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Adaptive Coping under Conditions of Extreme Stress: Multi-Level Influences on the Determinants of Resilience in Maltreated Children

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Abstract

The study of resilience in maltreated children reveals the possibility of coping processes and resources on multiple levels of analysis, as children strive to adapt under conditions of severe stress. In a maltreating context, aspects of self-organization, including self esteem, self reliance, emotion regulation, and adaptable yet reserved personalities appear particularly important for more competent coping. Moreover, individual differences in biological processes ranging from gene by environment interactions to the HPA axis to brain organization related to emotion also are shown to influence the resilience in maltreated youth, highlighting the multi-faceted contributions to successful coping.

Growing up under conditions of child maltreatment constitutes a profound immersion in severe stress that challenges and frequently impairs development across diverse domains of functioning. Not only is psychological development often compromised, but also biological consequences ensue. Nevertheless, not all maltreated children succumb to extreme adversity. Investigation of how some maltreated children cope adaptively with extreme stress offers an opportunity to discover processes at multiple levels of analysis that may be germane to effective coping, yet less readily detectable under more normative stress exposure.

Resilience, one of the most intriguing phenomena of human development, has been conceptualized as the individual's capacity for coping successfully and functioning competently despite experiencing chronic stress or adversity, or following exposure to prolonged or severe trauma (Luthar, Cicchetti, & Becker, 2000). Understanding how children develop and function adaptively despite experiencing a multitude of stressors offers considerable promise for prevention and intervention and for elucidating developmental theories of coping. Discovering how individuals initiate their self-righting strategies when confronted with adverse experiences will shed light on the manner in which an organism's active coping strivings influence whether an adaptive or maladaptive developmental pathway will be traversed.

Multi-Level Influences on Resilience

Stress has been conceptualized as a perceived threat to an individual's homeostasis and as a situation that brings about increases in the reactivity of the autonomic nervous system through hormone secretion (McEwen, 1994). Stressful experiences engender both biological and psychological responses. The biological response to stress includes the activation of specific neural circuits and neuroendocrine systems (Cicchetti & Walker, 2001). Furthermore, psychological factors such as the anticipation of stress and perceived lack of

control can serve as the initial link in a chain of events that can trigger a biological stress response (Cicchetti & Walker).

The experience of chronic stress is typically associated with deleterious outcomes such as neurobiological dysfunction, immunological difficulties, neuroendocrine dysregulation, and increases in autonomic activity, as well as with maladaptation and mental disorder (Gunnar & Vazquez, 2006). Yet, not all individuals who are exposed to stressful experiences are affected in a uniform fashion at either the biological or psychological level. There are multiple converging processes that determine such variability in the responses to stressors. These include the neural circuits that are activated by physiological and psychological stressors, as well as the influences of genetics, prior experience, and ongoing life events (Sapolsky, 1994).

Despite the growing attention paid to discovering how individuals avoid maladaptation after experiencing great risks and adversity, the empirical study of resilience has predominantly focused on detecting the psychosocial determinants of the phenomenon and largely eschewed the inclusion of genetic and biological measures (Curtis & Cicchetti, 2003). This artificial distinction among genetics, neurobiology, and behavior in research on resilience contradicts years of research indicating co-actions between all levels of analysis, from the environment broadly construed to the molecular. The pathways to either psychopathology or resilience are influenced, in part, by a complex matrix of the individual's level of biological and psychological organization, experience, social context, timing of adverse events and experiences, and developmental history. In recent years, scientists have argued that efforts to understand the underlying processes of resilient adaptation would be facilitated by more interdisciplinary research (Charney, 2004; Cicchetti & Curtis, 2007; Curtis & Cicchetti; Lester, Masten, & McEwen, 2006). Research of this nature would entail a consideration of psychological, biological, and environmental-contextual processes from which varied pathways to resilience might eventuate (known as equifinality), as well as those that result in the diverse outcomes that individuals attain following stress such as maltreatment (known as multifinality) (Cicchetti & Rogosch, 1996).

Child Maltreatment: Resilience as Coping

In this chapter, we utilize research on the determinants of resilience in maltreated children as an exemplar of how children experiencing acute and chronic stress and adversity nonetheless cope and succeed. In this work, child maltreatment is conceptualized via a multi-dimensional approach (see, Barnett, Manly, & Cicchetti, 1993) and incorporates sexual abuse, physical abuse, physical neglect, and emotional maltreatment. Consideration of onset, recency, frequency, and severity of the abuse and neglect experiences, as well as of the identity of the perpetrators of those incidents, yields a more complex characterization of the phenomenon of child maltreatment. In addition to specific incidents of abuse and neglect, children in maltreating families typically experience a chronically dysfunctional family milieu. Child maltreatment sets in motion a probabilistic path of epigenesis for abused and neglected children characterized by an increased likelihood of failure on stage-salient developmental tasks (such as emotion regulation and secure attachment) that eventuates in a profile of vulnerability factors that increase the probability of the emergence of maladaptation and psychopathology (Cicchetti & Lynch, 1995).

Because the vast majority of children are adversely affected, child abuse and neglect may represent the greatest failure of the caregiving environment to provide opportunities for successful coping and normal development. Importantly, however, not all maltreated children will show maladaptation, and, it is likely that the neurobiological structure, function, and organization of well-functioning, resilient maltreated children would be

different from those of other maltreated children. For example the brains of all maltreated children are not affected in the same manner (Cicchetti, 2002). In addition, the timing, nature, severity, and chronicity of the maltreatment experiences, in addition to the balance and type of risk and protective factors, likely play important roles in determining the neurobiological development of maltreated children. Indeed, some abused and neglected children function in a competent fashion and cope adaptively with their life's vicissitudes despite the pernicious experiences they have encountered. Just as deviations from the average expectable environment potentiate some children toward the development of maladaptation, others evidence adaptation, coping effectively in the face of the same stressful challenges.

Protective factors also play roles in children's developmental pathways following maltreatment. Among the array of protective factors that have been identified to promote resilient functioning in maltreated children are children's academic engagement, social competencies, average or above-average intellectual performance, and the presence of a secure relationship with an adult caregiver. Personality characteristics such as an internal locus of control for positive events and higher self-esteem provide further examples of individual characteristics that serve a protective function for maltreated children, mitigating the risk for maladaptive outcomes and potentially enhancing their coping capacities (Cicchetti & Valentino, 2006).

Maltreatment and brain functioning and development

The experience of child maltreatment has been shown to exert harmful effects on the brain, as well as on neuroendocrine regulation (Cicchetti & Rogosch, 2001a; Cicchetti & Toth, 2005; DeBellis, 2001). In order to comprehend neurobiological and neuropsychological development, it is essential to recognize that brains are not immutable and that their structural organization is a reflection of an individual's developmental history (Cicchetti & Tucker, 1994; Luu & Tucker, 1996). For example, the difficulty displayed by maltreated children in verbally expressing their negative feelings may be not only a reflection of psychological intimidation, but also a manifestation of the neuroanatomical and neurophysiological changes that occur secondary to maltreatment.

Stressful or threatening experiences such as child abuse and neglect create adaptational challenges. The hypothalamic-pituitary-adrenal (HPA) axis is one of the physiological systems that has evolved in mammals to help direct and sustain cognitive, emotional, behavioral and metabolic activity in response to threat. The capacity to elevate cortisol in response to acute trauma is critical for survival. Brief elevations in corticosteroids appear to enhance the individual's ability to manage and cope with stressful experiences competently, both physiologically and behaviorally.

However, both chronic hyperactivity of the HPA axis and reduced cortisol secretion, known as hypercortisolism and hypocortisolism, respectively, exert negative impacts on the brain and impede an individual's ability to cope with stress. Thus, it is best to avoid both chronic glucocorticoid hypersecretion and hyposecretion (Gunnar & Vazquez, 2001). Although the studies on HPA functioning in maltreated children have yielded inconsistent results, most cohere in finding neuroendocrine dysregulation, with children who have experienced extensive maltreatment subtypes (e.g., co-existing sexual, physical, and emotional abuse) demonstrating hypercortisolism, and physically abused children exhibiting hypocortisolism (Cicchetti & Rogosch, 2001a). The impairments in stress-regulation found in maltreated children also negatively affect these youngsters' thinking and decision-making abilities, as well as their coping skills, and thereby increase the likelihood of maladjustment and psychopathology (Cicchetti & Rogosch, 2001b).

Processes of resilience

In our laboratory, we have investigated the processes contributing to adaptive outcomes in heterogeneous samples of economically disadvantaged maltreated and nonmaltreated school-age children. In our first study, we examined an array of domains of functioning and personal resources, including peer relations, school functioning, internalizing and externalizing symptomatology, cognitive maturity, self-esteem, ego-resiliency, ego control, and relationship quality with nonfamily adults. Moreover, data were obtained from multiple sources, measures, and informants (Cicchetti, Rogosch, Lynch, & Holt, 1993). Our criteria for resilience were based on seven indices of competent adaptation on important stage-salient developmental issues for school age children, including effective peer relations, successful school adjustment, and low behavioral symptomatology. For each child, the number of indices of competent functioning was determined.

Maltreated children, as a group, were shown to evidence fewer indicators of competence when compared to their nonmaltreated counterparts. In particular, out of a maximum number of seven possible indices of resilience, over 43% of the maltreated children, compared to approximately 26% of the nonmaltreated comparisons, displayed resilience in either zero or one domain. From his earliest publications on the topic, Garmezy (1971) asserted that most children maintain the ability to show some resilience strivings in the presence of chronic and serious adversity. Given that the preponderance of the maltreated and nonmaltreated children displayed at least one index of adaptive functioning, it appears that most of these children continue to have resilient strivings as they strive to actively cope with the numerous stressors they encounter in their lives. The total absence of successful strivings for resilience in some maltreated (22%) and nonmaltreated (15%) provides cause for great concern.

Nevertheless, maltreated children with many areas of resilient functioning were identified. Furthermore, ego-resiliency, ego-overcontrol, and positive self-esteem emerged as predictors of resilient adaptation for maltreated children. In contrast, only ego resiliency and positive self-esteem were associated with resilient functioning among nonmaltreated children. We expect that ego-overcontrol may serve a protective function for maltreated children. Block and Block (1980) identified two types of resilient personality organization: resilient overcontrollers and resilient undercontrollers. The resilient maltreated children, through adopting a more reserved, controlled, and rational way of interacting and relating, may be more attuned to what is necessary to cope successfully in their adverse home environments. In contrast, the more expressive and straightforward style characteristic of resilient undercontrollers may not be well suited for adaptive coping in maltreating environments because such styles might provoke attention and reactions from others that could result in greater risk for continued maltreatment and developmental failure.

In a subsequent investigation, we recruited a unique heterogeneous sample of school-age maltreated and nonmaltreated children from socioeconomically disadvantaged backgrounds and examined the pathways of their adaptive functioning against the backdrop of significant adversity. Over 200 children were followed-up longitudinally over three consecutive years, and resilience was measured and assessed annually in the same manner as in our initial study. As previously, a higher percentage of nonmaltreated than of maltreated children were found to function resiliently over time (Cicchetti & Rogosch, 1997). Additionally, a higher percentage of maltreated than of nonmaltreated children were shown to exhibit functioning in the low resilient range over the course of the longitudinal follow-up. Of special concern was the consistently low functioning of the least competent group, comprised predominantly of maltreated children. Along these same lines, the not insignificant percentage (approximately 10%) of maltreated children who exhibited no resilient strivings across the three years of longitudinal assessments is disconcerting.

Differential predictors of resilience also emerged for maltreated and nonmaltreated children. Specifically, positive self-esteem, ego resiliency, and ego overcontrol predicted resilient functioning in maltreated children, whereas relationship features were found to be more influential for developing resilience in nonmaltreated children. We interpret these findings as suggesting that, in the face of unfulfilling relationships, the maltreated children who demonstrate resilient functioning have developed an adaptive coping mechanism toward less reliance on relatedness in their everyday functioning. Self-reliance and self-confidence, in concert with interpersonal reserve, may bode well for the development of resilient adaptation in maltreated children. Personal conviction may be powerful enough to maintain active coping, even in the context of severe and chronic stress and adversity. Although self-reliance and self-determination may play an adaptive role in these children achieving resilience despite experiencing maltreatment and great adversity, it will be important to ascertain whether these coping mechanisms will contribute to the emergence of problems later in life. These findings call for a more in-depth empirical examination of the development and functions of self-system processes in children's coping capacities. Such work would benefit from a conceptualization emanating from self-determination theory (Deci & Ryan, 1985; Ryan & Deci, 2000)

Neuroendocrine Influences on Resilience

In our more recent investigations of the processes contributing to resilience, we have adopted a multiple-levels-of-analysis perspective and have attempted to redress the unitary emphasis on psychosocial factors that has predominated in the literature. We examined resilience in adaptive functioning in a sample of nearly 700 maltreated and nonmaltreated children. Our focus on the contribution that the personality features of ego-resiliency and ego-control could make to resilience and coping under adversity was augmented by investigation of the regulation of two stress-responsive adrenal steroid hormones, cortisol and dehydroepiandrosterone (DHEA), primary products of secretory activity occurring in the HPA axis (Cicchetti & Rogosch, 2007). DHEA is a precursor of androstenedione, testosterone, and estradiol, and exerts an impact on diverse biologic systems, as well as emotionality, cognitive functioning, and health. Although operating at different levels of analysis, behavioral/psychological and biological factors each made unique contributions to resilience in this study.

Consistent with our earlier studies, ego resiliency and ego overcontrol were significant predictors of resilience. Moreover, they operated as mediators of the relation between maltreatment and resilient functioning. In contrast to the findings obtained in our prior investigations, ego overcontrol did not operate differentially in the maltreatment and comparison groups of children. For both maltreated and nonmaltreated children, resilient overcontrol personality organizations, a more reserved, controlled, and rational style of interacting with peers and adults, likely contributed to these children being more attuned to behave in ways that were critical for adapting successfully to their stress-laden environments.

At the biological level, the adrenal steroid hormones, cortisol and DHEA were associated with resilience. Prolonged stress, as is often the case in child maltreatment, can lead to allostatic load, characterized by cumulative physiological dysregulation across multiple biological systems, through a cascade of causes and sequelae that can damage the brain, organ systems, and the neurochemical balance that undergirds cognition, emotion, mood, personality, and behavior (Davies, Sturge-Apple, Cicchetti, & Cummings, 2007). Interacting genetic, developmental, and experiential factors, including child maltreatment, play prominent roles in the wide array of individual differences among individuals in coping with stressful challenges throughout their lives.

For the nonmaltreated comparison children, higher morning cortisol levels were related to lower levels of resilient strivings, whereas, for the maltreated children, morning levels of cortisol were not found to be related to increasing levels of resilience. Among nonmaltreated children, high basal cortisol may be indicative of children who are undergoing greater stress exposure and as a consequence are constrained in their capacity to adapt competently. A closer examination of the maltreated children revealed differences according to the subtype of maltreatment experienced. We found that physically abused children with high morning cortisol had higher resilient functioning than children with lower levels of morning cortisol. The positive role of increased cortisol for physically abused children is divergent from the more general pattern of higher cortisol being related to lower resilient functioning as we discovered in the nonmaltreated and sexually abused children.

Prior research on neuroendocrine regulation has indicated that physically abused children generally exhibit lower levels of morning cortisol secretion (Cicchetti & Rogosch, 2001a). It may be that the subgroup of physically abused children who were able to elevate cortisol to cope with the stressors in their lives was demonstrating a greater striving for resilient adaptation. In contrast, the larger subgroup of physically abused children with lower levels of morning cortisol may have developed hypocortisolism over time in response to chronic stress exposure. As a result, for the larger subgroup of physically abused children, there may be a diminished capacity to mobilize the HPA axis to promote positive adaptation under conditions of ongoing stress. Additionally, the findings of a very low level of resilience among sexually abused children with high basal cortisol may be a product of their different traumatic experiences and the consequences of chronic excessive vigilance and preoccupation, with commensurate HPA axis hyperarousal.

Another noteworthy discovery was the unique, atypical pattern of a relative diurnal increase in DHEA exhibited in maltreated children with high resilient functioning. It may be that maltreated children who possess the capacity to increase DHEA over the course of the day are better equipped to cope with the demands of high chronic exposure to stress in their lives and to adapt competently. The nonmaltreated children who functioned in a resilient fashion did not demonstrate the pattern of diurnal DHEA increase; rather, they exhibited the lowest levels of DHEA across the day.

Importantly, when considered jointly, independent main effects of both personality features and adrenal steroid hormones on resilient functioning were observed. Thus, steroid hormones and personality features were not reducible to each other; both levels of analysis, behavior and stress neurobiology, made important contributions to the ability of maltreated children to cope successfully with the major stresses they encountered in their daily lives.

Resilience and Hemispheric Asymmetry

In an extension of the multi-level perspective on resilient coping in maltreated children experiencing significant adversity, Curtis and Cicchetti (2007) conducted the first study investigating the association between an index of neural function, electroencephalogram (EEG) asymmetry, and resilience. Relative activation of the left versus right hemisphere of the cerebral cortex has been related to differential emotion experience. More specifically, the right hemisphere is associated with negative emotion and withdrawal, whereas the left hemisphere is linked to positive emotion and approach behavior (Davidson, 2000). We sought to determine at the neural level whether a greater propensity for positive emotion would contribute to resilience. In addition, at the behavioral level, we incorporated an observational assessment of emotion regulation to examine how differences in emotion regulatory capacities might promote resilient functioning.

Emotion regulation contributed to resilience in both maltreated and nonmaltreated children. For all children striving to cope with adversity, a greater capacity to modulate the expression of negative emotions fostered resilience. In contrast, EEG asymmetry contributed to resilience only in the maltreated group of children. Specifically, maltreated children who exhibited greater relative EEG activation in the left hemisphere were found to be more likely to function in a resilient fashion. However, children with restricted capacity to cope with maltreatment and adversity exhibited relatively greater right hemisphere activation.

Within the explanatory framework of the emotion theory of differential hemispheric lateralization (Davidson, 2000), the observed left hemisphere asymmetry in resilient maltreated children may reflect a bias in the recognition and representation of emotion. In conjunction with better emotion regulation abilities, the increased left hemisphere asymmetry in the group of resilient maltreated children may be associated with greater social competence with peers and adults. For example, in peer interactions, the bias toward perceiving emotion positively and the presence of emotion regulatory ability would be highly adaptive in the context of adversity. Investigations have shown the devastating consequences that a hostile attributional bias exerts upon the peer relations of physically abused children (Dodge, Pettit, & Bates, 1997). The left hemisphere EEG asymmetry observed in resilient maltreated children may reflect a positive attribution bias and hence contribute to these children being better prepared to successfully navigate peer relations. Parallel to our previous findings, there were no interactions observed between EEG asymmetry and emotion regulation. Thus, each level, neural and behavioral, uniquely contributed to resilient adaptation in maltreated children.

Genetic Contributions to Resilience

Knowledge of genetic variation may help to identify which individuals are most vulnerable to adverse experiences. Through investigating gene \times environment (G \times E) interactions, protective functions of genes that may facilitate coping with stress also may be discovered. Developmental psychopathologists have begun to examine behavioral effects that are the outcomes of the interdependence between a specific identified variation in the DNA sequence and a well-defined and carefully measured environmental pathogen – known as G \times E (Moffitt, Caspi, & Rutter, 2006). In G \times E, environmental experiences moderate genetic effects (or vice-versa) on normal, psychopathological, and resilient outcomes. For example, genetic effects on functioning outcomes may be observed only under certain environmental contexts or in conjunction with different histories of experience, or conversely, experience may only relate to outcomes among individuals with specific genetic characteristics.

Numerous investigations have reported links between child maltreatment and aggressive or antisocial behavior (Cicchetti & Lynch, 1995; Cicchetti & Valentino, 2006). However, not all maltreated children are aggressive or develop antisocial problems. Extrapolating from animal studies, Caspi and colleagues (2002) examined the interaction between monoamine oxidase A (MAOA) and maltreatment to ascertain if the heterogeneity of outcomes in maltreated children could be explained by a G \times E. MAOA is a mitochondrial enzyme that is responsible for the degradation of a variety of biogenic amines (e.g., the neurotransmitters dopamine, norepinephrine, and serotonin) (Youdim, Finberg, & Tipton, 1988). There is a well-characterized upstream variable number tandem repeat (u-VNTR) polymorphism in the promoter region of the MAOA gene, which is known to affect gene expression; the length of this polymorphism (i.e., low versus high number of tandem repeats) determines the efficiency with which MAOA is transcribed and ultimately produced within individuals (Caspi et al., 2002).

Caspi et al. (2002) found that the MAOA-uVNTR polymorphism moderated the impact of child maltreatment on the development of antisocial behavior in males. Specifically, they found that the effect of maltreatment on antisocial behavior was significantly less among males with high MAOA activity than among those with low MAOA activity. Hence, the probability that child maltreatment will eventuate in male antisocial behavior in adulthood is greatly increased among children whose MAOA is not sufficient to render maltreatment-induced changes in neurotransmitter systems inactive (Caspi et al.). Conversely, high MAOA may protect against antisociality when males are subjected to severe maltreatment.

A second large-scale prospective investigation conducted by Caspi et al. (2003) provides another compelling example of how the incorporation of a multiple-levels perspective and G×E interactions can elucidate the processes that contribute to pathological or resilient adaptation. These investigators found that adults with a functional polymorphism in the promoter region of the serotonin transporter (5-HTT) gene moderated the influence of stressful life events on depression in adults. Specifically, individuals with one or two copies of the short (s) allele of the 5-HTT linked promoter region (5-HTTLPR) gene developed more depressive disorders, depressive symptoms, and suicidality than individuals homozygous for the long (l) allele when confronted with high stress. Thus, the l/l homozygous allele may prove to confer a protective function against the development of adult depression in individuals who have been maltreated.

In our laboratory, we examined G×E interaction by contrasting adolescents who had high versus low MAOA activity genotypes and who varied in terms of the extensiveness of their maltreatment experiences (Cicchetti, Rogosch, & Sturge-Apple, 2007). We also measured adolescents' reports of their coping strategies for managing stress. Among the adolescents who experienced extensive maltreatment, the MAOA genotype influenced the level of adolescents' depressive symptoms; only adolescents with the low MAOA activity genotype evidenced high depressive symptoms, whereas their peers with high MAOA activity and extensive maltreatment had comparable levels of depressive symptoms to other youth in the sample. We then sought to determine whether the extensively maltreated adolescents varied in their coping strategies depending on their MAOA genotype. Interestingly, self-related coping processes contributed to lower depressive symptoms among high MAOA, extensively maltreated youth, whereas help seeking and avoidant coping did not. In contrast, none of these coping processes contributed to individual differences in depressive symptoms among adolescents with extensive maltreatment and the low MAOA activity genotype. Thus, self-related coping appeared to confer further protection from depressive symptoms among the youth with extensive maltreatment and the protective variant of the MAOA gene.

Concluding Comments

Studies of resilience in maltreated children reveal the possibility of coping processes and resources on multiple levels as children strive to adapt under conditions of high stress. Aspects of self-organization, including self esteem, self reliance, emotion regulation, and adaptable yet reserved personalities likely contribute to more competent coping. Moreover, individual differences in biological processes ranging from genes to the HPA axis to brain organization related to emotion also are likely to influence the coping capacities of maltreated youth. At this stage our findings have shown the relative independence of these varied domains of influence, highlighting the multi-faceted contributions to successful coping. Further work will be invaluable to begin to decipher co-actions across these multiple levels of analysis during the course of development for a more integrated appreciation of the varied ways in which coping with stress may be achieved.

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