Effects of neglect and abuse on brain development

Neurologists are beginning to understand exactly how a

baby’s interaction with their mother determines how, and

indeed whether, the brain grows in the way that it should.

Professor Allan Schore, of UCLA, who has surveyed the

scientific literature and has made significant contributions to

it, stresses that the growth of brain cells is a “consequence of

an infant’s interaction with the main caregiver [usually the

mother]”. The growth of the baby’s brain “literally requires

positive interaction between mother and infant. The

development of cerebral circuits depends on it.”

Prof Schore points out that if a baby is not treated properly in

the first two years of life, the genes for various aspects of

brain function, including intelligence, cannot operate, and

may not even come into existence. Nature and nurture cannot

be disentangled: the genes a baby has will be profoundly

affected by the way it is treated.

Understanding the Effects of

Maltreatment on Brain Development

Babies' brains grow and develop as they interact with their

environment and learn how to function within it. When

babies' cries bring food or comfort, they are strengthening the

neuronal pathways that help them learn how to get their

needs met, both physically and emotionally. But babies who

do not get responses to their cries, and babies whose cries are

met with abuse, learn different lessons. The neuronal

pathways that are developed and strengthened under

negative conditions prepare children to cope in that negative

environment, and their ability to respond to nurturing and

kindness may be impaired (Shonkoff & Phillips, 2000).

Brief periods of moderate, predictable stress are not

problematic; in fact, they prepare a child to cope with the

general world. The body's survival actually depends upon the

ability to mount a response to stress (Shonkoff & Phillips,

2000).

Children learn to deal with moderate stress in the

context of positive relationships with reliable adult caregivers.

Greater amounts of stress may also be tolerable if a child has

a reliable adult who can help to buffer the child. But

prolonged, severe, or unpredictable stress—including abuse

and neglect—during a child's early years is problematic. In

fact, the brain's development can literally be altered by this

type of toxic stress, resulting in negative impacts on the child's

physical, cognitive, emotional, and social growth.

The specific effects of maltreatment may depend on such

factors as the age of the baby or child at the time of the abuse

or neglect, whether the maltreatment was a one‐time

incident or chronic, the identity of the abuser (e.g., parent or

other adult), whether the child had a dependable nurturing

individual in his or her life, the type and severity of the abuse,

the intervention, and how long the maltreatment lasted.

The sections below give a brief description of abuse and

neglect and are followed by descriptions of some of the

consequences of maltreatment.

• Abuse—Physical, Sexual, and Emotional

• Neglect—Lack of Stimulation

• Global Neglect

• Emotional and Behavioral Impact

• Impact of Abuse and Neglect on Adolescents

• Long‐Term Effects of Abuse and Neglect

**Abuse—Physical, Sexual, and Emotional**

Abuse can refer to physical abuse, such as hitting, shaking,

burning, or other forms of maltreatment that a parent or

other caregiver might inflict. Sexual abuse is a subset of abuse

that refers to any type of sexual behavior with a minor, while

emotional abuse generally refers to any injury to a child's

psychological or emotional stability (Child Welfare

Information Gateway, 2008). Chronic stress may also qualify

as emotional abuse. In some States, alcohol or substance

abuse or domestic violence that affects the unborn child is

considered child abuse.

Physical abuse can cause direct damage to a baby's or child's

developing brain. For instance, we now have extensive

evidence of the damage that shaking a baby can cause.

According to the National Center on Shaken Baby Syndrome

(2009), shaking can destroy brain tissue and tear blood

vessels. In the short‐term, shaking can lead to seizures, loss of

consciousness, or even death. In the long‐term, shaking can

damage the fragile brain so that a child develops a range of

sensory impairments, as well as cognitive, learning, and

behavioral disabilities.

Babies and children who suffer abuse may also experience

trauma that is unrelated to direct physical damage. Exposure

to domestic violence, disaster, or other traumatic events can

have long‐lasting effects. An enormous body of research now

exists that provides evidence for the long‐term damage of

physical, sexual, and emotional abuse on babies and children.

We know that children who experience the stress of abuse

will focus their brains' resources on survival and responding to

threats in their environment. This chronic stimulation of the

brain's fear response means that the regions of the brain

involved in this response are frequently activated (Perry,

2001a). Other regions of the brain, such as those involved in

complex thought and abstract cognition, are less frequently

activated, and the child becomes less competent at processing

this type of information.

One way that early maltreatment experiences may alter a

child's ability to interact positively with others is by altering

brain neurochemical balance. Research on children who

suffered early emotional abuse or severe deprivation indicates

that such maltreatment may permanently alter the brain's

ability to use serotonin, which helps produce feelings of wellbeing

and emotional stability (Healy, 2004).

Altered brain development in children who have been

maltreated may be the result of their brains adapting to their

negative environment. If a child lives in a threatening, chaotic

world, the child's brain may be hyperalert for danger because

survival may depend on it. But if this environment persists,

and the child's brain is focused on developing and

strengthening its strategies for survival, other strategies may

not develop as fully. The result may be a child who has

difficulty functioning when presented with a world of

kindness, nurturing, and stimulation.

**Neglect—Lack of Stimulation**

While chronic abuse and neglect can result in sensitized fear

response patterns, neglect alone also can result in other

problems. Malnutrition is a classic example of neglect.

Malnutrition, both before and during the first few years after

birth, can result in stunted brain growth and slower passage

of electrical signals in the brain (Shonkoff & Phillips, 2000).

This is due, in part, to the negative effect of malnutrition on

the myelination process in the developing brain (ZERO TO

THREE, 2009). The most common form of malnutrition in the

United States, iron deficiency, can affect the growing brain

and result in cognitive and motor delays, anxiety, depression,

social problems, and attention problems (Shonkoff & Phillips,

2000).

Although neglect often is thought of as a failure to meet a

child's physical needs for food, shelter, and safety, neglect

also can be a failure to meet a child's cognitive, emotional, or

social needs. For children to master developmental tasks in

these areas, they need opportunities, encouragement, and

acknowledgment from their caregivers. If this stimulation is

lacking during children's early years, the weak neuronal

pathways that had been developed in expectation of these

experiences may wither and die, and the children may not

achieve the usual developmental milestones.

For example, babies need to experience face‐to‐face baby talk

and hear countless repetitions of sounds in order to build the

brain circuitry that will enable them to start making sounds

and eventually say words. If babies' sounds are ignored

repeatedly when they begin to babble at around 6 months,

their language may be delayed. In fact, neglected children

often do not show the rapid growth that normally occurs in

language development at 18‐24 months (Scannapieco, 2008).

These types of delays may extend to all types of normal

development for neglected children, including their cognitivebehavioral,

socio‐emotional, and physical development

(Scannapieco, 2008).

**Global Neglect**

Researchers use the term "global neglect" to refer to

deprivations in more than one domain, i.e., language, touch,

and interaction with others. Children who were adopted from

Romanian orphanages in the early 1990s were often

considered to be globally neglected; they had little contact

with caregivers and little to no stimulation from their

environment—little of anything required for healthy

development. One study found that these children had

significantly smaller brains than the norm, suggesting

decreased brain growth (Perry, 2002). (See Exhibit 2.

Exhibit 2



"These images illustrate the negative impact of neglect on the

developing brain. In the CT scan on the left is an image from a

healthy 3‐year‐old with an average head size. The image on

the right is from a 3‐year‐old suffering from severe sensorydeprivation

neglect. This child's brain is significantly smaller

than average and has abnormal development of cortex."

These images are from studies conducted by a team of

researchers from the Child Trauma Academy led by Bruce D.

Perry, M.D., Ph.D. (Reprinted with permission.)

This type of severe, global neglect can have devastating

consequences. The extreme lack of stimulation may result in

fewer neuronal pathways available for learning. The lack of

opportunity to form an attachment with a nurturing caregiver

during infancy may mean that some of these children will

always have difficulties forming meaningful relationships with

others (Perry, 2001a). But these studies also found that time

played a factor—children who were adopted as young infants

have shown more recovery than children who were adopted

as toddlers (Rutter, et al., 2000).

**Emotional and Behavioral Impact**

New brain imaging technologies, research with animals, and

studies of human growth in optimal and deprived conditions

(such as institutions) continue to shed light on the impact of

abuse and neglect on brain development. The sections below

describe some of the major effects.

Persistent Fear Response. Chronic stress or repeated traumas

can result in a number of biological reactions, including a

persistent fear state (Perry, 2006). Neurochemical systems are

affected, which can cause a cascade of changes in attention,

impulse control, sleep, and fine motor control (Perry, 2000a;

2000b). Chronic activation of certain parts of the brain

involved in the fear response (such as the hypothalamicpituitary‐

adrenal [HPA] axis) can "wear out" other parts of the

brain such as the hippocampus, which is involved in cognition

and memory (Perry, 2000b). The HPA axis may react to

chronic fear or stress by producing excess cortisol—a

hormone that may damage or destroy neurons in critical brain

areas (Putnam, 2006). Chronic activation of the neuronal

pathways involved in the fear response can create permanent

memories that shape the child's perception of and response

to the environment. While this adaptation may be necessary

for survival in a hostile world, it can become a way of life that

is difficult to change, even if the environment improves.

Hyperarousal. When children are exposed to chronic,

traumatic stress, their brains sensitize the pathways for the

fear response and create memories that automatically trigger

that response without conscious thought. This is called

hyperarousal. These children have an altered baseline for

arousal, and they tend to overreact to triggers that other

children find nonthreatening (Child Trauma Academy, n.d.).

These children may be highly sensitive to nonverbal cues, such

as eye contact or a touch on the arm, and they may read

these actions as threats. Consumed with a need to monitor

nonverbal cues for threats, their brains are less able to

interpret and respond to verbal cues, even when they are in a

supposedly nonthreatening environment, like a classroom.

While these children are often labeled as learning disabled,

the reality is that their brains have developed so that they are

constantly alert and are unable to achieve the relative calm

necessary for learning (Child Trauma Academy, n.d.).

Dissociation. Infants or children who are the victims of

repeated abuse may respond to that abuse—and later in life

to other unpleasantness—by mentally and emotionally

removing themselves from the situation. This coping

mechanism of dissociation allows the child to pretend that

what is happening is not real. Children who "zone out" or

often seem overly detached may be experiencing dissociation.

In some cases, it may be a form of self‐hypnosis (Stien &

Kendall, 2004). Dissociation is characterized by first

attempting to bring caretakers to help, and if this is

unsuccessful, becoming motionless (freezing) and compliant

and, eventually, dissociating. Dissociation may be a reaction to

childhood sexual abuse, as well as other kinds of active,

physical abuse or trauma. Children who suffer from

dissociation may retreat to the dissociative state when they

encounter other stresses later in life.

This type of response may have implications for the child's

memory creation and retention. The brain may use

dissociation to smother the memories of a parent's abuse in

order to preserve an attachment to the parent, resulting in

amnesia for the abuse (Stien & Kendall, 2004). However, the

implicit memories of the abuse remain, and the child may

experience them in response to triggers or as flashbacks or

nightmares. In its most extreme form, the child may develop

multiple personalities, known as dissociative identity disorder.

Disrupted Attachment Process. At the foundation of much of

our development is the concept of attachment, which refers

to the emotional relationships we have with other people. An

infant's early attachment to his or her primary caregiver

provides the foundation for future emotional relationships. It

also provides the base for other learning, because babies and

children learn best when they feel safe, calm, protected, and

nurtured by their caregivers. If the attachment process is

disrupted or never allowed to develop in a healthy manner, as

can occur with abusive and neglectful caretakers, the child's

brain will be more focused on meeting the child's day‐to‐day

needs for survival rather than building the foundation for

future growth (Applegate & Shapiro, 2005).

Disrupted attachment may lead to

impairments in three major areas for the

developing child (Cook et al., 2005):

• **Increased susceptibility to stress**

• **Excessive help‐seeking and dependency or**

**excessive social isolation**

• **Inability to regulate emotions**

Young infants depend on positive interactions with caregivers

to begin to develop appropriate emotional control and

response (affect regulation) (Applegate & Shapiro, 2005). For

instance, lots of appropriate face‐to‐face and other contact

helps infants recognize and respond to emotional cues.

Infants whose caregivers are neglectful or abusive may

experience affect dysregulation—meaning that these children

are not able to identify and respond appropriately to

emotional cues (Applegate & Shapiro, 2005). Ongoing

maltreatment may result in insecure or anxious attachment

because the child is not able to derive a feeling of security and

consistency from the caregiver. Children who have

experienced insecure or anxious attachments may have more

difficulties regulating their emotions and showing empathy for

others' feelings (Applegate & Shapiro, 2005). These children

may have difficulties forming attachments later in life as well.

**Impact of Abuse and Neglect on Adolescents**

Adolescents who are abused or neglected were often

maltreated at younger ages, as well. It can be difficult to

isolate the effects of abuse and neglect during the adolescent

years, because these youth often suffer from the cumulative

effects of a lifetime of abuse and neglect.

Most teenagers who have not been victims of abuse or

neglect find their teenage years to be exciting and challenging.

Normal puberty and adolescence lead to the maturation of a

physical body, but the brain lags behind in development,

especially in the areas that allow teenagers to reason and

think logically. Most teenagers act impulsively at times, using

a lower area of their brain—their "gut reaction"—because

their frontal lobe is not yet mature. Impulsive behavior, poor

decisions, and increased risk‐taking are all part of the normal

teenage experience.

For teens who have been abused, neglected, or traumatized,

this impulsive behavior may be even more apparent. Often,

these youth have developed brains that focus on survival, at

the expense of the more advanced thinking that happens in

the brain's cortex (Chamberlain, 2009). An underdeveloped

cortex can lead to increased impulsive behavior, as well as

difficulties with tasks that require higher‐level thinking and

feeling. These teens may show delays in school and in social

skills as well (Chamberlain, 2009). They may be more drawn to

taking risks, and they may have more opportunity to

experiment with drugs and crime if they live in environments

that put them at increased risk for these behaviors. Teenagers

who lack stable relationships with caring adults who can

provide guidance and model appropriate behavior may never

have the opportunity to develop the relationship skills

necessary for healthy adult relationships or for becoming

good parents.

**Long‐Term Effects of Abuse and Neglect**

Maltreatment during infancy and early childhood can have

enduring repercussions into adolescence and adulthood. As

mentioned earlier, the experiences of infancy and early

childhood provide the organizing framework for the

expression of children's intelligence, emotions, and

personalities. When those experiences are primarily negative,

children may develop emotional, behavioral, and learning

problems that persist throughout their lifetime, especially in

the absence of targeted interventions. The Adverse Childhood

Experiences (ACE) study is a large‐scale, long‐term study that

has documented the link between childhood abuse and

neglect and later adverse experiences, such as physical and

mental illness and high‐risk behaviors (Centers for Disease

Control and Prevention, n.d.).

Some of the specific long‐term effects of abuse and neglect on

the developing brain can include (Teicher, 2000):

Diminished growth in the left hemisphere, which may increase

the risk for depression

Irritability in the limbic system, setting the stage for the

emergence of panic disorder and posttraumatic stress

disorder

Smaller growth in the hippocampus and limbic abnormalities,

which can increase the risk for dissociative disorders and

memory impairments

Impairment in the connection between the two brain

hemispheres, which has been linked to symptoms of

attention‐deficit/hyperactivity disorder

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