Neurobiology for Clinical Social Work

Theory and Practice

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Chapter 5

The Neurodevelopmental Impact of Stress, Adversity, and Trauma

Implications for Social Work

ONE OF THE MOST WIDELY RECOGNIZED applications of neuroscience as it pertains to clinical social work is our enhanced understanding of how early adversity, trauma, and toxic stress can negatively impact neurodevelopment and, in turn, health and mental health across the life span (Garland & Howard, 2009; Kaufman & Charney, 2001; National Scientific Council on the Developing Child, 2014; Shonkoff et al., 2009). For social workers interested in understanding mechanisms of risk and resiliency, it is important to ask the question, how does exposure to early adversity and stress precipitate neurodevelopmental changes that, in turn, are associated with increased risk behaviors and poor health outcomes? The answer to this question requires multidisciplinary awareness of research from fields such as epidemiology, developmental psychopathology, neuroscience, and, in particular, brain development in early life.

Practitioners who work with young children and their families know that a high percentage of young children are experiencing stress associated with poverty, child abuse and neglect, and separa-

tion from caregivers due to factors such as incarceration and substance abuse. The research we review in this chapter shows that these types of early experiences, particularly in the absence of supportive care, can set children on a trajectory of disrupted neurodevelopment and risks to psychosocial and health outcomes. Thus, children in particular social contexts (e.g., economically vulnerable families) face not only the challenges of income inequality in a direct sense but are also at increased risk for poor health outcomes, contributing to social disparities in health (Green & Darity, 2010; Jones Harden, Buhler, & Jiminez Parra, 2016).

For social work practitioners interested in the impact of stress on the developing brain, two areas of research are particularly important. First, the Adverse Childhood Experiences (ACE) studies demonstrate, from an epidemiological perspective, the connection between specific types of early adversity and developmental and health outcomes across time. Relatedly, research describes how long-term activation of the stress response system can create neurodevelopmental and neuroendocrine changes that link unmediated stress to health outcomes in particular ways (Gunnar, 1998, 2000; Hart, Gunnar, & Cicchetti, 1996).

This chapter begins with a brief overview of the ACE studies, a set of groundbreaking, epidemiological studies that demonstrated the connection between childhood stress and adversity, and risk for poor health outcomes later in life. Key to understanding this trajectory is an awareness of how stress and adversity precipitate neurodevelopmental and neuroendocrine changes, particularly during sensitive periods of brain development. For this reason, this chapter also provides an overview of the stress response system and research on the impact of unmediated stress on the developing brain and nervous system. Finally, and from a more hopeful point of view, research on early adversity shows that supportive and secure attachment experiences are important buffers against stress exposure in early childhood (National Scientific Council on the Developing Child, 2007). For

this reason, it is vitally important that we understand more about what happens when conditions exist that interfere with the caregiver's ability to provide attuned and responsive care (Perry, Ettinger, Mendelson, & Le, 2010). We briefly consider the issues of maternal depression and parental substance use from this perspective.

THE ACE STUDIES

The ACE studies are multidisciplinary publications that originally stemmed from an epidemiological study undertaken as a collaboration between the Centers for Disease Control and researchers from Kaiser Permanente (Felitti, 2009; Felitti et al., 1998). Based on a 10-item questionnaire that asked adults to retrospectively endorse whether they had experienced specific adverse events as a child, subjects were assigned an ACE score, which represented the number of adverse events endorsed. These events included experiences familiar to clinical social workers who work with vulnerable children, adults, and families and include abuse and neglect; witnessing intimate partner violence; having a parent who abused drugs, had a mental illness, or was incarcerated; and experiencing separation from a parent or primary caregiver. The strongest finding of the early ACE studies was that the higher an individual's ACE score, the more likely he or she was to experience a host of negative health outcomes as an adult, even when other sociodemographic factors were controlled for in data analyses (Dube, Felitti, Dong, Giles, & Anda, 2003).

The ACE pyramid (see Figure 5.1), depicts a trajectory, moving forward in time, that connects early experiences of adversity to neurodevelopmental impacts, which in turn are associated with health risk behaviors, early onset of negative health outcomes, and, ultimately, mortality rates (Shonkoff et al., 2012). Specific associations have been documented between higher ACE scores and increased likelihood of neurodevelopmental alterations in areas such as memory (Brown et al., 2007), the emergence of depression and depressed affect (Chap-

man, Anda, Felitti, Dube, Edwards & Whitfield, 2004), health risk behaviors such as alcohol use and smoking (Dube et al., 2003), and the emergence of chronic disease such as autoimmune diseases and cancer (Brown, Thacker, & Cohen, 2014).

From a social work perspective, research on ACE points to the importance of primary prevention and protecting the developing child from exposure to toxic stress, as well as to the importance of intervention at various points along the ACE pyramid trajectory. The American Academy of Pediatrics argues that research on the connection between early adversity and later health disparities should be integrated with current work in neuroscience and neurodevelopment to create a holistic approach to prevention and intervention. The academy suggests that "research in molecular biology, genomics, immunology, and neuroscience" must be integrated into our understanding of the processes by which early experiences shape later outcomes in order to inform "science based strategies to build foundations for children's life-long health" (Johnson et al., 2011, p. 319). In particular, these researchers point to the quality of early caregiving relationships as key to emerging neuroendocrine, neurobiological, and other body systems that build the foundation for lifelong health (National Scientific Council on the Developing Child, 2007).

THE STRESS RESPONSE SYSTEM

Most clinicians are aware that even age-related changes, normative in nature, create stress of a certain sort for the developing person. A key focus of assessment is often the differentiation of short-term difficulties, perhaps understood as stress reactions to maturational demands, from longer-term, more persistent concerns or exposure to acute or overwhelming stressors that may give rise to serious developmental and mental health vulnerabilities (Boyd-Webb, 2015; Davies, 2010). Embedded in this understanding is the notion that not all stress has long-lasting negative impact and that for development to

exposed to toxic or traumatic stress, their stress response systems are activated and remain activated over long periods of time, potentially even after the stressor has been removed. This type of stress has the greatest potential to have negative impacts on the developing brain, such as (1) the volume of different parts of the brain, (2) neuroendocrine changes that may increase individuals' susceptibility to future stressors by increasing their overall level of reactivity to stress exposure, and (3) related impacts on development in multiple spheres, including growth and wellness, cognition and executive functioning, and indexes of emotional well-being and mental health (Loman & Gunnar, 2010; Lupien et al., 2009; Lupien, King, Meaney, & McEwen, 2001; McEwen, 2008; Shonkoff et al., 2009).

Just as not all stressors have negative developmental impacts, it is also true that activation of our stress response systems can be critical to our well-being and survival. An understanding of learning and memory is relevant to clinical social work practice in many ways. For example, research on adolescent brain development and drug use shows that during adolescence, the brain experiences a spurt of growth, resulting in many changes, including an enhanced capacity for learning and memory. While this process can support positive developmental outcomes such as knowledge and skill acquisition, it also makes adolescents particularly susceptible to addiction. The adolescent brain learns to be addicted more quickly than the mature, adult brain and so, drug usage during adolescence may have more immediate, severe, and long-term consequences (Jensen & Nutt, 2015). LTP refers to the increase in synaptic strength, or neuronal connections, that usually occurs after repeated activation or stimulus exposure. Researchers in addiction have demonstrated in animal studies that molecular changes associated with LTP can be induced with repetitive drug exposure. These changes are termed "drug-evoked synaptic plasticity" (Luscher & Malenka, 2011, p. 1). Gunnar and Vasquez (2006) described the human body's stress response

move forward, some exposure to stress may be necessary and developmentally optimal. Thus, researchers have differentiated among types of stress (Shonkoff & Phillips, 2000).

In a working paper titled, "Excessive Stress Disrupts the Architecture of the Developing Brain" (National Scientific Council on the Developing Child, 2014), experiences of stress are divided into three categories associated with differential activation of the stress response system. Positive stress is described as short lived in nature, moderate in intensity, and associated with an adaptive and brief activation of stress response systems followed by a timeline return to homeostasis, or baseline. These are the types of stressors that often accompany developmental transitions, such as starting school. With good-enough adult support, the developing child learns to negotiate new maturational tasks and potentially gains a sense of mastery and optimism. At the same time, an event that is manageable to one child may be in a different category for a child carrying preexisting vulnerabilities and experiences of traumatic stress. For a child who has experienced repeated attachment disruptions and lack of access to empathic care, the same event—starting at a new school—may be much more fraught. And, so an example of positive stress can become, for any given individual, more challenging. Tolerable stress refers to those stressors that are significant enough to potentially have longer-term neurobiological and neuroendocrine impacts if not offset by the provision of contingently responsive and empathically attuned support. These types of stressors, depending on the age of the child, will likely require adult intervention to reestablish a sense of homeostatic balance. For this level of stress, children will likely need attuned intervention provided by adults who have some insight into how moderately sustained activation of their stress response system may impact their physiology, behavior, cognition, affect, and even sense of identity. Toxic or traumatic stress refers to intense and sometimes frequent exposure to overwhelming stressors in the absence of supportive and responsive adult care. When children are

ability to mobilize energy and resources needed to deal with perceived stressors. When working optimally, the stress response system not only turns on when threats or stressors are perceived, but also turns off, or returns to baseline, when threats have passed. Before detailing specifics of our stress response systems, consider some of the commonly recognized psychophysiological signs of stress. Fear responses, for example, are often accompanied by increased respiration and heart rate, and surges of adrenalin that cause people to become ashen or pale with fright. Other types of stressors may be associated with state dysregulation as evidenced by sleep, appetite, and digestive disruption. We may be familiar with the headaches or stomachaches that accompany stress. Our immune systems may also be negatively impacted by the activation of our stress response systems, giving empirical support to the experience of feeling run down or vulnerable to illness when stressed. These experiences can be explained, in part, by consequences of our stress response systems being activated.

As with other aspects of neurodevelopment, the stress response system is shaped by many factors in the environment, including access to stable and empathically attuned care. When the developing child experiences consistent exposure to high levels of stress and adversity and lacks access to the buffering effects of responsive caregiving, chronic activation of the stress response system is associated with a range of risks to health and well-being. Below we provide a brief overview of two neurologically mediated pathways associated with the stress response system: the SAM system (Sympathetic Adrenal Medullary) and the HPA axis.

The SAM system involves two aspects of the autonomic nervous system—the *sympathetic nervous system* and the *parasympathetic nervous system.* The sympathetic nervous system revs up when a stressor is perceived, resulting in a release of hormones and the fight-or-flight response we commonly recognize. The adrenal gland releases catecholamines from the central part of the adrenal gland, including

adrenalin, sometimes referred to as epinephrine, as well as norepinephrine, sometimes referred to as noradrenaline. The release of these hormones is key to the fight-or-flight response. When they are released, we may observe an increase in heart rate, respiration, and dilation of pupils, all signs of increased adrenaline surge. The parasympathetic nervous system operates to counter the effects of the sympathetic nervous system (Ulrich-Lai & Herman, 2009). When the parasympathetic nervous system is activated, level of arousal is decreased, as may be evidenced by a decrease in heart and respiration rates, and the pupils becoming less dilated. Consider for a moment a young infant experiencing distress. When the SAM system is activated, the infant's cry becomes more intense, the legs kick, and the heart rate elevates. Infants and young children will likely need the aid of adult intervention to engage their parasympathetic system—as might be the case in the calming effect of being offered a pacifier for engaging the soothing of nonnutritive sucking, or the vestibular stimulation offered by being held closely and rocked. If effective, these strategies will support the infant's parasympathetic nervous system and speed the return to a state of homeostatic balance. As children move through the first year of life, they become more able to engage in self-soothing behaviors as simple as sucking on their fingers or thumb.

The HPA axis involves the release of hormones to the rest of the body via their secretion into the bloodstream. The paraventricular nucleus of the hypothalamus secretes stress hormones, including corticotropin-releasing hormone and vasopressin. These hormones, in turn, elicit the secretion of adrenocorticotrophic hormone from the adrenal cortex into the bloodstream. This, in turn, leads the adrenal gland to secrete glucocorticoids, such as cortisol.

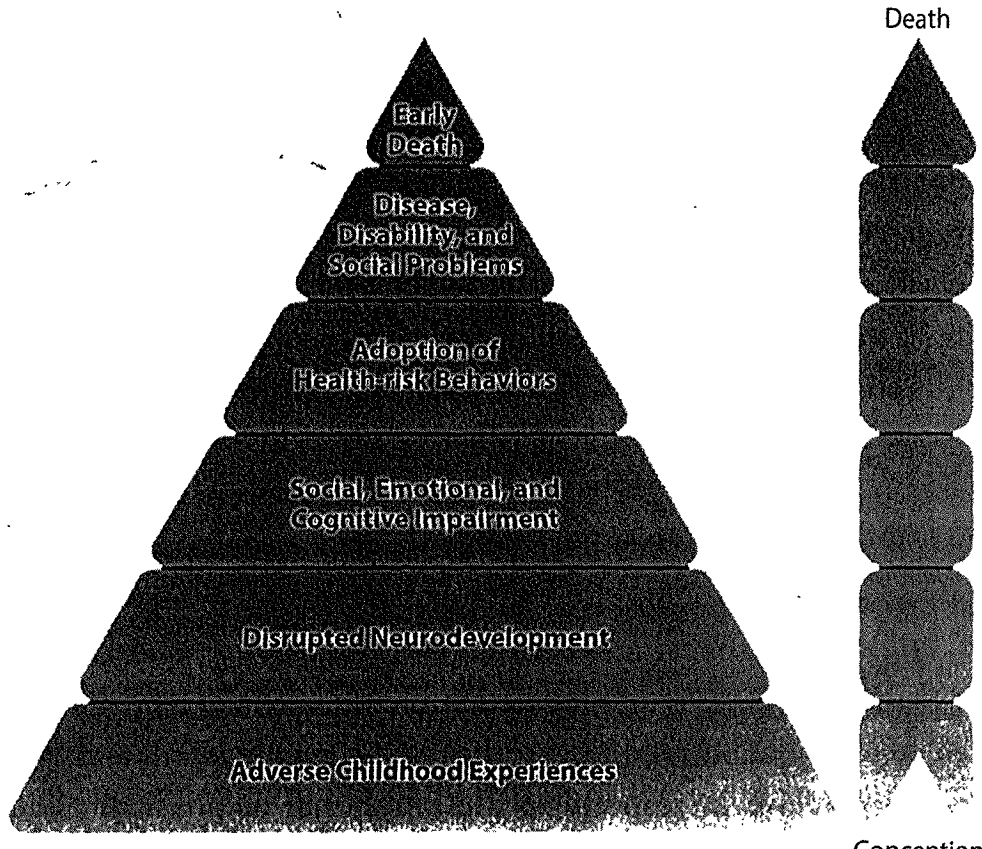
Cortisol, broadly recognized as a stress hormone, is essential to our functioning in everyday life. Cortisol plays a regulatory role in functions such as our sleep-wake cycle and state regulation with regard to experiences of hunger and satiation, as well as to mainte-

nance of blood pressure and even our ability to process information and both form and retain memories. Cortisol is always present, to some degree, in our bloodstream. Typically, the blood levels of cortisol vary, in a particularized pattern, throughout the day, giving rise to patterns of diurnal variation. Cortisol can be measured in the blood, but also through a saliva swab, making it easier and less invasive to measure in both normative and at-risk populations (Dozier, 2014; Gunnar et al., 2011).

As described above, when we experience stress, cortisol levels may rise and contribute to our ability to mount a stress response. Working in tandem with the SAM system, blood sugar may increase so that our bodies have more energy to focus our attention on immediate threats. Thus a rise in cortisol supports adaptation in a short-term sense. A well-functioning stress response system is one that turns on or is activated when a stressor is perceived but also turns off when it is no longer needed. Research on cortisol empirically demonstrates what we have seen clinically, namely, that chronic activation of the stress response will, over time, impair the ability of the system to turn off, even when an immediate threat has passed.

Chronic activation of the stress response system can damage brain development, organization, and function. For example, researchers have noted alterations in the volume in specific structures within the brain, including the hippocampus and the amygdala, in both children and adults associated with chronic activation of the stress response system (Gunnar & Quevedo, 2007). The hippocampus is central to information processing and memory, two functional areas also sometimes observed to be impaired by chronic stress. Likewise, researchers have noted negative impacts on those parts of the brain associated with executive functioning skills such as selective attention and effortful control, two areas of functioning key to overall well-being (Hostinar et al., 2012).

Research on early adversity sometimes emphasizes child abuse and neglect, because this type of adversity often puts children in



Mechanism by Which Adverse Childhood Experiences Influence Health and Well-being Throughout the Lifespan

Figure 5.1

double jeopardy. When the adversity or toxic stress occurs in the context of children's primary caregiving relationships, they are impacted directly by the experience of abuse and neglect, because they may lack access to the types of supportive care shown to protect the developing nervous system and brain. Research on the impact of abuse and neglect on brain development has identified several outcomes that are, in turn, associated with psychosocial and behavioral outcomes. For example, severe childhood neglect has been associated with reduced volume in the orbitofrontal cortex, which is associated with the capacities for emotion and self-regulation. Similarly, decreased volume in the hippocampus, cerebellum, and corpus callosum have also been documented in adolescents and adults who

experienced abuse and neglect in early childhood (Wilson, Hansen, & Li, 2011). These brain structures are associated with competencies such as memory and executive functioning. From a neuroendocrine perspective, as described above in our discussion of the stress response system, children who have experienced child abuse and neglect have been shown to have atypical patterns of blood cortisol, which in turn may be associated with alterations in their immune system, sleep-wake cycles, and multiple indicators of psychosocial well-being relationships (Bruce, Fisher, Pears, & Levine, 2009).

Prevention scientists have identified access to consistent, empathically attuned care as a key ingredient in neurodevelopment and a key protective factor for children who experience early adversity and stress (National Scientific Council on the Developing Child, 2014). Many parent-child dyads are deemed vulnerable because various risk factors, or sets of factors, combine to inhibit the caregiver's ability to accurately perceive or respond to the emotional or physical needs of the developing child. In addition to a range of contextual and social factors, such as social isolation and poverty, other factors may interfere with (1) the caregiver's own capacity for emotion regulation, (2) the ability to take the point of view of the child, and (3) the ability to use language to represent either emotional experience or to reflect back to the child the parental perception of the child's internal state of mind and experience. These kinds of obstacles interfere with the child's developing sense of being known or understood by the caregiver, resulting in critical problems in the child's emerging capacity to identify affective states, relate particular states of affect to known experience, and to regulate affect in a manner sufficient to help the child reinstate homeostasis when his or her affective experience becomes dysregulated. As has been discussed elsewhere in this volume, the relational environment of infants and young children is a primary context for early brain development. One of the reasons that researchers describe the early years as a critical or sensitive period with regard to brain development is because both the organization

and function of the child's neural systems are so affected during this time by the amount and quality of interactive experience. In particular, human infants are uniquely dependent on their adult caregivers for an environment that provides sufficient contingent responsivity (Weder & Kaufmann, 2011). These studies highlight the need for initial and early assessment, prevention, and intervention for at-risk parents and children (Dozier & Fisher, 2014).

VULNERABLE DYADS

Many groups of at-risk parents and children are characterized by atypical patterns of interaction and disruptions in early caregiving relationships. Research in the cognitive neurosciences has provided a new window into the clinical meaning of disorganized or traumatic early care experiences by delineating how disrupted early care precipitates change in the early wiring of the brain in neurobiological and neurochemical processes that have import for the experience and regulation of affect. It is now well understood that the human brain triples in size by 3 years of age and that the first year of life is a critical period with regard to the development of the prefrontal cortex, an important element of the biological basis of attachment behavior. As Schore and Schore (2010) point out, early attachment and caregiving patterns directly influence the development of the frontal limbic system in the brain's right hemisphere, a key neurobiological substrate of the emerging capacity for affect regulation, self-understanding, and the understanding of others (Cozolino, 2010; Fonagy & Higgit, 2004; Fonagy & Allison, 2012; Hofer, 1995). Thus, any factors or characteristics that are associated with the parental capacity for affect regulation or the child's developing capacity to regulate affect are understood as appropriate targets for support and intervention.

As previously noted, research on brain development and attachment shows that impaired

psychological and neurobiological vulnerability in the child that is sustained over time. Additionally, this research sharpens our understanding of how psychological and developmental vulnerability in a caregiver can be transferred from parent to child and sustained across generations (Fraiberg, 1980), an outcome that has also been examined from an epigenetic perspective (National Scientific Council on the Developing Child, 2011). As discussed elsewhere in this volume, disruptions in early caregiving experience are among the most damaging kinds of stress experienced by infants and young children.

For many families, pregnancy and early parenthood is a time of tremendous stress in ways that can impede even a well-intentioned caregiver's capacity to foster secure attachment and the child's experience of feeling psychologically held. Lack of access to consistent and empathically attuned relational care constitutes deprivation for the infant and young child because it poses great risk to developmental well-being. As Gunnar (2000) points out, deprivation can be characterized by a range of biopsychosocial factors including lack of access to health care and nutrition, age-appropriate stimulation and learning opportunities, and, of particular focus here, a lack of consistent access to stable and contingently responsive relationships. Relational deprivation in infancy confers a series of risks on the developing infant associated with deficits as measured by psychosocial characteristics, such as impaired attachment relationships, and the infant's underlying neurological well-being, particularly in terms of the stress response system (Gunnar, Bruce, & Grotevant, 2000; Gunnar, Morrison, Chisholm, & Schuder, 2001). This research is particularly relevant for practitioners working with caregivers and children in situations where a combination of parental, child, and environmental characteristics may combine to pose challenges to the development of secure caregiver-child attachment or disrupt existing attachment relationships by limiting the caregiver's capacity for empathic attunement and contingently responsive caregiving.

Why are some parents better able to provide empathic care that

meets the child's developmental needs? A range of biopsychosocial factors can combine to inhibit the caregiver's ability to accurately perceive and respond to the emotional, social, and physical needs of the developing child. Factors such as social isolation, poverty, and stress can combine with lack of knowledge of child development and parental mental health challenges such as maternal depression to interfere with the provision of sensitive and attuned care, thereby creating a context of risk and vulnerability for the developing child (Cohn & Tronick, 1989; Crandall, Fitzgerald, & Whipple, 1997). A capacity for reflective functioning supports parental sensitivity to the infant and thus attachment security because caregivers are more able to respond accurately not only to physical needs but to emotional needs as well. This, in turn, helps the child to "make meaning of feelings and internal experience and states of psychophysiological arousal associated with feelings without becoming overwhelmed and shutting down" (Slade, 2002, p. 11).

In this section, we consider two at-risk groups of parents and children: children whose primary caregiver is depressed, as in the case of maternal depression, and the impact of parental substance use on the developing child. Considered at risk for many social, psychological, physical, and developmental reasons, these groups can each be examined in terms of a variety of risk factors that can affect the parent-child relationship in ways that impair the quality of attachment and important developmental outcomes. Familiar from a psychosocial perspective, we seek to apply the research reviewed earlier in this text that discusses the connections between caregiver-child interaction patterns, the quality of attachment that emerges, and the related neurobiological development of children in early life.

MATERNAL DEPRESSION

As reported by the National Scientific Council on the Developing Child (2009) at Harvard University, an estimated 10–20% of moth-

will experience depression during the first year of their child's life, and the incidence rate is higher for women experiencing a range of other psychosocial stressors. Thus, assessment and intervention with mothers experiencing depression either prenatally or postpartum are important areas of practice, in particular for psychosocially vulnerable families. A developmentally informed approach to the impact of maternal depression requires an understanding of the factors that can lead to experiences of depression among mothers and the ways in which the consequences of maternal depression can disrupt the formation of stable attachment bonds and related indexes of developmental well-being in infancy and early childhood. Relational disruption and loss, both related to experiences of maternal depression, can constitute experiences of deprivation in infants and young children (Shapiro, 2015).

Affective disturbances, such as maternal depression, have been shown to increase vulnerability in the developing child (Tronick & Reck, 2009). Sustained periods of maternal depression, particularly during infancy and early childhood, create a context of developmental risk (Dawson, Hessl, & Frey, 1994). Children of depressed mothers have higher rates of developmental vulnerability as indexed by impairment in the regulation of behavior and attention, increased rates of childhood depression, and higher rates of other externalizing and internalizing disorders (National Scientific Council on the Developing Child, 2009). Longitudinal studies have also shown that children of depressed mothers have lower rates of secure attachment, less well-developed social skills, and more difficulties with school readiness and peer relationships (Ashman, Dawson, & Panatogiotides, 2008).

Researchers have documented the developmental risks to the child associated with maternal depression at various developmental phases. Prenatally, infants of depressed mothers are exposed to a higher level of stress chemicals, and alterations in the infants' immunological systems and prenatal growth patterns have been observed.

During infancy, infants of depressed mothers have been described as being more difficult to soothe, showing greater levels of distress, and having deficits in their ability to sustain gaze and interaction (Shapiro, 2015). During toddlerhood, research has shown that children of depressed mothers display more behavioral problems, less capacity for emotional regulation, and delays in language development. During childhood and adolescence, children of depressed mothers show greater difficulty with peer relationships, learning readiness, and both internalizing and externalizing disorders.

Maternal depression can create an environment in which the infant does not experience a sense of being psychologically held. Winnicott (1965) introduced the concept of the holding environment to describe the context of care that surrounds the developing child. A good-enough holding environment is characterized not by a perfect level of sensitivity and attunement, but by caregiving that is overall consistent and infused with an understanding of the infant's emotional life, needs, and development. When the attachment relationship develops in a good-enough holding environment, the caregiver is able to successfully support the infant's ability to modulate states of psychophysiological arousal and ultimately support the developing child's capacity for self-soothing. When such a supportive environment does not exist, or is only partially available, the developing child may not feel psychologically held and may develop a range of responses for coping with states of psychophysiological arousal that result from being either understimulated (e.g., neglect), overstimulated by intrusive care, or disorganized because of a chaotic care environment (Fonagy & Target, 1998).

Primary developmental goals of infancy and early childhood involve learning, in the context of important attachment relationships, (1) how to identify one's own feelings, (2) how to identify the feelings of others, (3) how to acquire the capacity to regulate affect sufficiently to maintain homeostasis, and (4) how to invest in the object world of people and exploration. Children of depressed

mothers are less likely to receive the empathically attuned and contingently responsive care that would contribute to their ability to understand cause-and-effect relationships, most saliently, the relationship between their own internal states and the development of language to describe affective experience. Research has shown that children of depressed mothers, particularly those whose mothers were depressed during the child's infancy and early childhood, are more likely to vigilantly observe their mothers' mood states and to be highly sensitive to relatively small changes in those states (National Scientific Council on the Developing Child, 2009). Even though maternal mood may be responsive to the advent of treatment, the child's early learning environment regarding the nature and regulation of affect may have resulted in styles of interaction, or attachment, and affect regulation that persist beyond the initial alleviation of the parental depression. Certainly, research on brain development in early life has highlighted the finding that the affectively charged relational environment of infancy is closely tied to those aspects of brain development that are primarily responsible for the experience and regulation of affect (Schore & Schore, 2010).

Infants and young children are uniquely dependent on primary caregivers for a relational environment that augments positive feelings of warmth, security, and joy, and mediates against prolonged states of negative affective arousal (e.g., sadness, anxiety). Children of depressed mothers may come to be at risk, in part, because the depressed caregiver may show either a flatness of affect or a disproportionate amount of negative affect. In either case, the caregiver may be emotionally unavailable and unable to respond contingently to the infant's cues. Moreover, a depressed caregiver is less likely to engage in shared states of positive affect, thereby providing less opportunity for the infant's brain to be engaged in a manner that supports the development of positively charged or positively wired connections. This theory relates to the use-dependency or experientially dependent concept of early brain development in which those

synapses that fire more often become more firmly wired into the neural architecture of the child's brain.

Below are two short vignettes showing ways in which maternal depression may pose risks to the caregiving environment that, in turn, can compromise the developmental well-being of the child. A more detailed discussion of maternal depression and its impact on child development follows, with discussion of the vignettes.

> Maya is a 5-month-old infant, born full term into an economically struggling family. Maya's mother and father recently immigrated to the United States and are struggling to resettle in their new country. Maya's mother works two jobs and often leaves Maya in the care of family members or, when necessary, neighbors. A community-based pediatrician referred Maya for a social services assessment because, though full term, she is small for her age and seems not to seek out interaction. The pediatrician was unable to coax her into a social smile or sustained eye contact and she noticed that Maya's mother didn't seem to expect any social recognition from Maya. A medical workup found no physical cause for Maya's withdrawal or lack of interest in people. The social worker noticed that Maya's mother also seemed exhausted and made very few efforts to communicate with either Maya or the worker. The worker did have at least one conversation with Maya's mother about how hard the transition to the United States had been, and how much she missed her home country. Maya's mother did comment that she was "glad" that Maya didn't really "need to play" and that "she seemed fine all on her own." Most worrisome to the pediatrician, Maya's growth was starting to fall below expectations, and Maya's mother reported that she was "the only baby she'd seen who didn't really like to eat." When the worker asked to hold Maya, Maya's mother agreed, but then said, "See . . . she'll settle right down with you. What differ-

> ence does it make if I'm here too?" She further added, "This is like when I try to feed her. . . . She just goes to sleep so . . . if she's not hungry, I'm not going to push it."

This vignette describes a pattern of possible maternal depression in which the mother, although trying to care for her infant, has little energy for interaction. From a brain development perspective, this is a concern because research describes the importance of affectively attuned, positively charged verbal interactions that help the developing child to augment positive experience and cope with negative states of affective arousal (Jones Harden et al., 2016). In addition, this research highlights the ways in which such patterns of interaction are key to the development of those systems involved in the regulation of affect and attention, and in the development of language that, over time, can be used by the child to represent and mediate internal states of mind and experiences (Siegel, 2012). In Maya's case, her mother is almost grateful for her lethargy because it matches mom's available energy. One hypothesis for exploration would be whether Maya had come to find interactions with her mother lacking sensitivity and mirroring, and perhaps even anxiety producing, leading to her withdrawal. Maya's mother seemed particularly sensitive to Maya's interest in the social worker. She interpreted this as proof that her own presence was not necessary, potentially a reflection of a low sense of agency that may also be associated with depression. Overall, Maya's case shows how cycles of misread and misunderstood interactions between infant and caregiver can be related to patterns of depressive symptoms and pose risks to the development of secure attachment and to those aspects of early social-emotional development related to early interactive experience. Moreover, Maya could be at risk for nonorganic failure to thrive. Her lack of enjoyment in the feeding process (as evidenced by her falling asleep during feedings) could be a signal of poorly attuned interactions that Maya responds to by turning away, shutting down, and even falling asleep.

> Claire is a healthy 11-month-old infant of a depressed mother. Born physically and neurologically intact, Claire moved through the first half of her first year of life with no apparent delays or complications. During the last several months, however, Claire's parents have been entrenched in marital conflict over the presence of Claire's father's daughter from a previous marriage. Claire's mother's affect and mood have steadily deteriorated, as has the consistency with which she empathically responds to Claire's bids for attention and interaction. Claire's mother shows intermittent and highly negative facial expressions that, seen from Claire's perspective, must seem to come over her mother. Steadily, Claire has begun to focus less of her attention on exploring her toys and enjoying positively charged interactions. Instead, she vigilantly attends to her mother's facial expressions, searching for a clue about her mother's affective state. Rather than the social referencing we would expect to see in an infant at this age, wherein the infant looks back to the mother in an effort to share excitement or for guidance as to whether a particular action (e.g., going up the stairs) is safe or not, Claire seems to have gotten increasingly still, and she focuses primarily on searching her mother's face. When Claire observes her mother's facial expression becoming more negative, Claire begins to show signs of anxiety (e.g., drooling, anticipatory crying, unable to sustain focus on play) and, if not quickly soothed, her distress escalates to a dysregulated state of crying. Claire is relatively unable to self-soothe or to easily receive soothing from others.

This vignette shows a different pattern of maternal depressive symptomatology and how it may manifest in the mother-child interaction by impacting the developing infant's capacity for affect regulation. Claire, at 11 months, already shows a pattern descriptive of children whose caregivers have affective disorders. Claire's vigilance

in monitoring her mother's mood states, including her search for facial clues to any changes, can be seen as an early coping strategy on Claire's part, an effort to create predictability where much lability exists. It is likely that no one else in Claire's immediate environment is as sensitive to these microaffective changes as is Claire. To Claire, changes in her mother's facial expression have come to represent loss of the emotionally available caregiving figure. In addition, changes in her mother's mood state also signal anxiety to Claire because they serve as a prelude, or forecast, of what may be coming. Because Claire is only 11 months old, her repertoire of self-soothing behaviors in the face of this potential loss and anxiety is limited. What an observer is likely to see is an infant who may turn away from her natural state of exploration and connection, becoming more dysregulated, as evidenced by body discomfort, an increase in drooling, a lack of muscle tone, or efforts at self-soothing, such as nonnutritive sucking, twirling of hair, stillness, or lack of interest in play.

The case of Claire is highly relevant to the discussion of the applied value of research on brain development in early life. In Claire's case, we can see that her mother's depressive stance creates challenges for her, not only in the regulation of her own affective states but in the ways in which her need to self-soothe and cope with anxiety may hinder her opportunities for learning in other ways, such as the exploration of the object world through play and spontaneous social interaction. To the extent that Claire has become preoccupied with monitoring her mother's affective state, she is spending less of her energy on coming to understand her own internal experience and likely does not have access to a caregiving figure that is reflecting back to her important data about her own experience. Thus, Claire's relational environment does not provide her with a mirror, through either maternal facial expression or language, of her own internal world. As Claire has become more attuned to changes in her mother's expression of affect, she has also become more anxious about the meaning of these changes, because they have come to be associated

with loss of maternal availability. Each of these elements is, in turn, related to important indexes of those aspects of early brain development related to affective and cognitive functioning.

DRUG USAGE AND PARENTING

Research on the impact of maternal substance use can have direct and indirect impacts on the developing child (Ross, Graham, Money, & Stanwood, 2014). Even though not all prenatal exposure to substances results in children being born addicted, many deleterious effects are associated with prenatal exposure to drugs such as alcohol, tobacco, cannabinoids, and opiates. Complications may include preterm birth, obstetric complications, respiratory vulnerabilities, reduced growth, cognitive delays, reduced volume in brain regions, and abnormalities in key aspects of brain development associated with emotional, social, and cognitive impairments (Ross et al., 2014). Importantly, while researchers acknowledge the neurological impact of prenatal drug exposure, they also emphasize the importance of the quality of the caregiving environment and access to social resources as important mediators of the long-term impact of prenatal drug exposure.

From the perspective of how drug usage impacts the caregiving environment, two interrelated issues emerge that could create a double jeopardy for children of substance-abusing parents. First, children born addicted to illicit substances face a range of physical and developmental challenges in recovery and present complex caregiving demands for primary caregivers. Children born addicted may have highly reactive nervous systems, become easily dysregulated, and may have difficulty attaining homeostasis. At the same time, if children are being cared for by parents actively involved in addiction or substance abuse, the caregiving environment is likely to be less than optimal, characterized by inadequate caregiving ranging from neglect to abuse. As well, the caregiving environment may continue to be shaped by those conditions that precipitated parental drug use, including paren-

tal depression, chronic stress, difficulties with the regulation of affect, limited problem-solving ability, and deficits in executive functioning, all factors also associated with parenting competency.

A summary prepared by the National Clearinghouse on Child Abuse and Neglect (1993) highlights the ways in which parental substance use can affect parenting behavior and, in turn, a range of child development outcomes, including the following:

1. *Parental access to sufficient income to provide for the child's basic needs and stability, including access to shelter, nutrition, medical care, child care, and education.* For parents with an active addiction, it is likely that the financial resources of the family will be strained by the cost of the addiction itself, or that the addiction will interfere with the stability of other important resources such as housing and nutrition.
2. *The importance of parental capacity for nurturance, sensitivity, and empathic relatedness.* In the parent-child relationship, the responsibility for nurturance, sensitivity, and empathic responsivity lies with adult caregiving figures. If a parent is involved in illicit drug usage, his or her ability to correctly perceive and respond to the needs of the infant may be limited. This limitation is particularly problematic if the infant was born, secondary to prenatal drug exposure, with unusual or challenging caregiving needs.

Below is a brief vignette that exemplifies some of the ways that parental addiction may pose risks to the caregiving environment via its impact on parenting behavior and ultimately, on child well-being.

Case Example: A Mother in Recovery from Addiction

Melanie is a 25-year-old mother of three who is in recovery from her addictions to opioids that she first took when recovering from an injury. At a certain point in her addiction, Melanie

was unable to provide consistent care for her children, and they were placed in foster care at ages 2, 3, and 7. Prior to the children's placement in foster care, they experienced considerable instability in their mother's care. Melanie would often leave the three children alone as she went out in search of drugs, leaving her eldest child in charge. When the children were left alone, they had little ability to care for themselves; on one occasion, they were found foraging for food in a neighbor's trash can. The children show very little emotion and evidence almost no expectation that adults will be responsive to them or sources of comfort or shared positive affect. The youngest child, aged 2, wanders off without looking back, showing no expectation that an adult or caregiver will keep track of her. Closely attached to each other, the children evidence signs of panic and anxiety if efforts are made to separate them, even briefly.

Melanie is in an active phase of recovery and is working hard to reconnect with her children. That said, she expresses frustration that the "children don't seem to trust" her and "prefer each other" to her. She is particularly concerned about the attachment of the younger two children to her oldest daughter, who is now almost 9 years of age. While continuing to make efforts at recovery, Melanie often talks about feeling that her children should "appreciate" more of what she is trying to do and how much she has "given up" for them. As she says, "I can't even reach out to my friends. . . . I just need to be here." On more than one occasion she has referred to her children as "spoiled," especially the youngest child, who seeks out close connection to her older sister. Melanie grew up in a family with an alcoholic father and has many times stated that her childhood was "good enough" for her and that even though she "never got any attention," she "turned out fine." From this perspective, Melanie often wonders, "If it was good enough for me, why isn't it good enough for them, too?"

The above vignette highlights some important problems in working with children of drug-addicted parents. Melanie's drug addiction, while certainly multiply determined, may have begun as an effort to self-soothe and protect against affects that were too overwhelming or painful. Although an outside observer of Melanie's childhood would recognize that Melanie experienced substantial neglect and sometimes abuse, she herself only describes "being alone." On a conscious, or verbal, level Melanie does not express a belief that she was neglected. In addition, although she is able to describe memories of being left alone, without access to adult support, she does not seem to experience affect associated with these memories. Clinical research has shown that for a parent to empathize with children's emotional pain, the parent must be able to empathize with his or her own childhood experiences. Melanie may be unable to identify or empathize with her children's emotions because she herself may have been too overwhelmed as a child, too far into survival mode, to let herself feel the affect associated with her own experiences. An infant mental health approach would focus on encouraging Melanie's ability to understand her children's feelings via building a relationship with Melanie that also focuses on offering empathy to Melanie. She may also need assistance in recognizing that what she perceives as rejection by her children may be related to their fears of loss in relationship to their mother. Rather than seeing her children's behavior as a disinterest in her, she may be helped to see it as uncertainty as to her emotional availability to them.

CONCLUSION

The primary goal of this chapter was to describe the vulnerability of those parent-child dyads whose relational stability is threatened by developmental, social, environmental, or psychological factors. Research in the cognitive neurosciences certainly highlights the importance of early care experiences to brain development in early

life. This research is an important complement to our psychosocial understanding of early attachment and its effects on developmental well-being. From a social work perspective, research on the neurobiological effects of early relational care is critical to our ability to delineate the processes by which developmental risk is accrued by children in at-risk care environments. In addition, we have learned that during the first years of life, neurobiological patterns are formed that, although plastic to some degree, are also significantly enduring—which may explain why at-risk children tend to retain an internal fragility and vulnerability even when the external, situational context has been altered and improved. Chapter 6 focuses on infant mental health strategies and new approaches to prevention and intervention infused with an understanding of child development and current research on the role of the caregiving environment in brain development.