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Review

Neglect as a Violation of Species-Expectant Experience: Neurodevelopmental Consequences

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ABSTRACT

The human brain requires a wide variety of experiences and environmental inputs in order to develop normally. Children who are neglected by caregivers or raised in institutional environments are deprived of numerous types of species-expectant environmental experiences. In this review, we articulate a model of how the absence of cognitive stimulation and sensory, motor, linguistic, and social experiences common among children raised in deprived early environments constrains early forms of learning, producing long-term deficits in complex cognitive function and associative learning. Building on evidence from animal models, we propose that deprivation accelerates the neurodevelopmental process of synaptic pruning and limits myelination, resulting in age-specific reductions in cortical thickness and white matter integrity among children raised in deprived early environments. We review evidence linking early experiences of psychosocial deprivation to reductions in cognitive ability, associative and implicit learning, language skills, and executive functions as well as atypical patterns of cortical and white matter development—domains that should be profoundly influenced by deprivation through the learning and neural mechanisms we propose. These patterns of atypical development are difficult to explain with existing models that emphasize stress pathways and accelerated limbic system development. A learning account of how deprived early environments influence cognitive and neural development provides a complementary perspective to stress models and highlights novel pathways through which deprivation might confer risk for internalizing and externalizing psychopathology. We end by reviewing evidence for plasticity in cognitive and neural development among children raised in deprived environments following interventions that improve caregiving quality.

Keywords: Brain development, Childhood adversity, Deprivation, Early life stress, Learning, Neglect

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The human brain requires a wide variety of experiences and environmental inputs, some during sensitive periods, in order to develop normally. The simplest demonstration of this principle can be observed in sensory systems; access to patterned light and complex sounds during the first months of life is required for normal visual and auditory function to develop. Similar sensitive periods exist for the development of more complex behaviors and competencies, including language and the formation of an attachment to a caregiver. The wide-ranging domains of functioning that require environmental input for normal development are referred to as experience expectant (1). In this review article, we examine what happens when these expected environmental inputs are absent. We present a conceptual model of how an absence of expected inputs from the environment influences learning and neurodevelopmental processes in children, and we review existing literature on youths raised in deprived early environments in light of this model. We highlight how atypical cognitive and neural development might serve as a mechanism linking environmental deprivation to psychopathology, and we end by reviewing evidence for plasticity in cognitive and neural outcomes among children raised in deprived environments following interventions that improve caregiving quality.

SCOPE OF THE PROBLEM

Neglect involves failure of a caregiver to act in ways that are necessary to meet the basic needs of a child (2–4). Neglect encompasses inadequate provision for physical needs, poor protection from harm, and failure to provide for emotional or educational needs (see Table 1) (2–4). Neglect is the most common form of maltreatment reported to child protective services in the United States (2,5). Worldwide, millions of children have lost their parents due to armed conflict, forced migration, or infectious diseases; a common response is to raise these children in institutions. Although most institutions provide for physical needs, institutional care is often characterized by limited interaction with caregivers, resulting in a failure to provide for children's emotional and developmental needs. Despite the high prevalence of neglectful early environments, the developmental consequences of neglect are understudied as compared with other forms of adversity (6).

NEGLECT AS ENVIRONMENTAL DEPRIVATION

Environmental deprivation is a central feature of child neglect and institutional rearing. This deprivation spans numerous inputs the human brain expects, often at particular points in

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Table 1. Key Domains and Examples of Child Neglect

Neglect Involves Failure of a Caregiver to Provide for:	Examples
Physical Needs	Nutrition, clothing, shelter, access to medical care
Protection From Harm	Inadequate supervision
Emotional Needs	Presence of a stable caregiver, sensitive and responsive caregiving, emotional nurturance
Educational Needs	School attendance

development. Deprivation is the core feature of neglect that distinguishes it from other forms of adversity, such as trauma and abuse, where the most prominent feature is harm or threat of harm to the child. Although experiences of deprivation often co-occur with experiences of threat (i.e., abuse), the developmental consequences of deprivation and threat are at least partially distinct (7–9). Here, we focus specifically on neurodevelopmental consequences of deprivation resulting from neglect and institutional rearing.

At the most fundamental level, neglected children are deprived of a stable, sensitive, and responsive caregiver, which is a species-expectant experience. Caregivers are necessary to ensure survival in early human development by providing nutrition and ensuring safety from threats (10). Infants are born with a behavioral repertoire designed to ensure caregiver protection and proximity (e.g., crying) (11). Children develop a secure attachment when caregiving is sensitive, responsive, and predictable (12–15). Caregivers impose regularity onto children's environment by regulating sleep–wake cycles and feeding and by responding contingently to distress with physical proximity and nurturance. Neglected children are not afforded sensitive, supportive, and stable caregiving on a consistent basis. Parents with documented histories of neglect generally show low levels of emotional warmth, positive behaviors, and empathy (16–18). Neglectful families also exhibit caregiving that is irregular and unstable (17). A similar absence of emotionally supportive caregiving occurs in institutional environments, where caregiver interactions with children are infrequent and contingent responding is low (19).

Early in life, most forms of learning occur in the context of caregiver interactions. The sensory, motoric, linguistic, and social experiences provided by caregivers determine the complexity of children's environment and the degree of cognitive stimulation children receive. Caregivers regulate exposure to environmental inputs of numerous kinds, including language and auditory stimulation in the form of caregiver vocalizations, social interaction through play, and sensory and motor stimulation through physical contact and the provision of objects for children to manipulate. In some domains (e.g., language), exposure to environmental input must occur in the context of social interaction to generate learning (20,21). The absence or unavailability of a primary caregiver results in gross reductions in sensory, cognitive, and social stimulation. Indeed, reductions in cognitive stimulation, provision of learning opportunities, supervision by adults, and parent–child interactions have been observed among children who are neglected (16,18,22). Similarly, children raised in institutions experience dramatic reductions in exposure to language, less frequent and predictable interactions with adults, limited variation in daily routines and experiences, and less access to novel and age-appropriate enriching cognitive stimuli than do children raised in families (19,23,24).

Importantly, the severity of deprivation experienced by neglected children exists along a continuum. Most studies do not measure specific types of deprivation directly (e.g., degree and complexity of linguistic experiences) but rather assess the presence of neglect or institutional rearing. Determining how the neurodevelopmental mechanisms outlined below vary as a function of the severity of deprivation is a critical goal for future research.

EXISTING PERSPECTIVES

A variety of brain regions and circuits are influenced by early deprivation. The absence of a caregiver to provide protection from harm and to regulate arousal and distress represents a pervasive stressor that can produce lasting changes in emotional development. Most existing models emphasize atypical limbic system development resulting from prolonged early-life stress as a central mechanism underlying developmental outcomes associated with caregiver deprivation (25–31). Strong evidence supports this view. Children deprived of a stable and responsive caregiver exhibit high levels of insecure and disorganized attachment and atypical affective development characterized by heightened emotional reactivity, accelerated functional development of the amygdala, poor emotion regulation, and atypical stress reactivity (25,32–37). These disruptions in attachment and affective development contribute to high levels of internalizing psychopathology among children raised in deprived early environments (31,38–40).

But is this the only mechanism involved in neglect? One of the most consistent observations of neglected children is that they exhibit deficits in numerous areas of cognitive development (27,28), and these deficits are more extreme than those observed in other forms of adversity (e.g., abuse) (41). Are disruptions in limbic system development sufficient to explain these widespread cognitive effects? We argue that additional mechanisms are involved.

Deprivation as an Absence of Learning

Environmental deprivation that characterizes child neglect and institutional rearing has a pervasive and lasting influence on development. Disruptions in early learning may underlie the far-reaching developmental consequences of neglect, including those not readily explained by atypical limbic development (e.g., low cognitive ability). Children who experience neglect are raised in an environment characterized by the absence or limited availability of a caregiver, which curtails the complexity of their sensory, motor, and linguistic experiences and reduces learning opportunities.

Early deprivation constrains basic forms of learning that depend on rich sensory and social inputs early in development, including associative and implicit learning. Caregivers play a critical role in the development of these learning