



Understanding and Enhancing  
Your Young Child's Growth and Development

# Brain Development in Infancy and Early Childhood

## Welcome and Introduction

Take a few moments to introduce yourself and welcome participants. Introduce the topic to be discussed.

## Icebreaker Activity –

Ask each person to introduce him or herself and briefly share a recent memorable time with a baby or toddler. If the group is large, have them pair up to introduce themselves and share their memories.

## I. Understanding the Brain

This program is all about babies and their brains! To get us tuned into this topic I want you to recall a recent memorable time with a baby or toddler. For example:

- As a mother feeds her child, she gazes lovingly into his eyes.
- A father talks gently to his newborn daughter as he changes her diaper.
- A caregiver sings a child to sleep.

These everyday moments, these simple loving encounters, provide essential nourishment. Just as their bodies need food to grow, science tells us that the experiences babies have in the earliest years are equally necessary for growth of a healthy brain.

## Display Overhead #1 –

*Brain Quiz: True or False?*  
Read statements and seek responses from the group.

## Brain Quiz: True or False?

As scientists learn more about how the human brain develops, many of our old ideas about the brain are being challenged. Let's take this Brain Quiz to find out more. Answer True or False.

1. At birth the brain is fully developed, just like one's heart or stomach.
2. The brain's development depends entirely on the genes you are born with.
3. A toddler's brain is less active than the brain of a college student.
4. Talking to a baby is not important because he can't understand what you are saying.
5. Children need special help and specific educational toys to develop their brainpower.

The answer to all of these statements is FALSE. These are all myths that have been replaced by new understanding.

We now know that actually:

1. Most of the brain's cells are formed before birth, but most of the connections among cells are made during infancy and early childhood.
2. Early experience and interaction with the environment is critical in a child's brain development.
3. A 3-year-old toddler's brain is twice as active as an adult's brain.
4. Talking to children establishes foundations for learning language during early critical periods when learning is easiest for a child.
5. What most children need most is loving care and new experiences, not special attention or costly toys. Talking, singing, playing, and reading are the activities that build a child's brain.

**Display Overhead #2 –  
Key Factors that Influence  
Early Brain Development.  
Discuss briefly.**

## **II. How the Brain Develops**

While there are a number of factors that influence early brain development, this program will focus on love and nurturing, providing interesting and varied everyday experiences, and giving children feedback.

As recently as 15 years ago, some scientists thought the brain was genetically determined at birth and brain growth only followed a biologically pre-determined path. Now we know that early experiences impact the development of the brain and influence the specific way in which the circuits of the brain become "wired."

**Encourage participants to  
brainstorm specific "sense"  
experiences that shape a  
child's world.**

A baby's brain is a work in progress. Its development is shaped by the outside world by experiences absorbed through the senses-vision, hearing, smell, touch, and taste. For example:

1. The smell of the mother's skin (smell)
2. The father's voice (hearing)
3. Seeing a face or a brightly colored toy (vision)
4. The feel of a hand gently caressing (touch)
5. Drinking milk (taste)

Experiences taken in by the five senses help build the connections that guide brain development. Early experiences have a decisive impact on the architecture of the brain.

Recent equipment and technological advances have allowed scientists to see the brain working. What scientists have found is that the brain continues to form after birth based on experiences. An infant's mind is primed for learning, but it takes early experiences to wire the neural circuits of the brain that facilitate learning.

**Visual Display –  
Use Markers and Flip Chart  
to illustrate the analogy of a  
house that has been built but  
requires connections to be  
installed.**

**Activity –  
*Establishing Brain  
Connections***

**Display Overhead #3 –  
*Neurons and Connections***

**Demonstrate a synapse or  
connection with another  
person by using hands as  
axons and dendrites.**

**Display Overhead #4 –  
*Synaptic Density in the  
Human Brain***

Imagine that a child's brain is like a house that has just been built. The walls are up, the doors are hung. Then you go to the store and buy electrical wiring, circuits, switches, a fuse box and other electrical supplies. You bring these supplies to the new house and set them on the floor. Will they work? Probably not. You must first string the wiring and hook up all of the connections. This is quite similar to the way our brains are formed. We are born with as many nerve cells as there are stars in the Milky Way. But these cells have not yet established a pattern of wiring between them--they haven't made their connections.

**Activity – *Establishing Brain Connections*. Ask the audience to stand and spread themselves out. Then ask them to toss one or more balls of yarn among themselves until everyone is connected at least once. As the activity progresses, you may explain about neurons (person), dendrites (arms and hands), and synapses (yarn connections).**

What the brain has done is to lay out circuits that are its best guess about what is required for vision, language, etc. Now it is up to sensory experiences to take this rough blueprint and progressively refine it. Circuits are made into patterns that enable the newborn infant to perceive his mother's touch, his father's voice, etc.

Normal sensory experiences direct brain cells to their location and reinforce the connections between brain cells. We are born with over 100 billion brain cells or neurons; we will not grow more. That's about 10 times the number of stars in the entire Milky Way and about 20 times the number of people on the planet. **Neurons** are the functioning core of the brain. Each cell body is about one-hundredth the size of the period at the end of this sentence. A neuron has branches or **dendrites** emerging from the cell body. These dendrites pick up a chemical signal across a **synapse** and the impulse travels the length of the axon. Each axon branch has a sac containing neurotransmitters at its tip. The electrical impulse causes the release of the neurotransmitters which, in turn, stimulates or inhibits neighboring dendrites, like an on-off switch.

These connections are miracles of the human body. But to understand their power, you have to multiply this miracle by trillions. A single cell can connect with as many as 15,000 other cells.

The incredibly complex network of connections that results is often referred to as the brain's "circuitry" or "wiring." Experience shapes the way circuits are made in the brain. There is a remarkable increase in synapses during the first year of life. It is through the development of these synapses or connections that the brain develops a functional architecture, without which there would be no habits, no thoughts, no consciousness, no memories and no mind. From birth, the brain is rapidly creating these connections.

By the time she is three, your baby's brain has formed about 1,000 trillion connections-about twice as many as adults have. A baby's brain is super-dense and will stay that way throughout the first decade of life. Beginning at about age 11, a child's brain gets rid of extra connections,

gradually making order out of a thick tangle of “wires.” The “wiring” it ends up with is more powerful and efficient.

As the synapses are strengthened through repeated experiences, these connections and pathways are forming the structures that will allow a child to learn. If they are not used, the pathway is eliminated based on the “use it or lose it” principle. It also means that things you do a single time, either good or bad, are likely to have little effect. When a connection is used repeatedly in the early years it becomes permanent. For example, when adults repeat words and phrases when they talk to babies, babies learn to understand speech and strengthen the language connections in the brain.

#### Activity –

##### *Color Chart Exercise.*

Give a couple of persons or the whole group the challenge of naming colors off a chart you have made. However, the trick is that you write the word of a color with a different colored marker than the word says!

Ask participants to test out their brain connections for naming colors and reading. Have them tell you the color as you point to it. Here’s an example of words to put on the chart:

Blue	Green	Yellow	Pink
Red	Orange	Tan	Black
Purple	Grey	White	Brown

This exercise shows that an adult has strong brain connections for reading. A 4-year-old would easily name the actual colors used to write each word, because the brain connections for reading have not yet been made.

### III. Brain Construction

We have discussed how the brain develops at the cellular level with neurons and connections. It is also useful to understand the different parts of the brain as a whole and how it functions and develops.

The brain grows in sequential fashion, from bottom to top, or from the least complex part (brain stem) to the more complex area (cortex). If you draw a line from the forehead to chin and open the brain for a side view, this is what you would see (Overhead #5).

1. The **brainstem** is at the base of the skull and it controls most basic life activities, including blood pressure and body temperature.
2. The **midbrain** is at the top of the brainstem and it controls motor activity, appetite and sleep.
3. The **cerebellum** is behind the brainstem and it coordinates movement and balance.
4. The **limbic system** is in the central part of the brain and it controls emotions, attachment and memory.
5. The **cortex** is the top layer of the brain about the depth of two dimes placed on top of each other. The cortex is the “executive branch” of the brain that regulates decision-making and controls thinking, reasoning and language. It contains 80 percent of the neurons.

#### Display Overhead #5 – *Brain: Side View*

Because it's the least developed at birth and keeps developing, until adolescence, it's more sensitive to experiences than other parts of the brain.

**Activity –  
*Lincoln Log or Tinker Toy House.***

**Build a Lincoln Log or Tinker Toy house as an analogy of building a brain (log connections are like brain cells; build from foundation to roof, like brain stem to cortex; add windows, like opportunities for development).**

Construction of the brain is somewhat like construction of a house. A house is built from the foundation up and there are different parts of the structure that provide different functions. Also, like the brain, once the architecture is in place, you can continue learning and “add on” or “decorate.” But, if you have to move a wall or add a window, it is more difficult and expensive than if you had done it earlier in the building process.

Brain development proceeds in waves, with different parts of the brain becoming active “construction sites” at different times. The brain's ability to respond to experience presents exciting opportunities. While learning continues throughout the life cycle, there are “prime times” or “windows of opportunity” when the brain is a kind of “super sponge,” absorbing new information more easily than at any other time in life. This is true especially in the first three years but continues through about age 12. For example, young children learn the grammar and meaning of their native language with only simple exposure. While learning later is possible, it is usually slower and more difficult. Some improvement in most skills is possible throughout life.

**Activity –  
*Prime Times for Learning Quiz***

**Ask participants to answer the following questions:**

1. The “prime time” for visual development and learning to see is:  
(a) 0-6 months; (b) birth to 4 years; (c) 3 to 5 years; (d) 5 to 10 years.

**Answer – B**

During the first few months especially, babies need to see shapes, colors, objects at varying distances, and movement for the brain to learn how to see.

2. The “prime time” for language development and learning to talk is:  
(a) 0 to 18 months; (b) birth to 5 years; (c) birth to 10 years; (d) 6 to 12 years. **Answer – C**

The real prime time for language learning is the first few years of life. Children need to hear you constantly talk, sing, and read to them during these early years. Respond to their babbling and language efforts. Children vary in their language development during these first years.

3. The “prime time” for emotional attachment to be developed is: (a) birth to 18 months; (b) 2 to 4 years; (c) 3 to 5 years; (d) 6 to 12 years.

**Answer – A**

Emotional intelligence is critical to life success. The part of the brain that regulates emotion, the amygdala, is shaped early on by experience and forms the brain's emotional wiring. Early nurturing is important to learning empathy, happiness, hopefulness, and resiliency.

Activity –  
*A Secure Environment.*  
Use toys such as children’s books, stuffed animals, blanket, etc., as props. Ask parents to consider how each can be used to foster elements of a safe, secure environment. Model both appropriate and less appropriate examples of interaction.

## IV. Laying the Foundations of Learning - A Safe and Secure Environment

The foundations of learning in infancy and childhood are best created by establishing a safe, secure environment for children. This is the first basic rule of building a child’s brain development. What are some practical guidelines for creating such an environment? Here are four key ideas.

### 1. Respond warmly and quickly to a baby’s cues.

Infants need close, positive relationships with adults. Babies experience their parents’ love through reassurance and responses to their needs for food and comfort. Respond to a baby’s cues. Infants can’t use words to communicate their moods, preferences, or needs, but they send signals: the sounds they make, the way they move, facial expressions, or even the way they seek (or avoid) contact. Children become securely attached when parents and other caregivers read these signals and try to respond with sensitivity. Research suggests that children develop better when parents follow a child’s lead and respond in ways that encourage continued learning matched to the child’s capabilities and interests.

*Example – When reading to a toddler, choose stories or pictures the child enjoys, read only as long as the child seems interested, and involve the child by asking questions or inviting her to add to the story.*

### 2. Hold, touch, and snuggle with your child.

Touch is a fundamental and important source of security to a child. If you deprive an infant of touch, the body and brain will stop growing in a healthy manner. Physical stroking helps premature babies gain weight more quickly, and helps healthy babies digest food better. Babies cry less when they are held and carried more. Touch is an infant’s lifeline to security and reassurance.

*Example – Carry an infant in a carrier that provides physical contact, snuggle with children each night before bed, or hug your children several times a day.*

### 3. Beware of overstimulating your child.

Some parents are so concerned with brain development that they buy expensive educational toys, videos and language tapes. What does research suggest? Save your money. Too many new experiences or too much stimulation can cause stress and hinder a child’s development. The brain is developed by a child’s experience over a lifetime, but stress can inhibit this development.

### 4. Create a safe environment and reduce your baby’s stress by removing any physical threats (i.e. unsafe toys, abusive persons).

Brain research has shown that too much stress early in life can affect development negatively. Stress and trauma can cause elevated levels of cortisol, a brain chemical, to release and wash over the brain. This can make the brain vulnerable to processes that destroy brain cells, reduce the number of connections in certain parts of the brain,

and cause regions of the brain that regulate emotional response and attachment to be smaller than normal. Children who experience high stress or abuse may develop adaptive responses characterized by fear, high arousal and anxiety, and have difficulty developing more mature, reasoned emotional responses.

Display Overhead #7 –  
*Windows of Learning – An  
Enriched Learning Environment*

Activity –  
*Windows of Learning.*

Have the large group break up into smaller groups and pass out examples of baby/toddler toys and discuss how these items would help a child's brain develop, OR have each person share one example of a toy or activity that worked well in their relationship with a young child.

Have each group report back answering: How would you use this \_\_\_\_\_ with a \_\_\_\_-month/year old child? and What would it stimulate?

## V. Opening the Windows of Learning – An Enriched Learning Environment

An enriched learning environment is the second cornerstone of a child's brain development in infancy and childhood. Parents, grandparents, and other caregivers can do a number of things to open the windows of learning. Four key ideas are included below.

### 1. Provide an interesting variety of brain-building activities and experiences.

Children need simple, real-life experiences. These include touching, talking, listening, tasting, smelling, playing, singing, looking, running — all build young children's brains. Because infants are primed to learn from any experience, the key is to provide a variety of interesting activities over time. Exposing your child to new, interesting things helps the brain strengthen old connections and make new ones.

*Example – With a baby, provide something interesting whenever she's awake or alert, like a new picture to look at or some time to wiggle on the floor. Limit the time toddlers spend with television or pre-programmed mechanical toys.*

### 2. Give time to practice and encourage repetition of songs, stories, and other experiences.

Give lots of opportunities for practice. Telling the same stories and singing the same songs over and over may feel boring to you, but not to children. They learn through repetition, and repetition of an experience tends to set neural connections. The pathways in the brain dealing with emotions are built and strengthened when parents respond day after day to a newborn's smiles by smiling back or by picking the child up.

*Example – A child whose parents have read to her for only 10 minutes a day from six months on has a brain that has received over 300 hours of this type of stimulation by kindergarten.*

### 3. Talk, laugh, sing, converse, play peek-a-boo — children need to hear language.

Children need to hear language from birth, long before they can speak. Toddlers whose mothers talk with them as infants have bigger vocabularies and a solid basis for later learning. Play rhyming games. Read aloud. Sing songs. Music helps children learn structure and spatial and math skills.

*Example – Make up stories with a toddler, listen to classical or other music, read books and ask the child questions as you go. Talk and talk some more.*

#### **4. Provide opportunities that challenge and stretch a child's abilities.**

Young children learn most efficiently when they're provided with some opportunities to work slightly above their current ability with the assistance of an adult. Play games that help them learn new skills and provide learning situations that will enable them to stretch and grow.

*Example – Provide a low table for a new walker to grab until he's confident enough to take his first few steps, or help a preschooler to find the first few pieces in a new puzzle.*

**Toys and Play Materials – Ideas for toys or play materials to use as props include books; board games; imaginative play, including puppets, dress-up costume items; water play, including plastic cups, shampoo bottle; math, including stacking toys, blocks, puzzles; music, including classical music cassettes and player, homemade instruments; creative, including art materials.**

**Provide Handout #1 –  
What Can Communities,  
Parents and Other Caregivers  
Do to Promote Infant Brain  
Development?**

**Encourage discussion and  
sharing of examples of commu-  
nity programs or parental  
actions that can support and  
enhance brain development.  
A flip chart or overhead could  
be used to list examples.**

**If available, show brochures on  
local community programs,  
books, videos, or other parent  
education tools on this topic.**

**Conduct Evaluation**

**Share handouts:**

**Handout #2 – Ten Things Every  
Child Needs**

**Handout #3 - Ten Things Every  
Child Needs - Reminder Cards**

**Handout #4 - Your Amazing  
Baby - Cognitive Development**

## **VI. Conclusion**

The development of a child's brain holds the key to its future. A hostile or sterile living environment coupled with inattentive, emotionally unpredictable or changing caregivers can leave a child with diminished potential. If critical times of development are missed, the parts of the brain regulating emotion and attachment do not develop properly.

However, clearly loving, nurturing care provided by a consistent caregiver during the first years of life can go a long way toward ensuring optimal brain development in a young child. A child has a greater chance to reach his or her full potential when the surrounding atmosphere is rich with interesting things to do and visual and language opportunities. Loving interactions with parents and other caregivers, a secure environment, and community programs that support families are keys to brain development.

Although it is true that the "first years last forever" in terms of the rapid development of young children's brains, the actual first years of a child's life go by very quickly. So touch, talk, read, smile, sing, count and play with your children. It does more than make you both feel good. It helps your child's brain develop!

*(Portions of this lesson were adapted from "The First Years Last Forever" lesson materials prepared by Karen Hintz, Cooperative Extension Service, University of Wisconsin-Extension).*