's somebody out there who makes you feel like you're special and important, then you can internalize that when you're developing your view of the world. When you look at children who come out of terrible environments and do well, you find that someone in their lives somehow instilled in them the

attitude that they aren't helpless, that they aren't powerless, that they can do something.

Studies show that every dollar spent on early childhood development programs translates into saving approximately five dollars later in social services, mental health services, prisons, and other programs intended to deal with the aftermath of aggression and violence. Developmental experiences determine the capability of the brain to do things. If you don't change those developmental experiences, you'll end up having to build more prisons and hospitals.

One Caring Adult Can Make A Child More Resilient

The brain is very resilient and maintains an even course in the face of the most outrageous experiences. That's why most children born in conditions of poverty and violence come out okay. Scientists suspect that the reason some children, regardless of their social or economic status, come out with damaged brains may be that they are genetically more vulnerable to stress. Furthermore, their bad experiences are not neutralized by a caring parent or involved adult.

Animal experiments clearly show the protective power of a little security, and the brain damage that can occur when it is absent. Newborn animals that are deprived of nurturing become dysfunctional and antisocial.

Education MATTERS!

The brain is nourished by stimulation and challenge. Exposure to information and disciplined thinking help to develop its capacities. Education protects us by reducing our risk of making bad choices. Education provides such strong immunity, in fact, that people who acquire more of it are living longer than ever before while those who don't have it are falling farther behind. It is conducive to a healthier, longer life.

In many studies looking at lower mortality and lower morbidity rates, people who do much better are not an exceptional, elite group. The favored group are the those who are high school graduates. Just getting out of high school puts

people in a category where their risks of morbidity and mortality are substantially lower. People with twelve or more years of education can look forward to nearly four more years of active life than those who are less educated.

The earlier education is acquired, the more impact it seems to have against sickness and early death. But throughout life education acts like a continuing series of booster shots. Education works in two fundamental ways:

1. Biologically, by laying down significantly more connections between brain cells that accompany learning. Memory, as a result, is increased and the additional connections also provide a buffer against the destructive forces of Alzheimer's disease.

2 Behaviorally, by promoting positive values and attitudes about health, higher self-esteem, effective coping skills, access to preventive health services, and association with people who have similar views. At the same time, education reduces risky behaviors such as smoking.

Some Mental Retardation May Be Preventable

A CDC study of more than 1,000 children showed that mild retardation, defined as having an IQ between 50 and 70, occurs at the rate of nearly 1 in 100 children. The biggest risk factor for mild retardation is the mother's low educational level, which far exceeds the risk posed by poverty.

About 22 percent of all births in this country are to mothers with less than a high school education. These women often do not know how to provide stimulation--talk, toys, physical activity--to their infants, which can lead to stunting of the brain during the crucial first three years of life.

Mild mental retardation is generally believed to be caused by a failure to provide the brain with the kinds of experiences from its surrounding world that it needs to develop to its maximum capacity. Early educational intervention programs for children at risk have shown that they can increase IQ levels by fifteen points or more. Many experts believe that at least half of the cases of mild mental retardation are preventable.

Growing evidence indicates that early mental stimulation

promotes the growth of synaptic connections between brain cells. Building a better brain, keeping your brain active, particularly starting at a very young age, might offer you some protection against brain disease and disabilities later on.

Use It or Lose It!

The harder you use your brain, the more in shape it's going to be. Scientists at the University of California at Los Angeles recently found in autopsy studies that the brains of university graduates who remained mentally active had up to 40 percent more connections than the brains of high school dropouts.

Education Benefits the Brain

As you go up the educational ladder, there is a dramatic increase in dendritic material. Dendrites sprout from brain cells like tree branches. Studded along the branches like leaves are junctions called synapses, which connect to other brain cells. Just as leaves receive light from the sun to enable a tree to grow, synapses receive information from other brain cells to increase the brain's power to think. Unless the brain is continuously challenged, it loses some of is earlier connections.

OPTIMIZING INFANT DEVELOPMENT

Strategies for Enhancing Day Care

Part 4

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STRATEGIES FOR OPTIMIZING INFANT CARE

Direct

How we spend time with infants.
What we do and what we let them do. (passive and active)

1. SENSORI-MOTOR intellectual Development

We need to provide rich, abundant, varied

Sensory experiences (balanced stimulation and accomodation of individualization individual differences in temperament; children learn idiosyncratically: what works splendidly for one, might not for another)

Touch - language of love

Sound - music activates the brain (research on exercise)

Vision - clarity-colors-complexity

Taste - breadth of experience

Smell - enhance memory

Pre-reading experiences : Build positive associations to books! If the act of reading is tied to cozy feelings of security and enthusiastic social interactions, opportunities to read will be more actively sought later.

2. MOTOR EXPLORATION builds Competence motivation
Chances for mastery and manipulation permit operant learning. Children learn to control and trust their bodies by moving them!

I can matter! I can change things!

3. Social context

Trust-Mistrust - Building optimism versus pessimism

Consistency - Demonstrating our reliability

Eye contact - real, genuine sharing and connection

Self-calming and appropriate use of others for calming

Enthusiasm - Role Models with an eagerness to learn

Classical conditioning - people = good

My three year old after day care: "But mom, ALL people are nice."

STRATEGIES FOR OPTIMIZING INFANT CARE

Indirect

1. Making the invisible visible for ourselves

Measuring our impact.
How do we know how well we're doing?

Infant behavior:

Time spent quiet (always desirable?).
Time spent crying.
Time spent actively engaged.
Time spent alert.
Time spent fighting with peers.

Parents comments

Peer feedback

Research involvement - monitoring effects of our innovations
Adopting an experimental mindset encourages our growth
Videotaping and behavioral sampling can help us see our impact

2. Cheering ourselves on!

Articulating our accomplishments to ourselves and others

Building More Effective Peer Support

Informing parents about our efforts

Informing managers about our efforts

Informing the world! Using writing as a tool for motivation

The better we do, the better our marketing success!

3. Keeping ourselves fresh

Adopting an experimental mindset keeps our brains growing,too!

Tending to our OWN mental health:

Avoiding Fatigue

Avoiding Depression

Getting Exercise with Children: Dancing the day away!

LANGUAGE/COMMUNICATION

1. Recite poems and fingerplays such as "Eensy-Weensy Spider".
2. Sing songs such as "The Wheels on the Bus" and "Old MacDonald".
3. Talk to baby as though he/she understands what is being said.
4. Encourage baby to laugh aloud by nuzzling, kissing, tickling, walking fingers over body, etc.
5. Talk with baby in front of mirror.
6. Show approval (hug, smile, kiss) of pleasing sounds baby makes; repeat his/her sound.
7. Encourage baby to imitate sounds - kissing, raspberry, clicking tongue, Ma-Ma, Da-Da.
8. Talk about surrounding activity.
9. Use appropriate descriptions with tactile experience such as stroking with a soft object, playing with sticky tape, tasting and touching cold items such as ice cream.
10. Read books and encourage the child to repeat sounds and find objects.
11. Ask child to find his/her shoe, sock, etc.
12. Ask child to find another child's personal belongings and hand it to that child.
13. Provide opportunities to answer who, what and where.
14. Make collage from magazine pictures and talk about the pictures.
15. Play games such as "Peek-a-boo" and "Bring Me" and play with toys such as telephones.
16. Change tone of voice to show certain words (No, stop, come here). Relate to boundaries.
17. Call child by name to familiarize with own and others.
18. Encourage simple communication - "Hi, Bye-bye", etc.

MOTOR SKILLS (Fine, Gross, Coordinated)

1. Use fingerplays.
2. Do action songs such as Ring-Around-The-Rosie and Hokey-Pokey.
3. Provide edible fingerpainting - ketchup, pie filling, jello, pudding, peanut butter, dream whip, etc.
4. Provide play with masking tape.
5. Provide water play activities (may add soap bubbles, pouring toys, etc.)
6. Put small objects such as raisins or cheerios into paper cups and give to child to play with or eat.
7. Encourage child to feed self with fingers and as control is gained of eye-hand-mouth, use spoon.
8. Provide texture tubs - fill with variety of food items (one at a time - once per week) such as spaghetti, corn meal, cooked peas, mashed potatoes, etc. (Use small containers so that items can be poured from one to another).
9. Play with different doughs such as corn starch, oatmeal or flour.
10. Encourage baby to hold own bottle - put his/her hand on bottle and cover with your hands (NOTE: Even though baby may be capable of holding own bottle, personal contact through cuddling, rocking, etc. is paramount!)
11. Encourage baby to drink from sippy cup (about 5 months) then "glass" as coordination develops.
12. Provide scribbling activities with crayons.
13. Provide tearing activities with paper (magazines work well).
14. Supply a variety of manipulative toys - busy box, rings, pegs, stacking cups, blocks, beads, slotted containers with corresponding shapes, etc.

MOTOR SKILLS (Fine, Gross, Coordinated) Cont'd

15. Lay baby on his back - move toys, etc. so baby can follow object with eyes and head.
16. Give opportunity to turn pages of books.
17. Encourage shadow casting.
18. Blow bubbles so youngest can follow with eyes and oldest can chase.
19. Supply a variety of different sized balls - to carry, kick, throw, roll, etc.
20. Lay baby on stomach and shake rattle, etc. Encourage baby to raise head and chest.
21. Surround baby with different stuffed toys, books, etc. - just out of reach and encourage baby to reach for items and crawl to them.
22. Provide opportunities to bang, shake, grasp and release objects.
23. Be physical with baby - tickle, bounce, roll, hold hand to walk forward and backward, up and down and dance.
24. Shine flashlight or reflect sun on to wall/ceiling so baby can follow with eyes and head.
25. Provide building/stacking and then knocking down, activities with safe toys.
26. Use age-appropriate riding and push toys.
27. Tie an interesting toy to the end of a string. Gently pull the string in front of the baby and encourage her/him to crawl after it.
28. Drop a few drops of water into palms of hands. Help him open and close palms as water drips.
29. Gently pull long scarf across palm of baby's hand. Encourage baby to grasp scarf.
30. Provide walk, push and riding toys.

I[illegible]ELLECTUAL

1. Make child aware of colors through verbalization - red ball, blue crayon.
2. Use fingerplays and songs such as "Six Little Ducks".
3. Provide matching experiences such as puzzles, like objects, etc.
4. Introduce a variety of tactile experiences. Use appropriate descriptive words. (i.e. Rub soft objects against cheek, etc.).
5. Ask child to retrieve certain toys spread around the room; then have the child place them in a bag.
6. Point to body parts and have child name them.
7. Provide opportunities to unwrap packages.
8. Play hide and seek with objects - partially cover with a blanket or put into box or other container.
9. Provide opportunities for eye-hand, eye-body coordination as listed under motor skills. (Shake rattle in front of baby slowly raising it to encourage him/her to raise head and chest etc.).
10. Provide manipulative toys - stacking blocks, rings, various shapes and corresponding holes, etc.
11. Provide opportunities to explore objects through taste and touch.
12. Provide opportunities for child to make simple choices. (Place food and toy in from of child, set up several activities, etc.).
13. Provide opportunities for refining eye focus (bubbles, blow feather or tissue or other light object, etc.).

SOCIAL/EMOTIONAL

1. Use fingerplays and songs such as "Wheels on the Bus".
2. Play rhythm games such as "Pat-A-Cake".
3. Play sharing games such as handing an object back and forth.
4. Use self-awareness games such as handing and object back and forth.
5. Encourage play in front of a mirror.
6. Talk to baby-describe everything.
7. Give toys and leave immediate presence.
8. Play "Peek-A-Boo" games with self, peers and toys.
9. Roll a ball back and forth between adult and child.
10. Encourage pointing to or use of language to indicate preferences - " Which do you want?".
11. Encourage helping while being dressed, cleaning up after snacks, putting toys away, etc.
12. Identify objects which belong to members of class (Can you give Emi her snuggle bunny?").
13. Call child by name; provide pictures of each child - point and say name.
14. Provide experiences in which all children do similar activity/games such as "Ring-Around-The-Rosie", snacking and lunching at the same time, napping, musical instruments, etc.
15. Use courtesy words with child (please, thank-you).
16. Provide cooperating activities such as helping with laundry folding and picking up toys.

Suggestions

1. A game of "Pat-A-Cake" during diaper changing helps keep baby still.
2. Vacuuming is a great spectator sport and social activity!
3. Hang a punch ball from a string attached to a ceiling hook. Children enjoy making it move.
4. Hang a mobile or small toy over the changing area, let it swing gently for babies eyes to follow as you change them.

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Printed Name/Position/Title: Catherine Chambliss, Ph.D., Chair, Psychology

Organization/Address: Dept. of Psychology, Ursinus College, Collegeville, PA 19426

Telephone: (610) 409 3000

FAX: (610) 489 0627

E-Mail Address: cchambliss@acad.ursinus.edu

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