

Stressful Challenges and Resilient Functioning: Illustrations from a Multi-Level Perspective on Child Maltreatment

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Research conducted within a developmental psychopathology perspective demonstrates that there is multifinality in developmental processes such that the manner in which the individual constructs, responds to, and interacts with vulnerability and protective forces at each level of the ecology allows for diversity of outcomes. Accordingly, developmental psychopathologists stress that it is equally informative to comprehend the mechanisms that promote resilient functioning as it is to investigate developmental pathways to normality and psychopathology.

Furthermore, discovering the processes underlying resilient functioning offers considerable promise for affirming, challenging, and expanding upon extant developmental theories, as well as for translating these findings to inform prevention, intervention, and social policy initiatives.

Resilience has been conceptualized as the individual's capacity for adapting successfully and functioning competently, despite experiencing chronic stress or adversity following exposure to prolonged or severe trauma. Resilience is a dynamic developmental process, not a static or trait-like condition. Moreover, resilience is multi-dimensional in nature, exemplified by findings that high-risk individuals may manifest competence in some domains and contexts, whereas they may exhibit problems in others.

Child Maltreatment

Child maltreatment is a pathogenic relational experience that represents one of the most adverse and stressful challenges that confront children. Child maltreatment ushers in motion a probabilistic path of epigenesis for abused and neglected children that is marked by an increased likelihood of failure and disruption in the successful resolution of salient developmental tasks, resulting in a profile of relatively enduring vulnerability factors that increase the probability of the emergence of maladaptation and psychopathology.

Because the vast majority of children are adversely affected by their experiences, child abuse and neglect may exemplify the greatest failure of the caregiving environment to provide opportunities for normal biological and psychological development.

Importantly, however, not all maltreated children develop in a maladaptive fashion. Indeed, some abused and neglected youngsters function in a competent fashion despite the pernicious experiences they have encountered and the ignominious treatment they have received.

Despite the increased attention paid to discovering the processes through which maltreated children develop in a competent fashion, the empirical study of resilience, including resilience in maltreated children, has focused predominantly on detecting the extraorganismic and individual-level psychosocial determinants of the phenomenon.

Because self-righting, one of the basic mechanisms underlying resilience has historical roots embedded in the fields of embryology and genetics, it is unfortunate that researchers investigating the pathways to resilient adaptation have eschewed the inclusion of genetic and biological measures. **(But see Cicchetti and Curtis, 2007, Special Issue of *Development and Psychopathology* on “A Multi-Level Perspective on Resilience” and Lester, Masten, and McEwen, 2006, *Resilience in Children*, New York Academy of Sciences).**

The role of biological factors in resilience is suggested by evidence on neural and neuroendocrine system function in relation to stress reactivity, and in behavior-genetic research on nonshared environment effects. Likewise, molecular genetic research has begun to reveal the genetic elements that may serve a protective function for individuals experiencing significant adversity such as child maltreatment.

In order for our understanding of the pathways to competent functioning in maltreated children to grow in ways that are commensurate with the complexity of the construct, the incorporation of a multiple-levels-of-analysis perspective must increasingly be included in the design and implementation of investigations on the determinants of resilient adaptation.

The incorporation of such a perspective into the study of resilience also will result in a more sophisticated and comprehensive portrayal of this phenomenon that will serve not only to advance the scientific knowledge of resilience, but also to inform efforts to translate research on positive adaptation in the face of adversity into the development of interventions to promote resilient functioning.

Stress

Stress has been conceptualized as a perceived threat to an organism's homeostasis and as a situation that causes increases in autonomic nervous system activity or hormone secretion. Stressful or threatening experiences such as child abuse and neglect create adaptational challenges for the organism. There are multiple, converging pathways that determine the neural response to different stressors, including not only the neural circuits that are activated by physical, psychological, and immunological stressors, but also the influence of genetics, early experience, and ongoing life events.

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 steroid hormones cortisol and DHEA are the two primary adrenocortical products of secretory activity occurring in the HPA axis.

Basal activity of cortisol follows a circadian rhythm, with high levels around the time of awakening, declining to low levels as the day proceeds. Basal levels of cortisol are critical for normal brain development and for the support of the metabolic activity necessary to sustain overall functioning. In addition, the capacity of individuals to elevate cortisol levels in response to exposure to acute trauma is important for survival.

In contrast, the secretory diurnal pattern of DHEA appears to be fairly stable across the course of the day. Thus, it seems that cortisol secretion is more variable and that DHEA secretory levels are a more consistent and stable index of underlying adrenal steroidogenic capacity. DHEA, a precursor of the steroid hormones androstenedione, testosterone, and estradiol, exerts an impact upon a diverse array of biologic actions, including effects on the immune, cardiovascular, endocrine, metabolic, and central nervous systems. Furthermore, as is true for cortisol, circulating levels of DHEA have been shown to be associated with individual difference in emotionality, cognitive functioning, health, and behavior.

Although a number of investigations of the effects of child maltreatment on cortisol regulation have been conducted, to date there have been no studies on DHEA regulation in abused and neglected children. The studies of maltreated and nonmaltreated children have revealed divergent patterns of cortisol regulation, both between-and-within groups. For example, Cicchetti and Rogosch (2001a) found that children who experienced an early onset of maltreatment, and multiple subtypes of abuse and neglect across a range of developmental periods expressed elevated levels of cortisol concentrations across the week in both the morning and late afternoon (a pattern resembling that of hypercortisolism).

In contrast, physically abused children exhibited lower levels of cortisol and less diurnal variation in cortisol levels from morning to afternoon over the course of the week than did nonmaltreated children (a pattern akin to hypocortisolism). Finally, no differences were obtained between the neglected and emotionally maltreated groups of children and the comparison group of nonmaltreated children.

Personality Functioning,
Adrenal Steroid Hormones, and
Resilient Functioning in Maltreated
and Nonmaltreated Children

In this investigation of the developmental pathways to resilience in maltreated and nonmaltreated children, we adopted a multiple-levels-of-analysis perspective and examined the unique and interactive contributions that personality features and adrenal steroid stress hormone regulation make to the achievement of competent functioning in the face of significant stress and adversity. Utilizing a large, representative sample of maltreated children and a well-matched groups of nonmaltreated children, we embarked on one of the first empirical studies of biological and psychological contributors to resilience in abused and neglected children.

Not all maltreated children manifest cortisol dysregulation, nor do they exhibit the same pattern of cortisol dysregulation. Given the variability in cortisol regulation shown by maltreated children, we decided to examine the relation between cortisol regulation and resilience.

Additionally, because no research has been conducted on diurnal variation in DHEA in maltreated children, we chose to investigate DHEA regulation in maltreated children.

Furthermore, because of the multiplicity of effects that DHEA exerts on biological systems, as well as its intimate link with cortisol as the two major adrenal steroid hormones, we explored the relation between DHEA regulation and resilient functioning. In addition, because cortisol and DHEA are both released during stress and because incidents of child maltreatment engender massive stress in these vulnerable children, we also explored the relation between the cortisol/DHEA ratio and the development of resilience.

Also, personality functioning (Ego-resiliency and ego-control) was examined in this multi-level investigation of resilience.

Resilience composite: multi-domain, multi-measure, multi-informant (peer relations, school performance, child depression, behavioral observations of prosocial, withdrawal, and aggressive behaviors, externalizing and internalizing symptoms, etc.)

To date, the vast majority of research on the developmental sequelae of severe psychological stress in humans has focused on discovering the pathways to maladaptation and psychopathology. This investigation is one of the first studies to examine the role that neurobiological responses to stress play in the development of resilient adaptation in maltreated and nonmaltreated children.

Method

Sample

677 children

maltreated 347 (vast majority maltreated within first 5 years of life)

nonmaltreated 330

\bar{x} age = 9 years

55% = boys

62% = African American

19% = Caucasian

17% = Hispanic

2% = other racial/ethnic groups

Low income families; 95% had a history of receiving welfare benefits.

There were no differences between Maltreated and Nonmaltreated on all demographics

Summer Camp Context

Week in duration (9 AM to 4 PM)

Cortisol }
DHEA } assayed 9 a.m. and 4 p.m. daily

Resilience composite

Assessed throughout the week (35 hours)

Results

- Ego Resiliency and Ego Overcontrol both predicted resilient functioning in maltreated and nonmaltreated children.
- Maltreatment was not related to difference in average levels of morning or afternoon cortisol or DHEA.
- Lower morning cortisol was related to higher resilient functioning, but only in nonmaltreated children.
- In contrast, among physically abused (PA) children, high morning cortisol was related to higher resilient functioning. (note: most PA children have low AM and PM levels of cortisol. Hypocortisolism due to high allostatic load?)

- AM and PM DHEA were negatively related to resilient functioning.
- Although diurnal change in cortisol was not related to resilience, for DHEA, maltreated children with high resilience showed an atypical rise in DHEA from AM to PM
- AM and PM cortisol/DHEA ratios were positively related to resilient functioning, but did not interact with maltreatment status.
- Ego resiliency and Ego- (over-) control differentiated maltreated and nonmaltreated children; moreover, these personality variables predicted resilience.
- Personality, cortisol, DHEA, and cortisol/DHEA ratios each made independent contributions in predicting resilience.
- There were no personality x hormone interactions in the prediction of resilience.

Cicchetti, Rogosch, & Gunnar study (in preparation)

- Cortisol regulation, early abuse experience, and depression.

Future

Genetic levels of analysis

Studying HPA regulation over the course of development is needed to differentiate the influences of innate individual differences in HPA regulation, the manner in which individuals with innate differences in HPA regulation respond differentially to stress, and the developmental course of HPA regulation under stress, particularly the potential conversion from early hypercortisolism to later hypocortisolism among individuals chronically exposed to stress.

Research has documented the role of stress hormones in the expression of genes that govern brain function. For example, glucocorticoid receptors in the nuclei of neurons are responsible for genomic effects, such that stress hormones influence gene expression, and affect neuronal growth, neurotransmitter synthesis, receptor density and sensitivity, and neurotransmitter reuptake.

Also: corticotropin releasing hormone alleles.

Because stress hormones can have such direct effects on genes that control brain structure and function (Watson & Gametchu, 1999), research on stress in developing organisms is crucially important. Therefore, understanding the transactions between the regulation of adrenal steroid hormones and brain processes over the course of development, particularly under conditions of stress, will be invaluable for providing insight into resilience promoting processes.

Emotion Regulation and EEG Asymmetry as Predictors of Resilience

- Method – Camp sample; included extremes of sample: resilient and non-resilient children
- Almost all maltreated children were abused/neglected within first 5 years of life.
- First study to show a direct association between an index of neural function and resilient adaptation.
- Both emotion regulation and hemispheric EEG asymmetry independently contributed to the prediction of resilience.
- Resilient maltreated children showed greater relative left hemisphere activity across homologous central electrode sites C₃/C₄. (Reflective of positive/approach emotions).

- Emotion regulation predicted resilience in both maltreated and nonmaltreated children.
- Nonmaltreated resilient females had greater relative left frontal activity compared to more right frontal activity exhibited by resilient maltreated females. Non-resilient maltreated children had a greater relative right frontal activity compared to resilient maltreated children (Reflective of negativity/withdrawal).
- Emotion regulation predicted resilience in the maltreated and nonmaltreated groups.
- Hemispheric EEG asymmetry predicted resilience only in the maltreated group.

Molecular Genetic Level

Report results of two studies of maltreated children and adolescents, the majority of whom experienced early maltreatment:

- 1) Cicchetti, Rogosch, & Sturge-Apple (2007a) MAOA, 5-HTTLPR, maltreatment, coping processes, and depression in adolescence
Report data on vulnerability and protective genes plus role of self-coping processes to depressive symptoms
- 2) Cicchetti, Rogosch, & Sturge-Apple (2007b) 5-HTTLPR, maltreatment, child depression, and suicidal ideation

Implications of a Multiple-Levels-Of-Analysis Approach for Resilience-Promoting Interventions

Suniya Luthar and I (2000) concluded that research on resilience “should target protective and vulnerability forces at multiple levels of influence”. The incorporation of a neurobiological framework and the utilization of genetically sensitive designs into interventions seeking to promote resilient functioning or to repair positive adaptations gone awry may contribute to the ability to design individualized interventions that are based on knowledge gleaned from multiple biological and psychological levels of analysis.

The inclusion of neurobiological assessments in the design and evaluation of interventions designed to foster resilience enables scientists to discover whether the various components of multifaceted interventions each exert a differential impact on separate brain systems.

The incorporation of a neurobiological framework into the conceptualization of preventive intervention holds considerable promise for expansion of knowledge regarding complexity of the developmental process. By basing preventive trials on more comprehensive, integrative developmental theories of psychopathology, prevention research offers the opportunity to conduct developmental experiments that alter environment and experience in efforts to promote resilient functioning among individuals faced with significant adversity.

I think that successful resilience-promoting interventions may be conceptualized as examples of experience-dependent neural plasticity. If assessments of biological systems are routinely incorporated into the measurement batteries employed in resilience-facilitating interventions, then we will be in a position to discover whether the nervous system has been modified by experience.

Experience-Dependent Processes

- Involve the brain's adaptation to information that is unique to the individual.
- Because everyone encounters distinctive environments, each brain is unique.
- Do not take place within a stringent temporal interval.
- Thus, interventions can repair disordered brains.

Experience & Brain Development

- Children whose genes construct a disordered brain experience the world differently and require environments to be adapted.
- Children with “normal” brains may encounter experiences (poverty, institutional upbringing, maltreatment) that negatively impact on the brain and distort world experiences.

Experience & Brain cont'd.

- Children may be particularly vulnerable to the effects of negative occurrences during periods of rapid creation or modification of neuronal connections.
- Children who experience pathology-inducing occurrences may add brain connections that are pathological rather than functional.

The concept of neural plasticity offers a valuable heuristic for conceptualizing how preventive interventions may affect brain structure and function, contributing to resilience among individuals confronted with adversity.

Analogous to recovery from physical injury to the brain, neural plasticity also may involve recovery from the damaging effects of trauma and extreme stress. Adverse environmental experience can induce physiological changes in the brain, and conversely, experiences to ameliorate and safeguard against severe adversity may similarly produce physiological changes that are advantageous to the CNS.

Given the rapid rate of growth and organization occurring during the early years of life, early interventions that alter adverse and stressful environments may influence the type of brain that emerges during this important period of neurobiological epigenesis.

The timing of interventions plays a crucial role in the successful alteration of behavioral aberrations and biological misorganization.