Published in final edited form as:

J Child Psychol Psychiatry. 2013 April ; 54(4): 402–422. doi:10.1111/j.1469-7610.2012.02608.x.

Annual Research Review: Resilient functioning in maltreated children: Past, present, and future perspectives

Dante Cicchetti

Institute of Child Development, University of Minnesota and Mt. Hope Family Center, University of Rochester

Abstract

Through a process of probabilistic epigenesis, child maltreatment progressively contributes to compromised adaptation on a variety of developmental domains central to successful adjustment. These developmental failures pose significant risk for the emergence of psychopathology across the life course. In addition to the psychological consequences of maltreatment, a growing body of research has documented the deleterious effects of abuse and neglect on biological processes. Nonetheless, not all maltreated children develop maladaptively. Indeed, some percentage of maltreated children develop in a resilient fashion despite the significant adversity and stress they experience.

The literature on the determinants of resilience in maltreated children is selectively reviewed and criteria for the inclusion of the studies are delineated. The majority of the research on the contributors to resilient functioning has focused on a single level of analysis and on psychosocial processes. Multilevel investigations have begun to appear, resulting in several studies on the processes to resilient functioning that integrate biological/genetic and psychological domains.

Much additional research on the determinants of resilient functioning must be completed before we possess adequate knowledge based on a multiple levels of analysis approach that is commensurate with the complexity inherent in this dynamic developmental process. Suggestions for future research on the development of resilient functioning in maltreated children are proffered and intervention implications are discussed.

Child maltreatment is a complex, insidious problem that exerts an astronomical toll on individuals, families, and society and that possesses great public health significance (Cicchetti & Lynch, 1993; Cicchetti & Toth, 2003). Nearly one million children in the United States are confirmed victims of child maltreatment each year (Prevent Child Abuse America, 2007). Official rates of substantiated maltreatment, as well as referral rates for alleged cases of abuse and neglect that are unsubstantiated (over 2 million per year), most likely underestimate the true incidence and prevalence of child maltreatment in the United States (for elaboration, see Barnett, Manly, & Cicchetti, 1993; Prinz, Sanders, Shapiro, Whitaker, & Lutzker, 2009).

A 2007 study conducted by Prevent Child Abuse America estimated the economic costs of child abuse and neglect to be over 100 billion dollars annually (Wang & Holton, 2007). The average estimated lifetime cost per each individual maltreated child is over \$210,000 in 2010 dollars. These costs are associated with the utilization of social services, foster care, law enforcement and juvenile justice systems, educational systems, mental health treatment,

Address correspondence and reprint requests to Dante Cicchetti, Institute of Child Development, University of Minnesota, 51 East River Road, Minneapolis, MN 55455. cicchett@umn.edu.

The authors have declared that they have no competing or potential conflicts of interest.

and hospitalization, and productivity losses. These cost estimates must be an underestimation of the true amount spent because they are based on official reports of child maltreatment and do not take into account the cost expenditures of unreported cases of child abuse and neglect (Prinz et al., 2009). Moreover, although the lessened productivity and reduced quality of life for a generation of maltreated children are substantial, they are inordinately difficult to calculate economically. Furthermore, a recent study by the Centers for Disease Control (CDC) estimated the total lifetime economic burden resulting from child maltreatment in the United States to be as large as \$585 billion (Fang, Brown, Florence, & Mercy, 2012).

Child maltreatment has been conceptualized as a pathogenic relational experience that represents one of the most adverse and stressful challenges that confront children (Cicchetti & Lynch, 1995). Child maltreatment constitutes a severe, if not the most severe, environmental hazard to children's adaptive and healthy development. Deprived of many of the experiences believed to promote adaptive functioning across the lifespan, maltreated children traverse a probabilistic pathway characterized by an increased likelihood for a compromised resolution of stage-salient developmental tasks. Because the maltreating home represents such a dramatic violation of the average expectable environment, research on child maltreatment informs developmental theory by elucidating the conditions necessary for normal development and healthy adaptation. Moreover, research on child maltreatment enhances clinical, legal, and policy decisions aimed at promoting children's safety and well-being (Cicchetti & Toth, 1993).

Although child maltreatment may occur at all socioeconomic levels, the vast majority of maltreated children reside in low-income, highly impoverished environments (Sedlak, Mettenburg, Basena, Petta, McPherson et al., 2010). Consequently, maltreated children are exposed not only to intra-familial stressors, but also to high levels of community stress, including high crime, violence, noise, overcrowding, poor schools, and diminished local resources (Cicchetti & Lynch, 1993). Abuse and neglect and family violence have been described as constituting toxic conditions whereby children are exposed to chronic, severe, and prolonged stress, often occurring in the absence of protective factors (Shonkoff, Boyce, & McEwen, 2009).

Substantial cross-sectional and longitudinal research investigations reveal that the experience of child maltreatment initiates a probabilistic path of epigenesis for abused and neglected children that is marked by an increased likelihood of repeated disruptions in developmental processes that may create a cascade of maladaptation across diverse domains of neurobiological, socioemotional, and cognitive development (Cicchetti & Toth, 1995; Cicchetti & Tucker, 1994; DeBellis, 2001; Masten & Cicchetti, 2010; McCrory, DeBrito, & Viding, 2010). Specifically, maltreated children are likely to manifest atypicalities in neurobiological processes, physiological responsiveness, emotion recognition and emotion regulation, attachment relationships, self-system development, representational processes, social information processing, peer relationships, school functioning, and romantic relationships (Cicchetti & Valentino, 2006; DeBellis, 2001, 2005; Teicher, 2002). These difficulties pose significant risk for the development of substance abuse and psychopathology across the life course (Cicchetti & Valentino, 2006; Cohen, Brown, & Smaile, 2001; Collishaw, Pickles, Messer, Rutter, Shearer, & Maughan, 2007; Dackis, Rogosch, Oshri, & Cicchetti, in press; Nanni, Uher, & Danese, 2012; Rogosch & Cicchetti, 2005; Rogosch, Oshri, & Cicchetti, 2010; Toth, Pickreign Stronach, Rogosch, Caplan, & Cicchetti, 2011; Widom, 1999; Widom, DuMont, & Czaja, 2007).

Furthermore, there exists an increased risk for abused and neglected children to perpetuate maltreatment with their own offspring (see also Maestriperi's [2005] work with rhesus

monkeys). This intergenerational transmission of maltreatment, although not inevitable, contributes to costs for future generations of children and families, and for society (Egeland, Jacobvitz, & Sroufe, 1988; Kaufman & Zigler, 1989). Moreover, maltreated children also are likely to continue to be victimized into adulthood via sexual assault and domestic violence (Noll, Trickett, Harris, & Putnam, 2009; Trickett, Noll, & Putnam, 2011).

Allostatic load refers to the price the body pays when confronted with repeated major stressors and the resultant physiological sequelae of chronic exposure to heightened and sustained neural and neuroendocrine responsiveness (Ganzel, Morris, & Wethington, 2010; Juster, Bizik, Picard, Arsénault-Lapierre, Sindi et al., 2011; McEwen & Stellar, 1993). Whenever adaptive interconnected biological systems become chronically dysregulated over long time intervals, then maladaptive physiological and psychological consequences are likely to ensue that may persist throughout the life course (Juster, McEwen, & Lupien, 2010; Karatsoreos & McEwen, 2012; Lupien, Ouellet-Morin, Hupbach, Tu, Buss et al., 2006). Because these biological systems are interconnected and interacting, alterations in the functioning of one adaptive system can cascade or spread its effects across other systems (Cicchetti & Tucker, 1994; Masten & Cicchetti, 2010).

Allostatic load processes may be unfolding very early in the development of maltreated children, setting up the potential for life-long difficulties in the regulation of physiological stress systems (Cicchetti, Rogosch, Gunnar, & Toth, 2010). Adults who experienced maltreatment during childhood have been shown to exhibit increased allostatic load in later life and this cumulative stress is associated with adverse emotional and physical health outcomes in adulthood (Danese, Moffitt, Pariante, Ambler, Poulton et al., 2008; Dube, Fairweather, Pearson, Felitti, Anda et al., 2009; Felitti, Anda, Nordenberg, Williamson, Spitz et al., 1998; Miller, Chen, & Parker, 2011; Wegman & Stetler, 2009). These include susceptibility to the chronic diseases of aging, including increased risk for developing hormonal dysregulation (Cicchetti & Rogosch, 2001; Cicchetti et al., 2010; Trickett, Noll, Susman, Shenk, & Putnam, 2010), obesity, cardiovascular and inflammatory difficulties, unhealthy lifestyle choices, and telomere shortening (Miller et al., 2011; Shalev et al., 2012; Tyrka, Price, Kao, Porton, Marsella et al., 2010). Moreover, increasing evidence points to the impact of maltreatment on physical, in addition to mental, health during childhood (Rogosch, Dackis, & Cicchetti, 2011; Shalev et al., 2012).

Heckman (2006) has emphasized the economic and humanitarian value to society of reducing the impact of adverse early family environments on the developing child in order to ameliorate the diminished cognitive and socioemotional capacities ensuing from deprivation, trauma, and high stress. Allostatic load likely is a major influence on these unrealized potentials, through the negative sequelae of stress occurring in early sensitive periods of brain development and progressive accumulation of liabilities that extend to other stress sensitive systems (e.g., sympathetic nervous system; limbic, endocrine and immune systems; and the epigenome) (Cicchetti, 2002; Dackis et al., in press; Miller et al., 2011; Shonkoff, Boyce, & McEwen, 2009).

Because the vast majority of maltreated 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 (Cicchetti & Lynch, 1995; Teicher, 2002). Importantly, however, not all maltreated children develop maladaptively. In fact, some abused and neglected children exhibit positive adaptive functioning despite the pernicious experiences they have encountered and the ignominious treatment they have received (Cicchetti & Valentino, 2006; Haskett, Nears, Ward, & McPherson, 2006).

Developmental Psychopathology Perspective on Resilience

Developmental psychopathologists are not only interested in examining the interrelations among dynamic systems and the processes characterizing system breakdown, but also in explaining the mechanisms by which compensatory, self-righting tendencies are initiated whenever higher level monitors detect deviances in a subsystem (Cicchetti & Rizley, 1981). One of the major principles inherent to a developmental psychopathology perspective is that there is multifinality in developmental processes such that the manner in which individuals respond to and interact with vulnerability and protective factors at each level of the ecology (i.e., culture, community, family, and their transactions; cf. Cicchetti & Lynch, 1993, 1995) allows for diversity in developmental outcomes (Cicchetti & Rogosch, 1996). Individuals may begin on the same developmental trajectory, yet exhibit very different patterns of maladaptation or positive adaptation. The pathways to either maladaptive or positive adaptive functioning are influenced by a complex matrix of the individual's biological and psychological organization, current experiences, active choices, the social context, timing of adverse events and experiences, and the developmental history of the individual (Cicchetti & Tucker, 1994).

Deviations from the expectable environment potentiate some individuals toward the development of maladaptive functioning, whereas others demonstrate positive adaptation in the face of the same challenges (Luthar, 2006; Luthar, Cicchetti, & Becker, 2000; Masten, 2001). Accordingly, developmental psychopathologists assert that it is equally important to examine the factors and mechanisms that promote positive adaptation among individuals experiencing significant adversity as it is to investigate the developmental trajectories toward maladaptation and psychopathology (Cicchetti, 1993; Cicchetti & Cohen, 1995; Cicchetti & Toth, 2009; Luthar et al., 2000; Sroufe & Rutter, 1984).

Resilience is conceived as a dynamic developmental process encompassing the attainment of positive adaptation despite exposure to significant threat, severe adversity, or trauma that typically constitute major assaults on the processes underlying biological and psychological development (Cicchetti & Garmezy, 1993; Luthar et al., 2000; Masten, Best, & Garmezy, 1990; Masten & Tellegen, 2012; Rutter, 2012). When there is a clear perturbation or deficit in a developmental system, examination of how that atypicality relates to the organization of other developmental systems can reveal important information regarding the integration of systems that are not apparent under normal conditions (Chomsky, 1968; Cicchetti, 1996; Lenneberg, 1967).

Empirical investigations of the determinants of human behavior are greatly hampered by the ethical impossibility of conducting experiments that will compromise the integrity of biological and psychological developmental processes (Cicchetti, 2003; O'Connor, 2003; Rutter, 2007). Research on developmental processes in child maltreatment is important for the purpose of dissociating possible mechanisms that may offer alternative explanations for normal, maladaptive, and resilient developmental outcomes. The occurrence of resilient outcomes in some maltreated children also points out that self-righting tendencies in human development may be strong, even in the face of deviance and failure in the environment (Hanson & Gottesman, 2012; Masten, 2001; Sameroff, 1983; Waddington, 1957). Discovering how maltreated children develop and function resiliently despite experiencing a multitude of stressors offers considerable promise for expanding, affirming, and challenging extant developmental theories regarding pathways to adaptive functioning (Luthar et al., 2000) and for informing the design and implementation of prevention and intervention programs (Luthar & Cicchetti, 2000). As a "natural experiment" (O'Connor, 2003; Rutter, 2007), the examination of individuals who have been abused and neglected also can provide a natural entrée into the study of system organization, disorganization, and reorganization

that may otherwise not be possible in research on individuals reared in an average-expectable environment (Cicchetti & Lynch, 1995).

To theorize about developmental processes, normal, maladaptive, or resilient, without considering the deviations that would be expected from prominent and pervasive intra- and extra-organismic disturbances, as well as the transactions that occur among them, would result in incomplete and ambiguous accounts of the developmental process. Resilience research may elucidate the mechanisms through which maltreated children are able to initiate or maintain their self-righting tendencies when confronted with adversity (Cicchetti & Rizley, 1981; Waddington, 1957).

As research on resilience has evolved over the years, it has become understood that the achievement of positive adaptation against the backdrop of significant adversity undergoes a developmental progression. Specifically, new vulnerabilities and challenges, as well as strengths and opportunities, often emerge with changing biological, psychological, and contextual circumstances over the life course (Egeland, Carlson, & Sroufe, 1993; Luthar et al., 2000). Resilience is conceived as a multiply determined developmental process that is not fixed or immutable (Cicchetti & Blender, 2006; Luthar et al., 2000; Sapienza & Masten, 2011; Rutter, 2012). Moreover, because either resilient functioning or maladaptive functioning may be attained during transitional “turning points” across the life cycle (Rutter, 1987), longitudinal research on the developmental timing of exposure to adversity can yield insights into “sensitive periods” during which the effects of adversity are particularly strong (Kim-Cohen, 2007). Furthermore, such longitudinal research also can uncover the processes whereby formerly resilient individuals “bounce back” or recover positive functioning after experiencing challenging stressful and adverse circumstances that contributed to developmental setbacks. Additionally, because resilience may be achieved at any point in the life cycle, research on the development of resilient functioning in adulthood and in later life is important (Bonnano & Mancini, 2008; Cicchetti & Tucker, 1994).

Psychosocial Contributors to Resilient Functioning in Maltreated Children

Although much research on the determinants of resilience in maltreated individuals remains to be carried out, several investigations have examined the factors and processes contributing to resilient functioning in maltreated children and adults who have been maltreated. Studies reviewed herein were chosen because they met the following criteria: 1) a clear definition of resilience; 2) well spelled out maltreatment criteria; and 3) a comparison group of nonmaltreated individuals from a comparable low-SES background. The inclusion of a low-SES nonmaltreatment group is crucial because it eliminates the interpretation put forth in earlier methodologically flawed research (Elmer, 1979) that abuse per se has no deleterious effects on development independent of those risk factors associated with low-SES membership (see Aber & Cicchetti, 1984, for a critique of this assertion). Well-designed, theoretically informed research has consistently demonstrated that maltreatment exerts more harmful effects on development than low-SES membership per se. Nonetheless, nonmaltreated children living in poverty-laden environments also must regularly endure stressful events and conditions that pose ongoing challenges for their healthy adaptation (Evans, 2004; Hackman & Farah, 2010; Hackman, Farah, & Meaney, 2010; Yoshikawa, Aber, & Beardslee, 2012).

Just as is the case in studies on the pathways to resilient functioning in other high-risk populations, the focus on the vast majority of these investigations on contributors to resilient functioning in maltreated children have been examining psychosocial correlates and consequences. Child maltreatment is a major risk factor that exerts negative impacts on numerous domains of functioning. Because resilience has been demonstrated to be a

multidimensional construct (Luthar et al., 2000), investigations of the determinants of resilience that examine multiple domains of adaptive functioning are emphasized in this review.

Egeland and Farber (1987) conducted a longitudinal follow-up investigation of a group of disadvantaged maltreated and nonmaltreated children studied from 12 months through the preschool period. When examining their data, Egeland and Farber (1987) found that there was a drop-off in the percentages of competent, maltreated children across each developmental period assessed. Fifty-three percent of the infants, 40% of the toddlers, approximately 15–20% of the 42-month-olds, and 20% of the preschoolers who participated in the Egeland and Farber (1987) study were rated as competent, defined as the successful resolution of the critical developmental task for each age period investigated. In contrast, their nonmaltreated age-mates showed a far less steep decline in competence when viewed through a cross-sectional lens. Within the group of nonmaltreated children, approximately 67% of 12–18-month-olds, 53% of toddlers, 43% of 3 1/2-year-olds, and 45% of preschoolers achieved competent adaptation on assessments of stage-salient developmental tasks (e.g., secure attachment, effective problem solving, good peer relations).

More strikingly, an examination of the adaptation of these two groups of children over time presents an even more sober picture with respect to competent adaptation in the face of adversity. Of the maltreated infants who had formed a secure attachment relationship with their primary caregiver, 52% remained competent as toddlers, 15% as 3 1/2 year-olds, and 30% as preschoolers. In contrast, in the non-maltreatment group, 54% of the securely attached infants remained competent as toddlers, 47% as 3 1/2-year-olds, and 47% as preschoolers.

In keeping with the results obtained by Egeland and Farber (1987), Herrenkohl, Herrenkohl, and Egolf (1994) conducted a longitudinal study of developmental outcomes in maltreated children and found that fewer than 15% of children who had been maltreated before age 6 were identified as resilient. When these maltreated children were assessed again in adolescence, nearly half of the maltreated children who were previously designated as resilient were found to be no longer demonstrating resilient functioning.

Egeland and Farber (1987) concluded that there were very few competent maltreated children. They did not find even one child who was consistently competent across each age period assessed. As their varying profiles of adaptive functioning reveal, resilience is not a static construct, but it is an ongoing, dynamic developmental process. Although the declining quality of adaptation for maltreated infants, toddlers, and preschoolers portrayed by Egeland and Farber (1987) paints a bleak picture for the future outcomes of maltreated children, it is conceivable that the advances in biological, cognitive, social-cognitive, and socioemotional development in older maltreated children may provide these children with coping resources not available in their earlier years.

In a cross-sectional study that served as an initial foray into examining the pathways to competent functioning, Cicchetti, Rogosch, Lynch, and Holt (1993) investigated evidence for competence in a sample of 205 school-aged maltreated and nonmaltreated children attending a 35 hour, week-long summer camp research program. Multiple areas of adaptation (e.g., social adjustment, risk for school difficulty, psychopathology) that are developmentally salient for school-age children, were assessed from self, peer, and camp counselor perspectives and school records. A composite index of adaptive functioning was developed, and levels of competence were delineated (see Cicchetti et al., 1993, for details). The adoption of a composite index strategy reflects the view that children can function

resiliently despite exhibiting difficulties in some domains compared to others (Luthar et al., 2000).

Maltreated children as a group evidenced significantly lower overall competence when compared to nonmaltreated children. An equal proportion of maltreated and nonmaltreated children, however, demonstrated high levels of competence, whereas more maltreated children than nonmaltreated children evidenced significantly lower levels of adaptive functioning/competence. 15% of the nonmaltreated and 22% of the maltreated children displayed none of the seven indices of resilient adaptation that were specified in this investigation. Likewise, 11 % of the nonmaltreated children and 21% of the maltreated children exhibited only one index of competent functioning. The remainder of maltreated and nonmaltreated children manifested competence in two or more domains of competent functioning.

From his earliest writings on the topic, Garmezy (1971, 1974) emphasized that most children maintain the ability to show some strivings for resilience in the presence of chronic and serious adversity. Although the results of Cicchetti and colleagues (1993) corroborate Garmezy's thesis, the total absence of resilient strivings in some not insignificant percentages of maltreated (21%) and nonmaltreated (11%) children appears to be most aberrant, as self-righting tendencies are important characteristics of all living organisms (Sameroff & Chandler, 1975; Waddington, 1957).

An examination of the processes leading to adaptive functioning outcomes revealed that ego-resiliency, ego-control, and self-esteem each were found to be related to individual differences in competent functioning. Evidence for the differential role of ego-control in promoting competence for maltreated versus nonmaltreated children was found. Specifically, ego-resiliency, ego-overcontrol, and positive self-esteem were found to account for significant amounts of variance in adaptive functioning for the maltreated children. In contrast, only ego-resiliency and positive self-esteem contributed significant amounts of variance in the prediction of competent adaptation in the nonmaltreated. This finding of a differential contribution of ego-overcontrol for the two groups in predicting adaptive or resilient functioning suggests that ego-overcontrol may serve a protective function for maltreated children.

Given the predictive role of ego-overcontrol for more adaptive functioning in maltreated children, there is likely to be a greater tendency for successfully adapting maltreated children to be characterized by a resilient overcontrolling type of personality organization (Block & Block, 1980). Through adapting a more reserved, controlled, and rational way of interacting and relating with others, resilient overcontrollers may be more attuned to what is necessary for successful adaptation in their adverse home environments. Their more overcontrolled style may protect them from being targets of continued maltreatment incidents. In contrast, the more affectively expressive style of resilient undercontrollers may not be well suited for successful adaptation in maltreating environments because such styles may provoke attention and reactions from others that could result in greater risk for recurrent maltreatment. Given that ego-control does not relate to competent outcomes for the nonmaltreated children, it may be the case that either resilient overcontrolling or resilient undercontrolling personality organization may be effective when the home environment does not contain the hazards experienced by maltreated children.

Informed by the Cicchetti et al. (1993) investigation, a new sample of 213 school-age maltreated and nonmaltreated children was recruited and assessed annually over 3 consecutive years in a research camp setting (Cicchetti & Rogosch, 1997; for details regarding camp procedures, see Cicchetti & Manly, 1990). Findings gleaned from the

Cicchetti et al. (1993) study served as the cornerstone for designing and embarking on a prospective longitudinal investigation. The only measures and constructs employed that differed from the initial cross-sectional study were assessments of children's reports of the quality of their relationship with their primary caregiver and camp counselors' ratings of the quality of their relationship with children in their camp group.

Consistent with the extant literature on the developmental impact of child maltreatment, maltreated children exhibited significantly greater deficits than nonmaltreated children on six of the seven indicators of adaptive functioning. Moreover, many of these deficits were found to persist across 2 or 3 consecutive years of assessment. Further, across each of the 3 years, maltreated children manifested a significantly lower level of competent functioning than did the nonmaltreated comparisons. Additionally, the continuity of maladaptive functioning exhibited by maltreated children across the 3 years of this investigation was substantial. Taken together, these results underscore the deleterious impact that maltreatment experiences have on competent functioning and attest to the non-transient nature of their influence.

With respect to placement in the 3-year resilient functioning pattern groups, a significantly greater percentage of maltreated children (40.6%) than nonmaltreated (20%) children were found in the low group. Strikingly, nearly 10% of the maltreated children compared to approximately 1% of the nonmaltreated children displayed zero competence indicators. Thus, one out of every ten maltreated children exhibited an absence of resilient strivings across the entire 3 year longitudinal assessment period. Moreover, there was a significantly higher percentage of nonmaltreated than maltreated children in the high resilient functioning group across the course of the longitudinal investigation. Furthermore, over a third of the nonmaltreated children achieved membership in the high resilient functioning group at least once during the longitudinal study, whereas only 10% of the maltreated children had done so.

A great deal of stability in resilient and nonresilient functioning was demonstrated in the Cicchetti and Rogosch (1997) longitudinal investigation. Of special concern is the consistently low functioning of the least competent group, comprised predominantly of maltreated children. Along these same lines, the not insignificant percentage of maltreated children who exhibited no resilient strivings across the 3 years is cause for great concern (cf. Cicchetti et al., 1993).

As in the Cicchetti et al. (1993) study, ego-resiliency, ego-overcontrol, and positive self-esteem predicted adaptive functioning in maltreated children, whereas ego-resiliency, perceived emotional availability of the mother, and positive relationships with camp counselors were predictors of adaptive functioning in nonmaltreated children. Thus, it appears that relationship factors were more critical to resilient outcomes in nonmaltreated children and self-system processes and personality characteristics were more central to resilient outcomes in maltreated children (Kim & Cicchetti, 2003). Because most maltreated children develop insecure, and often disorganized, attachment relationships with their caregiver (Cyr et al., 2010), it is not surprising that relationship factors were less important to maltreated children. Maltreated children develop insecure and generalized inner working models of attachment relations; hence, in their interpersonal relationships, maltreated children are more likely to exhibit a similar insecurity and distrust toward nonparental adults outside the home (Lynch & Cicchetti, 1991; Lynch & Cicchetti, 1992). Thus, self-reliance, personal conviction, and self-confidence, in concert with interpersonal reserve, may bode well for the development of resilient adaptation in maltreated children.

Importantly, in both the Cicchetti et al. (1993) and Cicchetti and Rogosch (1997) studies, among maltreated children, higher resilience indicator scores were not significantly correlated with lower maltreatment severity, lower maltreatment chronicity, or timing of onset and recency of maltreatment. Moreover, the low, medium, and high maltreatment resilience groups did not differ in their distribution of subtype groups, or in maltreatment onset, severity, recency, and the number of different developmental periods during which maltreatment was experienced.

Given the salience of individual personality characteristics for predicting resilience in maltreated children, Rogosch and Cicchetti (2004) conducted a subsequent longitudinal study that assessed diversity of personality organization in maltreated and nonmaltreated children. In this sample of 211 children, personality organization was assessed yearly from 6 years of age through age 9 using the California Child Q-sort (CCQ) (Block & Block, 1969). A score for each of the Big Five personality dimensions was derived from the CCQ for each child. Cluster analysis revealed five distinct subgroups of children who possessed a similar pattern of personality dimensions; two of these patterns, labeled the “Gregarious” and “Reserved,” were similar to the “Resilient” personality group identified in other studies of personality in childhood (Robins, John, Caspi, Moffitt, & Stouthamer-Loeber, 1996). Maltreated children fell predominantly in the less adaptive personality clusters (i.e., Dysphoric and Undercontrolled clusters). Although nearly one third of the maltreated children were members of the more adaptive Gregarious and Reserved clusters, the nonmaltreated children were significantly more likely to be in one of these two more adaptive personality pattern clusters. Finally, a three year follow-up of the maltreated and nonmaltreated children revealed strong evidence of stability in personality organization across each year and stability in personality cluster membership from age 6 to 9. Children in the Gregarious and Reserved personality clusters, be they maltreated or nonmaltreated, had more adaptive peer relations than those in the overcontrolled, undercontrolled, or dysphoric clusters.

Bolger and Patterson (2003) conducted a three-year longitudinal study of 107 8–10 year old school-age maltreated and nonmaltreated children. These investigators employed an adaptive functioning composite comprised of internalizing, externalizing, peer acceptance, and academic achievement scores. Maltreated children who had a close reciprocal friendship were significantly more likely than those who did not have a reciprocal friendship to be later classified as resilient during at least one of the three longitudinal time points examined. In addition, maltreated children with internal perceptions of control were more likely to be later classified as resilient than were maltreated children with external perceptions of control (cf. Moran & Eckenrode, 1992). The results of Bolger and Patterson (2003) regarding the protective roles of internal control are in concert with findings from other research implicating active coping and effortful control as processes whereby maltreated children are able to adapt successfully. Additionally, the finding that a close reciprocal friendship is a promotive factor for resilience is in keeping with prior research that identifies a consistent, supportive relationship with an adult as a protective factor for maltreated children (Egeland, Jacobvitz, & Sroufe, 1988). Moreover, these reciprocal friendship relationships may improve maltreated children's social acceptance, working models of attachment, and enhance self-perceptions. Children who experienced early onset and chronic and enduring maltreatment were least likely to function adaptively.

Similar to the findings obtained in longitudinal studies on the development of resilient functioning in maltreated children, Bolger and Patterson's (2003) results demonstrate that there is fluidity in the adjustment and resilient functioning of children experiencing maltreatment. For example, 21% of the maltreated children were characterized by resilient

functioning; however, only five maltreated children (4%) were found to be consistently resilient across all 3 years of the Bolger and Patterson (2003) investigation.

Several studies of resilient functioning in adults who reported having been maltreated during childhood have been conducted. McGloin and Widom (2001) interviewed a group of nearly 1,200 young adult participants. 676 reported having been maltreated during childhood and 520 served as low-SES nonmaltreated comparison young adults. All individuals were administered a 2-hour face-to-face interview, including a semi-structured psychiatric diagnostic measure. In keeping with much of the extant empirical literature, McGloin and Widom conceptualized resilience as a dynamic process that needs to be reflected through adaptive functioning across multiple domains despite the experience of significant adversity. Their criteria for resilience spanned eight individual domains of functioning: successful employment, no homelessness, high school graduation, social activity, no psychiatric disorder, no substance abuse, no arrest, and no self-reported violence. To be considered resilient, an individual must have demonstrated success on six out of eight domains of functioning. Utilizing this criterion for resilient functioning, 22% of the adults who were abused and neglected during childhood were classified as resilient. In contrast, 51% of the comparison group females and approximately 33% of the comparison group males were resilient. What remains unknown is the elucidation of the developmental processes underlying the development of resilient functioning in these young adults.

In a subsequent study, Dumont, Widom, and Czaja (2007) examined resilient functioning in the adolescents and young adults who were participants in the McGloin and Widom (2001) investigation. Using their exact resilience criteria, Dumont et al. (2007) found that approximately 50% of the maltreated children were resilient in adolescence and that nearly 33% were resilient in adulthood. Additionally, over half of the individuals who were resilient in adolescence retained their resilient functioning in young adulthood. Interestingly, 11% of the adolescents who were not functioning resiliently achieved resilient functioning in young adulthood. During both adolescence and young adulthood, females were more likely to be resilient. Unfortunately, the nonmaltreated comparisons were not included in this investigation; hence, no maltreated vs. nonmaltreated comparisons with respect to resilient functioning could be conducted.

Collishaw and colleagues (2007) conducted a follow-up of the adult participants in the classic Isle of Wight epidemiological study. Individuals in the Isle of Wight study were originally assessed in adolescence and again at midlife during this follow-up investigation. Ratings of psychiatric disorder, peer relationships, and family functioning were collected in adolescence. In adulthood, a lifetime psychiatric history, personality and social functioning, and retrospective reports of childhood sexual and physical abuse were assessed. The primary aim of this follow-up study was to determine resilience to adult psychopathology in this representative community sample as well as to examine the predictors of positive functioning in individuals having experienced the significant adversity inherent in child abuse.

55.5% of the individuals who reported having been abused in childhood had at least one Axis-I adult psychiatric disorder, compared to approximately 36% of the non-abused individuals. The greater percentage of adult psychopathology in abused participants was found in every disorder assessed, including major depressive disorder, recurrent depressive disorder, suicidality, any anxiety disorder, PTSD, and substance abuse/dependence. A significant proportion (44.5%) of the abused group reported no history of psychiatric disorder over the intervening years prior to interview. Collishaw and colleagues classified these adults as resilient.

These investigators also examined predictors of resilience. Considerable continuity between psychiatric disorders in adolescence and in adulthood was obtained. Specifically, individuals with a psychiatric disorder in adolescence had significantly lower rates of resilience in adulthood. Adults who reported that at least one of their parents had been caring during childhood had higher rates of resilience than those who did not. Furthermore, the quality of adolescent peer relationships, the quality of adult friendships, and a stable love relationship history, all were strongly related to resilience. It is important to keep in mind that the retrospective nature of the reporting of child abuse in the Collishaw et al. (2007) study may make it difficult to determine what is antecedent and what is consequence with respect to the predictors of resilience.

Mersky and Topitzes (2009) utilized prospective data from the Chicago Longitudinal Study (Reynolds, 2000) to examine associations between child maltreatment and resilient outcomes in adulthood. They employed a 7 – item multidimensional index of resilience. Domains included in the resilient outcome index were educational and economic attainments, criminal offending, and behavioral and mental health. In order to be deemed to exhibit resilient functioning, individuals had to have favorable outcomes on 5 or 6 of these indices. Utilizing two cut-points on the index, between 5% and 16% of the adults who were maltreated in childhood met the criteria for resilience. In contrast, a significantly higher proportion of adults who were not maltreated in childhood met the criteria for resilience.

Biological contributors to resilient functioning in maltreated children

The vast majority of what is known about the correlates, pathways, developmental course, and consequences of resilient functioning has been gleaned from investigations that have focused on psychosocial variables. In the past decade, a number of scientists have urged researchers to incorporate neurobiological and molecular genetic assessments into their measurement batteries aimed at discovering pathways to resilient functioning (Charney, 2004; Cicchetti, 2003; Cicchetti & Blender, 2006; Cicchetti & Curtis, 2006; Curtis & Cicchetti, 2003; Feder, Nestler, & Charney, 2009; Karatsoreos & McEwen, 2012). Technological advances in neuroscience and genetics have begun to pave the way for an unprecedented opportunity to examine resilience from a multiple levels of analysis perspective. In order to advance the understanding of a multifaceted phenomenon such as resilience, it is essential that researchers investigating pathways to resilient functioning simultaneously examine biological and psychological systems (Cicchetti & Blender, 2006; Curtis & Cicchetti, 2003).

Masten (Masten & Obradovic, 2008; Sapienza & Masten, 2011) has labeled the present movement that focuses on the processes of interaction across system levels that influence the development of adaptive functioning in the presence of significant adversity as the integrative fourth wave of resilience research. Moreover, contemporary definitions of resilience have begun to be delineated within a multi-system framework that can be applicable across multiple disciplines. For example, Masten (2011) described resilience as "... the capacity of a dynamic system to withstand or recover from significant challenges that threaten its stability, viability or development" (p. 494). Conceptualized within a systems framework, resilience can be applied to many systems, ranging from the level of cells to individuals, families, communities, and societies (Sapienza & Masten, 2011; see also Cicchetti & Pogg-Hesse, 1982, and Werner, 1948, for a similar viewpoint on conducting a "developmental analysis" across systems).

To date, few multilevel studies of resilient functioning in maltreated children have been completed. Because investigations of biological contributions to resilience only have begun to be conducted recently, each of these studies has been cross-sectional in nature.

In the first published multilevel investigation of resilience in maltreated and nonmaltreated children from high-stress, low socioeconomic backgrounds, Curtis and Cicchetti (2007) sought to discover whether the positive emotionality and increased emotion regulatory ability associated with resilient functioning would be related to relatively greater left frontal EEG activity. A large body of literature concerning the meaning and correlates of hemispheric asymmetries in EEG activity has suggested that this ubiquitous phenomenon indexes a neural system that has emotion-specific influences whereby the two hemispheres of the cerebral cortex have been found to be differentially involved in emotion (Davidson, 2000). Specifically, the left hemisphere is associated with positive emotions/approach behavior and the right hemisphere is linked with negative emotions/withdrawal behavior. Emotions, and in particular positive emotion and good emotion regulatory abilities, have consistently been associated with resilient adaptation (Buckner, Mezzacappa, & Beardslee, 2003; Masten, 1986; Werner & Smith, 1992). Thus, the potential connection of hemispheric EEG asymmetry with resilience lies in their common linkages with emotion and emotion regulation.

EEG asymmetry across central cortical regions distinguished between children with high and low resilient functioning such that left hemisphere activity characterized those maltreated children, but not nonmaltreated children, who were adapting resiliently based on a competence composite index (e.g., good peer relations, adapting successfully to school, low levels of depressive symptomatology, low externalizing and internalizing psychopathology). Moreover, a behavioral measure of emotion regulation (Shields & Cicchetti, 1997) based on 35 hours of observation of the children, also independently contributed to the prediction of resilience in maltreated and nonmaltreated children.

The investigation of a neural-level phenomenon such as hemispheric EEG asymmetry in the context of resilient adaptation underscores that there is certainly no one single characteristic that will be ascendant in the process of resilience over the course of development. Resilience is a dynamic, interactive and bidirectional process between multiple levels across time, none of which hold primary importance at any given moment (Cicchetti & Cannon, 1999). However, the relative importance of various biological and psychological processes, although inevitably interrelated, may also vary across development.

In another multilevel investigation, resilient functioning in maltreated and nonmaltreated low-income children was examined in relation to the regulation of two stress-responsive adrenal steroid hormones, cortisol and dehydroepiandrosterone (DHEA), as well as the personality constructs of ego resiliency and ego control (Cicchetti & Rogosch, 2007). The steroid hormones chosen as potential predictors of resilience were the two primary adrenocortical products of secretory activity of the hypothalamic-pituitary-adrenal (HPA) axis. The capacity of individuals to elevate cortisol levels in response to exposure to acute trauma is important for survival (Gunnar and Vazquez, 2006). DHEA exerts an impact upon a diverse array of biological actions, including effects on the immune, cardiovascular, endocrine, metabolic, and central nervous systems (Majewska, 1995).

A composite measure of resilience was utilized that included multi-method, multi-informant assessments of competent peer relations, school success, and low levels of internalizing and externalizing symptomatology. Cicchetti and Rogosch (2007) found that the personality characteristics, ego resiliency and ego overcontrol, and the adrenal steroid hormones associated with stress (i.e., cortisol and DHEA) made independent and non-interactive contributions to resilience. Although operating at different levels of analysis, behavioral/psychological and biological factors each made unique contributions to 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 change the brain, organ systems, and the neurochemical balance that undergirds cognition, emotion, mood, personality, and behavior (Juster et al., 2011; McEwen & Stellar, 1993). Allostatic load is thought to occur when the adaptation to stress necessitates that the responses must be maintained over sustained time periods. Allostasis and allostatic load can be conceived as embodying a general biological principle – namely that the systems that help the body adapt to stress, and serve a protective function in the short term, also may take part in the development of pathophysiological processes when overused or managed ineffectively.

Cicchetti and Rogosch (2007) found that higher morning levels of cortisol were related to lower levels of resilient functioning for the nonmaltreated children. High basal cortisol may indicate that nonmaltreated children are experiencing greater stress exposure and, consequently, are constrained in their ability to adapt competently. Within the group of maltreated children, differences in cortisol regulation were found as a function of the subtype(s) of maltreatment experienced. Physically abused children with high morning cortisol had significantly higher resilient functioning than physically abused 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 was discovered in the nonmaltreated and sexually abused children in this study.

Prior research on neuroendocrine regulation has indicated that physically abused children generally exhibit lower levels of morning cortisol secretion (Cicchetti & Rogosch, 2001), especially those children who experienced physical abuse early in life (Cicchetti et al., 2010; Cicchetti, Rogosch, & Oshri, 2011). It may be that the subgroup of physically abused children who were able to elevate cortisol to cope with the stressful vicissitudes in their lives were 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 (i.e., allostatic load) (Ganzel et al., 2010). As a result, for these children there may be a diminished capacity to mobilize the HPA axis to promote positive adaptation under conditions of ongoing stress. Additionally, Cicchetti and Rogosch (2007) found that the very low level of resilience among sexually abused children with high basal cortisol may be a product of their different traumatic experiences and consequences of chronic excessive vigilance and preoccupation, with concomitant HPA axis hyperarousal.

Finally, Cicchetti and Rogosch (2007) also discovered that maltreated children with high resilient functioning exhibited a unique atypical pattern of a relative DHEA diurnal increase. Maltreated children who have the capacity to elevate DHEA over the course of the day may be better equipped to cope with the demands of high chronic exposure to stress and to adapt competently. In contrast, the nonmaltreated children who functioned resiliently did not exhibit the pattern of diurnal DHEA increase; instead they displayed lower levels of DHEA across the day. DHEA has been shown to generate effects that are associated with resilience. For example, DHEA counteracts the harmful effects of hypercortisolism, thereby potentially conferring neuroprotection to the brain (Charney, 2004).

Research on gene-environment interaction has demonstrated that child maltreatment is a strong candidate environmental pathogen (Caspi, Hariri, Holmes, Uher, & Moffitt, 2010; Karg, Burmeister, Shedden, & Sen, 2011). Moffitt, Caspi, and Rutter (2006) delineated three considerations for selecting candidate environmental pathogens for GxE research. First, there should be variability in response among individuals exposed to the identical risk.

Second, there should be evidence that the environmental risk affects a neurobiological pathway to disorder. Finally, evidence should exist documenting that the putative risk is a veridical environmental pathogen that has causal effects that are environmentally mediated. Child maltreatment conforms to each of the criteria for an environmental pathogen proposed by Moffitt and colleagues (2006).

Maltreatment is an objectively measured, well defined stressor and meta-analyses have shown that robust findings in theoretically-informed GxE investigations are more likely to be obtained whenever a specific stress, such as child maltreatment, is identified (cf. Karg et al., 2011). Much of the GxE research that is relevant to resilience has focused on how genes also may serve as protective factors against developing psychopathology in individuals who have experienced maltreatment. Although the criteria for resilience adopted in this review require that studies investigating resilient functioning in maltreated children contain multilevel indicators of resilient functioning, we include some of these GxE studies as exemplars of a nascent multiple levels of analysis approach to resilience in individuals experiencing childhood maltreatment (for additional examples, see Nelson et al., 2009, and Nikulina, Widom, & Brzustowicz, 2012).

GxE studies on psychopathology are instructive and relevant for resilience research because they provide an illustration of how genetic variation may confer protection against mental disorder in individuals who have experienced maltreatment. However, the absence of mental disorder is conceptually distinct from resilience, a dynamic developmental process indicated by positive adjustment across multiple domains of competent functioning despite the presence of significant adversity (Kim-Cohen & Gold, 2009; Luthar, 2006). Moreover, the presence of mental disorder does not preclude the achievement of resilient functioning. Many persons with mental disorder not only experience periods of remission, but also an appreciable number manage to function in an adaptive fashion for prolonged periods of their lives (Hinshaw & Cicchetti, 2000).

In a landmark investigation, Caspi, McClay, Moffitt, Mill, Martin et al. (2002) found that the MAOA-uVNTR polymorphism moderated the impact of child maltreatment on the development of antisocial behavior in adult males. Specifically, Caspi et al. (2002) found that the effect of child maltreatment on antisocial behavior was significantly less among males with high MAOA activity than among those with low MAOA activity (also see Cicchetti, Rogosch, & Thibodeau, 2012, and Kim-Cohen, Caspi, Taylor, Williams, Newcombe et al., 2006, for similar findings with maltreated children. These findings suggest that 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., 2002). Although researchers investigating the genetics of mental disorder have long focused on the vulnerabilities that certain genetic elements may confer, it is equally probable that particular genetic variants may, from an evolutionary perspective, serve a protective function against environmental insults for some individuals (Belsky, Jonassaint, Pluess, Stanton, Brummett et al., 2009; Cicchetti & Blender, 2006).

Bradley, Binder, Epstein, Tang, Nair et al. (2008) examined whether the effects of child abuse on adult depressive symptoms may be moderated by genetic polymorphisms within the corticotropin-releasing hormone type 1 receptor (CRHR1) gene. Adults retrospectively reported their childhood histories of trauma on the Childhood Trauma Questionnaire (CTQ) (Bernstein & Fink, 1998). Fifteen single nucleotide polymorphisms (SNPs) of the CRHR1 gene were examined. A TAT haplotype formed by 3 SNPs of the CRHR1 gene was found to be most significantly associated with diminished effects of child sexual, physical, and emotional abuse on adult depressive symptoms. These results were obtained both with an

African American sample (N = 422) from the low-SES strata and replicated independently from a predominantly Caucasian, socioeconomically less impoverished sample (N = 199).

Polanczyk and colleagues (2009) attempted a replication of the Bradley et al. (2008) findings in which a TAT haplotype in the CRHR1 gene was associated with protection against depressive symptoms in adults who were maltreated during childhood. Polanczyk et al. (2009) examined participants from two prospective longitudinal cohort studies – women in the E-Risk Study (N = 1,116) and men and women in the Dunedin Study (N = 1,037). In the E-Risk Study, the results of the Bradley et al. (2008) investigation were replicated. Once again, the TAT haplotype exerted a significant protective effect against depression for women who reported experiencing maltreatment during childhood. Maltreatment information was obtained from adult reports on the CTQ. However, in the Dunedin Study, the TAT CRHR1 haplotype protective effect on depression in adults maltreated in childhood was not obtained. Maltreatment information in the Dunedin Study was gleaned from three sources of prospective information and two sources of retrospective information. Polanczyk and colleagues (2009) conjectured that the different measurements of child maltreatment in the E-Risk and Dunedin studies may explain the failure to replicate the TAT haplotype protective factor against depression finding. The CTQ, assessed in the E-Risk Study, is a measure that elicits emotional memories by posing specific questions regarding maltreatment history to respondents. Thus, as suggested by Polanczyk et al. (2009), the TAT haplotype CRHR1 gene protective effect on depression conferred to adults who retrospectively reported having experienced childhood maltreatment may be due to CRHR1's role in consolidating memories of emotionally arousing experiences.

In a related study, DeYoung, Cicchetti, and Rogosch (2011) investigated whether CRHR1 moderates the association of child maltreatment with neuroticism. Children who possessed two copies of the TAT haplotype had different levels of neuroticism depending on whether they had been maltreated or not and on the most severe type and the number of types of maltreatment they had experienced. Specifically, when DeYoung et al. (2011) categorized maltreatment according to the number of types of maltreatment that had been experienced [as it was in the Bradley et al. (2008) and Polanczyk et al. (2009) studies], having two copies of the TAT haplotype of CRHR1 was associated with heightened levels of neuroticism in children who had experienced 1 or 2 types of maltreatment, but not among those who had experienced 3 or 4 subtypes of maltreatment. The finding that children who had experienced 3 or 4 types of maltreatment had levels of neuroticism similar to those of the nonmaltreated children is reminiscent of the protective effect of the TAT haplotype on depression found in previous research (Bradley et al., 2008; Polanczyk et al., 2009).

Whenever DeYoung and colleagues (2011) classified maltreatment in terms of the most serious subtype of maltreatment experienced, a different picture emerged. Children with two copies of the TAT haplotype who had been emotionally maltreated, neglected, or physically abused had levels of neuroticism that were considerably higher than the nonmaltreated comparison group. In contrast, children who had been sexually abused (often in addition to experiencing other forms of maltreatment) had levels of neuroticism that were lower than the comparison group.

The results of the DeYoung et al. (2011) study suggest that having two copies of the TAT haplotype puts maltreated children at risk for higher levels of neuroticism (and hence at greater risk for depression and other internalizing disorders) unless they have been sexually abused or have experienced 3 or 4 different types of maltreatment, in which case they may be protected from increased neuroticism. Future studies on the protective function of CRHR1 on depression should examine both the most severe type of maltreatment experienced, as well as the number of types of maltreatment experiences.

To our knowledge, there has been only one molecular genetic investigation that has examined whether particular genetic variants might be related to resilient functioning in the presence of child maltreatment. In order to examine the processes underlying the development of resilience at another level of analysis, Cicchetti and Rogosch (2012) embarked on research aimed at discovering whether there were gene variants of specified genes, in interaction with the experience of child maltreatment, that were associated with higher levels of resilient functioning in maltreated and nonmaltreated school-aged children ($N = 595$). A multi-component index of resilient functioning was identified. Four genes that have been found to be related to behaviors associated with resilient functioning, 5-HTTLPR, CRHR1, DRD4 -521C/T, and OXTR, were chosen and genetic variants in each of these genes were investigated.

Maltreatment consistently exerted a strong, adverse main effect on resilient functioning; however, none of the gene variants of the four respective genes were shown to have a main effect on resilience. In contrast, GxE interaction (GxE) effects were obtained and a similar pattern emerged for all four genes – a particular genotype was found to differentiate between the level of resilient functioning in maltreated and nonmaltreated children more strongly.

Opposite of the typical gene-environment interaction (GxE) studies on psychopathology, the results of the Cicchetti and Rogosch (2012) investigation revealed that genetic variation had a negligible effect for the maltreated group in predicting resilient functioning. In contrast, genotype was shown to contribute to higher resilient functioning in nonmaltreated children when they possessed a particular genotype, at least relative to the maltreated children with the same genotype.

In the case of 5-HTTLPR, nonmaltreated children with the SS genotypic variant were significantly more likely to have higher resilient functioning, whereas maltreated children who possessed the same genetic variant had significantly lower resilient functioning. These findings are consistent with a differential susceptibility to environmental influences interpretation (Belsky et al., 2011; Belsky & Pluess, 2009; Ellis, Boyce, Belsky, Bakermans-Kranenburg, & van IJzendoorn, 2011). According to this perspective, the characteristics individuals possess that render them disproportionately vulnerable to adverse experiences also make these same individuals disproportionately likely to profit from a supportive context (Boyce & Ellis, 2005; Ellis et al., 2011). For children who possess the same SS genotypic variant of 5-HTTLPR, nonmaltreated children, in the context of a more normal childrearing environment, achieved higher resilient functioning, whereas maltreated children, in the context of an adverse childrearing environment, demonstrated lower resilient functioning.

For CRHR1, nonmaltreated children with 0 copies of the TAT haplotype had significantly higher levels of resilient functioning relative to maltreated children with the same number of copies of the TAT haplotype. Once again, these findings are in keeping with a differential susceptibility to the environment perspective (Belsky & Pluess, 2009; Ellis et al., 2011); maltreated and nonmaltreated children have the same genetic variant (i.e., 0 copies of the TAT haplotype), yet the nonmaltreated children show higher levels of resilient functioning, whereas the maltreated children (living in a more stressful context) evince lower levels of resilient functioning.

Analyses of the DRD4 -521C/T single nucleotide polymorphism (SNP), revealed that nonmaltreated children and, in particular, those with the TT genotype, were more likely to exhibit significantly higher resilient functioning scores than were maltreated children with this same genotype. The maltreated children manifested significantly lower levels of resilient functioning. As with the previous results for 5-HTTLPR and CRHR1, findings with

DRD4 -521C/T provide support for the differential susceptibility to environmental influences perspective (Belsky & Pluess, 2009; Ellis et al., 2011).

In further analyses, Cicchetti and Rogosch (2012) examined the relation between number of maltreatment subtypes and DRD4 -521C/T genotype to resilient strivings. Maltreated children who had experienced 3 or 4 subtypes fared dramatically worse with the TT genotype, whereas nonmaltreated children with this genotype fared the best. Maltreated children with 3 – 4 subtypes with the CC or CT genotypes were indistinguishable in level of resilient functioning from nonmaltreated children with these genotypes. Despite the very large detrimental effect that extensive maltreatment exerts on resilient functioning independent of genotype, these results provide an example of where the 3 – 4 maltreatment subtype group exhibits the same level of resilient functioning as do nonmaltreated comparisons with the same CC or CT genotypes.

Finally, with OXTR, not being maltreated was related to significantly higher resilient functioning scores; in contrast, maltreatment was strongly related to lower levels of resilient functioning. In particular, nonmaltreated children who had either the AA or AG genotypes of OXTR displayed greater levels of resilient functioning than maltreated children with these same genotypes. Consistent with the findings obtained with the three previous candidate genes, the results provide strong support for the differential susceptibility to environmental influences framework (Belsky & Pluess, 2009; Ellis et al., 2011).

It is noteworthy that Cicchetti and Rogosch (2012) identified different gene variants as differentially important through contrasting maltreated and nonmaltreated children and their strivings for resilience. The variation among the genotypes and their relation to functioning differences would not be apparent without the consideration of experience. The genes did not have a singular role, outside of experiential context. The contrast between groups of maltreated and nonmaltreated children was important for understanding development in normal and atypical rearing environments.

Cicchetti and Rogosch's (2012) findings suggest that the genes included in this investigation appear to be minimally related to resilient functioning in maltreated children. Maltreatment consistently had a statistically significant main effect on resilient functioning with each of the genes examined. Genetic variation had more of an impact on resilient functioning among the nonmaltreated children who also resided in stressful poverty-laden environments. Accordingly, it appears that the powerful maltreatment main effects may have overshadowed any potential contribution of genetics to resilient functioning in abused and neglected children. Despite the multidomain assessment of adaptive functioning and the large well-defined sample of maltreated and nonmaltreated children, a limitation of the study is its cross-sectional nature. Because resilience is a dynamic developmental construct that is not immutable, future investigations of gene-environment interaction and resilient functioning should be prospective and longitudinal (Luthar, 2006; Luthar et al., 2000).

It also is important to acknowledge that other biological systems are negatively impacted by abuse and neglect (Cicchetti & Valentino, 2006). Differences in brain structure and function (DeBellis, 2001, 2005; Hart & Rubia, 2012; McCrory, DeBrito, & Viding, 2010), stress neurobiology (Cicchetti et al., 2010, 2011; Heim, Newport, Mletzko, Miller, & Nemeroff, 2008; Trickett et al., 2010), and inflammatory processes (Danese et al., 2008; Miller, Chen, & Parker, 2011), among other biological systems, are not innate features of children, but rather are consequences of maltreatment. As research advances continue to occur in development and neuroimaging, endophenotypes will be discovered that can be utilized as intermediate targets for molecular genetic studies investigating the multilevel pathways to resilience (Gottesman & Gould, 2003).

Maltreatment experiences also may influence other developmental processes, including epigenetic processes involving the extent to which DNA methylation has occurred and the degree to which genes are expressed (Tyrka, Price, Marsit, Walters, & Carpenter, 2012); however, these effects are not examined when focusing exclusively on GxE interaction. Future investigations of molecular genetic contributions to resilience also should pay more attention to the process of development (D). These GxE, GxD, and GxExD studies could discover how a particular genotype may operate differently depending on developmental period or environmental context (see Sroufe, 2007). Moreover, genotypic variation for genes other than those utilized in the Cicchetti and Rogosch (2012) investigation may be related to higher resilient functioning in maltreated children. Thus, broader approaches to genetic influences associated with resilience in maltreated children must occur. The design and conduct of longitudinal multilevel RCTs that incorporate baseline pre-intervention, post-intervention, and intervention follow-up assessments of psychosocial, neuroimaging and epigenetic processes through the collection of DNA and RNA over developmental time should be implemented in the future.

Conclusion and Future Perspectives

Since its inception over a quarter of a century ago, research on the determinants of resilience in maltreated children has enhanced the understanding of the development of competence in abused and neglected children. The deleterious effects of maltreatment on biological and psychological development are not inevitable. Some maltreated children function resiliently even after experiencing such great adversity. Unfortunately, it appears that, across studies conducted to date, only approximately 10 – 25% of maltreated children achieve resilient functioning (Walsh, Dawson, & Mattingly, 2010).

Despite the lessons learned from the current body of research, there remains much to discover about the processes underlying the development of resilience in abused and neglected children. Most of the research is either cross-sectional or short-term longitudinal. Moreover, almost the entirety of resilience research has been conducted at a single-level of analysis and with a focus on psychosocial processes. Because resilience is a dynamic developmental process, it is critical to conduct multilevel short- and long-term longitudinal studies. Resilient functioning is not immutable. Transitional “turning points” provide opportunities and challenges for individuals either to remain on a positive developmental trajectory despite ongoing adversity, to “bounce back” from a decline in functioning, to persist on a maladaptive trajectory, or to exhibit a decline in functioning from positive functioning (Cicchetti & Rogosch, 1997; Luthar et al., 2000; Rutter, 2012; Sapienza & Masten, 2011).

In these longitudinal investigations, resilience should be conceptualized as a multidomain, multidimensional construct. Changes in one domain of adaptive functioning can cascade to affect other developmental domains over time (Cicchetti & Tucker, 1994; Masten & Cicchetti, 2010). Hence, a multiple levels of analysis approach to investigating resilient adaptation in maltreated children will help to ensure that resilience processes are examined in a thorough and developmentally appropriate fashion (Cicchetti & Blender, 2006; Curtis & Cicchetti, 2003). Growth curve modeling and person-centered approaches are examples of two statistical methods that should be utilized to address the fluidity of resilient functioning across developmental periods. For example, person-oriented statistical methods can identify subgroups of maltreated children that do not follow trends toward developmental problems across domains. Additionally, a person-oriented approach (von Eye & Bergman, 2003), in which genetic, neurobiological, and psychological systems are studied within individuals over developmental time, should be implemented in future research on the effects of maltreatment on biological and psychological processes. In this way, vital information on

how the neurobiological systems of maltreated children develop at different developmental periods, as well as when such developing neural systems may be most vulnerable or resilient in different profiles of individuals who share similar aspects of genetic, neurobiological, and psychological functioning, and who may range from none or minimal damage to major neurobiological and psychological dysfunction, may be discerned.

Such longitudinal multilevel investigations increase the likelihood that all relevant domains are assessed at their appropriate developmental period, thereby increasing the likelihood that interventions may be timed and guided and conducted as closely as possible to the identification of deviations from adaptive functioning. Fortunately, many of the adaptive systems that play roles in vulnerability or resilience processes are malleable through intervention (Luthar & Cicchetti, 2000; Sapienza & Masten, 2011). A broad multilevel approach to resilience has advantages for the maltreated child. Because resilient maltreated individuals rarely manifest competence across all developmental domains, intervention evaluations should be broader than focusing only on one specific outcome (Cicchetti & Gunnar, 2008; Walsh et al., 2010).

In addition, we possess little knowledge about the development of resilient functioning in young maltreated children. The majority of the research investigations on the development of resilient functioning have been conducted with school-aged maltreated and nonmaltreated comparison children, maltreated and nonmaltreated comparison adolescents, and adults who report either having been maltreated or never having experienced maltreatment during childhood. Although a number of cross-sectional and longitudinal studies have been published on the developmental adaptation of young maltreated children (Cicchetti & Lynch, 1995; Cicchetti & Valentino, 2006), in general the sample sizes have been too small to examine processes and mechanisms contributing to resilience. Moreover, the studies have focused on single level psychosocial processes.

Protective factors against maladaptive functioning have been identified in short-term longitudinal studies of maltreated infants and toddlers (e.g., Beeghly & Cicchetti, 1994; Egeland & Sroufe, 1981; Schneider-Rosen & Cicchetti, 1984); however, none of these investigations were multilevel. Thus, these studies did not possess the appropriate measurement complexity to warrant conceptualizing positive functioning in maltreated youngsters as constituting resilient adaptation. The conduct of longitudinal multilevel research with maltreated youngsters will be important to rectify this significant gap in our knowledge. Such investigations would provide critical information to design and implement interventions to promote resilient functioning and to prevent the emergence of negative developmental cascades in maltreated children.

Future research also should examine maltreatment parameters over and above maltreatment vs. nonmaltreatment status (Manly, 2005). These should include the number of subtype(s) of maltreatment experienced, onset severity, chronicity, number of developmental periods maltreated, frequency, and perpetrator(s) (Barnett, Manly, & Cicchetti, 1993). Each of these parameters has the potential to provide additional information regarding the processes contributing to resilient functioning. Greater specificity regarding the nature of maltreatment experiences these children have endured may clarify individual differences in the aspects of the maltreatment experience that may differentially influence biological and psychological development. Exploring aspects of parent-child interactions and parent-child relationships within maltreatment groups also may elucidate qualitative points of divergence in the experiences of maltreated children that may influence the course of their development. Additional co-occurring risk factors, including parental psychopathology, criminality, and substance abuse, also may contribute to individual differences.

Additionally, because most cases of child maltreatment that are indicated by departments of human services reside in low-SES environments, knowledge of these parameters may prove helpful in discovering family- and community-level protective factors. For example, it is conceivable that maltreatment by nonparental adult strangers may enable researchers to discover that some maltreated children have supportive families, good quality parenting, or supportive relations with nonparental adults outside (e.g., teachers – Lynch & Cicchetti, 1992) or inside (e.g., grandparents) the home that may be important promotive factors in the development of resilient functioning.

Relatedly, we possess virtually no information about the effects of child maltreatment in middle- or upper-socioeconomic environments. Maltreatment clearly transcends social class. Consequently, research on the developmental consequences of child maltreatment and on pathways to resilient adaptation in children raised in non-low-SES environments is important to conduct in order to discover similarities and differences in the development of resilient functioning across various social class strata. It would be interesting to ascertain whether family and community protective factors are more likely in middle-SES maltreating families than in maltreating families from the low-SES. Would any of the resources that are more common in non-low-SES maltreating families result in different pathways to maladaptive or resilient functioning, or to a significantly higher percentage of resilient children? Nonmaltreated children in affluent backgrounds are not immune to developing substance abuse or psychopathology (e.g., depression). Indeed, youth from affluent families can even exhibit more problematic functioning than youth from the low-SES (Luthar, 2003; Luthar & Barkin, 2012). Thus, comparison of maltreated children from different SES backgrounds may shed light on differential pathways to resilient functioning. Relatedly, it is equally important to conduct multilevel research on the pathways to resilient adaptation in maltreated children from different cultures (see, e.g., Flores, Cicchetti, & Rogosch, 2005).

Several studies that examined the development of adaptive functioning in maltreated and nonmaltreated children have found differential predictors of competence. For example, ego resiliency, ego overcontrol, and positive self-system functioning have been found to predict adaptive functioning in maltreated children, whereas ego-resiliency and relationship factors, such as a perceived positive relationship with the mother and a non-parental adult figure predicted adaptive functioning in nonmaltreated children. The differential predictors of and pathways to resilient functioning in maltreated and nonmaltreated children underscore the importance of including a comparison group of nonmaltreated children from comparable SES backgrounds in investigations of resilient functioning in maltreated children.

It is instructive to inquire how some maltreated children were able to develop ego overcontrol, ego-resiliency, and positive self-esteem while experiencing such great adverse circumstances. Put differently, is there evidence indicating that maltreated children traverse different developmental pathways in their strivings for resilient adaptation? Clearly, maltreated children have not experienced the good-quality caregiving and secure attachment relationships with their caregivers that Block and Block (1980) identified as antecedent conditions of egoresiliency. Maltreated children, though capable of developing good-quality relationships with nonparental adults such as their teachers, have more difficulty connecting positively with alternative caregivers than do nonmaltreated children (Lynch & Cicchetti, 1992). Moreover, maltreated children lack the maternal support and additional family characteristics found to antedate the development of ego-control. Similarly, maltreated children also are unlikely to experience warm, nurturant, and mirroring aspects in parent-child relationships, features that are central to positive self-regard.

Nonetheless, it appears that most maltreated children manage to sustain at least some strivings toward resilience and that some become ego-overcontrollers and function in a

resilient fashion in the absence of the typical processes engendering these personality dimensions that have been noted in the literature (Block & Block, 1980). In future research, it also will be critical to examine the question of whether employing alternative or less commonly utilized pathways to achieving competent adaptation is successful in contributing to children remaining competent over time, or if embarking on these alternate pathways result in children being more vulnerable to manifesting later deviations or delays in development (cf. Cicchetti & Schneider-Rosen, 1986).

Given the consistent detrimental impact of maltreatment on resilient functioning and the larger number of maltreated children who exhibit low levels of resilience, the importance of prevention and intervention to ameliorate the effects of maltreatment must be underscored. Research on resilience in maltreated children possesses substantial potential to guide the development and implementation of interventions for facilitating the promotion of resilient functioning despite the experience of significant adversity. One of the main objectives of the field of prevention science is to intervene in the course of development to foster the recovery of function and to promote resilient adaptation in individuals at risk for psychopathology. Thus, it is now essential to utilize a multiple levels of analysis perspective, ranging from DNA sequences to neurobiology to behavior to culture, in research aimed at evaluating the efficacy of randomized control trial (RCT) interventions whose goal is to foster the development of resilient adaptation (Cicchetti & Blender, 2006).

Cicchetti, Rogosch, and Toth (2006) conducted a multilevel RCT with maltreated and nonmaltreated 13-month-old infants. Maltreated infants were randomly assigned either to an attachment theory informed intervention (Child-Parent Psychotherapy; Lieberman, 1992), a didactic parenting intervention, or to the standard community services offered to maltreated children. At baseline, virtually all maltreated infants were insecurely attached to their mothers; the majority had disorganized-disoriented (Type D) attachments (Main & Hesse, 1990). There also was a nonmaltreated comparison group and these babies had significantly higher rates of secure attachment than the maltreated infants. At the end of the year-long intervention, maltreated infants (now 26 months) receiving child-parent psychotherapy or the parenting intervention, exhibited significant increases in attachment security, whereas increases in secure attachment were not found for the infants in the community services group and the normative nonmaltreated comparison group. Thus, although the negative effects of maltreatment on attachment are profound, these effects are not immutable and plasticity of the attachment system is feasible. Genetic variants did not alter the receptiveness of the maltreated children to benefit from the interventions (Cicchetti, Rogosch, & Toth, 2011). Accordingly, early intervention in maltreating families is imperative, particularly given the substantial stability of attachment disorganization among maltreated infants in the absence of active efforts to improve family functioning and the parent-child relationship.

Random assignment to child maltreatment is not possible; however, random assignment to intervention is. If biological systems recover in responses to a multilevel intervention, then this provides support that the systems under investigation are sensitive to environmental input during development. Furthermore, preventive interventions may contribute to recovery or repair of biological and psychological sequelae, in maltreated children and also may suggest targets for preventive intervention. Consequently, multilevel RCTs that investigate the processes whereby changes in experience and psychological functioning occur may modify biological processes and promote resilient functioning. One important goal of preventive intervention research is to identify periods of development when a specific intervention may be most efficacious so that the intervention can be targeted to that period. An aim of multilevel preventive intervention research that includes measures of genetic and neurobiological processes is to better identify sensitive periods for intervention.

For example, we do not know whether the differences in brain structure and functioning exhibited by many maltreated children are permanent or irreversible, or, if reversible, at what point in ontogeny and to what degree? Similarly, no studies have been conducted to ascertain whether brain structure and function are organized differently in maltreated children who are functioning resiliently than is neurobiological development in maltreated children functioning in a non-resilient fashion. In addition, we do not possess the knowledge regarding whether some to-be-identified neural systems may be more plastic than other neural systems that may be more refractory to change or have a more time-limited window when neural plasticity can occur.

It is therefore important to ascertain whether the timing of resilience-promoting interventions is a critical variable that merits consideration. Specifically, it will be extremely important to discover whether resilience-promoting interventions are more effective when implemented in the early years of life. Likewise, are such interventions more likely to achieve their goal of promoting resilience if they are instituted as closely as possible to the identification of the adverse event(s) or experience? The incorporation of a multiple levels of analysis perspective will enable scientists to learn whether, for example, resilience promoting interventions implemented in the early years of life are better for brain development and functioning, even if improvement occurs in individuals who receive resilience-facilitating interventions later in life or who receive their interventions further removed in time from their adverse event(s) or traumatic experiences.

Determining the multiple levels at which change is engendered through RCTs will provide insight into the mechanisms of change, the extent to which neural plasticity may be promoted, and the interrelations between biological and psychological processes in the development of maladaptation, psychopathology, and resilience in maltreated children (Cicchetti & Curtis, 2006). It is thus possible to conceptualize successful resilience-promoting interventions as examples of experience-dependent neural plasticity (Cicchetti & Curtis, 2006). Early intensive interventions in child maltreatment to establish more sensitive and nurturant parenting, secure attachment, and neurobiological reorganization in maltreated youngsters (Bernard, Dozier, Bick, Lewis-Morrarty, Lindheim, et al., 2012; Cicchetti et al., 2006; Cicchetti Rogosch, Toth, & Sturge-Apple, 2011; Moss, Dubois-Comtois, Cyr, Tarabulsky, St. Laurent, & Bernier, 2011) hold great promise for instilling adaptive developmental trajectories. Consolidated, multisystemic approaches beginning early in development are necessary to reduce environmental stress exposure, child maltreatment, and allostatic overload in order to improve physical and mental health across the life span.

We are in the midst of an exciting period for research on the pathways to resilient functioning in maltreated children. For example, the advances in genomics, epigenetics, brain imaging, stress neurobiology, and immunology will make important contributions to increased knowledge about the developmental processes leading to resilience (Curtis & Cicchetti, 2003; Masten, 2007). Such enhanced understanding has great potential for the development and implementation of novel, perhaps even individualized, resilience-promoting interventions for maltreated children and adults who are not functioning well due to experiences of adversity and trauma. In order to comprehend fully how maltreated individuals achieve resilient functioning in the face of adversity, it is incumbent upon researchers to investigate resilience processes with a commensurate level of complexity.

Acknowledgments

The preparation of this manuscript was supported by grants from the National Institute on Drug Abuse (DA12903, DA17741), the National Institute of Mental Health (MH54643), and the Spunk Fund, Inc. This review article was invited by the journal, for which the principal author has been offered a small honorarium payment towards personal expenses.

References

- Aber, J.L.; Cicchetti, D. Socioemotional development in maltreated children: An empirical and theoretical analysis. In: Fitzgerald, H.E.; Lester, B.; Yogman, M., editors. *Theory and research in behavioral pediatrics*. Vol. 2. Plenum Press; New York: 1984. p. 147-205.
- Barnett, D.; Manly, J.T.; Cicchetti, D. Defining child maltreatment: The interface between policy and research. In: Cicchetti, D.; Toth, S.L., editors. *Child abuse, child development, and social policy*. Ablex; Norwood, NJ: 1993. p. 7-74.
- Beeghly M, Cicchetti D. Child maltreatment, attachment, and the self system: Emergence of an internal state lexicon in toddlers at high social risk. *Development and Psychopathology*. 1994; 6:5–30.
- Belsky J, Jonassaint C, Pluess M, Stanton M, Brummett B, Williams R. Vulnerability genes or plasticity genes? *Molecular Psychiatry*. 2009; 14:746–754. [PubMed: 19455150]
- Belsky J, Pluess M. Beyond Diathesis Stress: Differential Susceptibility to Environmental Influences. *Psychological Bulletin*. 2009; 135:885–908. [PubMed: 19883141]
- Bernard K, Dozier M, Bick J, Lewis-Morrarty E, Lindheim O, Carlson E. Enhancing attachment organization among maltreated children: Results of a Randomized Clinical Trial. *Child Development*. 2012; 83:623–636. [PubMed: 22239483]
- Bernstein, D.P.; Fink, L. *Childhood Trauma Questionnaire: A retrospective self-report manual*. The Psychological Corporation; San Antonio, TX: 1998.
- Block, J.; Block, J.H. *The California child Q-set*. University of California Press; Berkeley, CA: 1969.
- Block, J.; Block, J.H. The role of ego-control and ego-resiliency in the organization of behavior. In: Collins, W.A., editor. *The Minnesota symposia on child psychology: Development of cognition, affect, and social relations*. Vol. 13. Erlbaum; Hillsdale, NJ: 1980. p. 39-101.
- Bolger, K.E.; Patterson, C.J. Sequelae of child maltreatment: Vulnerability and resilience. In: Luthar, S.S., editor. *Resilience and Vulnerability: Adaptation in the Context of Childhood Adversities*. Cambridge University Press; New York: 2003. p. 156-181.
- Bonnano GA, Mancini AD. The human capacity to thrive in the face of potential trauma. *Pediatrics*. 2008; 122:369–375.
- Boyce WT, Ellis BJ. Biological sensitivity to context: I. An evolutionary-developmental theory of the origins and functions of stress reactivity. *Development and Psychopathology*. 2005; 17:271–301. [PubMed: 16761546]
- Bradley RG, Binder EB, Epstein MP, Tang Y, Nair HP, Liu W, et al. Influence of child abuse on adult depression: Moderation by the corticotropin-releasing hormone receptor gene. *Archives of General Psychiatry*. 2008; 65:190–200. [PubMed: 18250257]
- Buckner JC, Mezzacappa E, Beardslee WR. Characteristics of resilient youths living in poverty: The role of self-regulatory processes. *Developmental Psychopathology*. 2003; 15:139–162.
- Caspi A, Hariri A, Holmes A, Uher R, Moffitt TE. Genetic sensitivity to the environment: The case of the serotonin transporter gene (5-HTT) and its implications for studying complex diseases and traits. *American Journal of Psychiatry*. 2010; 167:509–527. [PubMed: 20231323]
- Caspi A, McClay J, Moffitt TE, Mill J, Martin J, Craig IW, et al. Role of genotype in the cycle of violence in maltreated children. *Science*. 2002; 297:851–854. [PubMed: 12161658]
- Charney D. Psychobiological mechanisms of resilience and vulnerability: Implications for successful adaptation to extreme stress. *American Journal of Psychiatry*. 2004; 161:195–216. [PubMed: 14754765]
- Chomsky, N. *Language and mind*. Harcourt Brace Jovanovich; New York: 1968.
- Cicchetti D. Developmental psychopathology: Reactions, reflections, projections. *Developmental Review*. 1993; 13:471–502.
- Cicchetti D. Child maltreatment: Implications for developmental theory. *Human Development*. 1996; 39:18–39.
- Cicchetti, D. How a child builds a brain: Insights from normality and psychopathology. In: Hartup, W.; Weinberg, R., editors. *Minnesota symposia on child psychology: Child psychology in retrospect and prospect*. Vol. 32. Lawrence Erlbaum Associates; Mahwah, NJ: 2002. p. 23-71.

- Cicchetti D. Experiments of nature: Contributions to developmental theory. *Development and Psychopathology*. 2003; 15:833–835. [PubMed: 14984128]
- Cicchetti, D. Foreword. In: Luthar, SS., editor. *Resilience and vulnerability: Adaptation in the context of childhood adversity*. Cambridge University Press; New York: 2003. p. ix-xxii.
- Cicchetti D, Blender JA. A multiple-levels-of-analysis perspective on resilience: Implications for the developing brain, neural plasticity, and preventive interventions. *Annals of the New York Academy of Sciences*. 2006; 1094:248–258. [PubMed: 17347356]
- Cicchetti D, Cannon TD. Neurodevelopmental processes in the ontogenesis and epigenesis of psychopathology. *Development and Psychopathology*. 1999; 11:375–393. [PubMed: 10532615]
- Cicchetti, D.; Cohen, DJ. Perspectives on developmental psychopathology. In: Cicchetti, D.; Cohen, DJ., editors. *Developmental psychopathology: Theory method*. Vol. Vol. 1. Wiley; New York: 1995. p. 3-20.
- Cicchetti, D.; Curtis, WJ. The developing brain and neural plasticity: Implications for normality, psychopathology, and resilience. In: Cicchetti, D.; Cohen, DJ., editors. *Developmental psychopathology: Developmental neuroscience*. 2nd ed.. Vol. Vol. 2. Wiley; New York: 2006. p. 1-64.
- Cicchetti D, Garmezy N. Prospects and promises in the study of resilience. *Development and Psychopathology*. 1993; 5:497–502.
- Cicchetti D, Gunnar MR. Integrating biological processes into the design and evaluation of preventive interventions. *Development and Psychopathology*. 2008; 20:737–743. [PubMed: 18606029]
- Cicchetti D, Lynch M. Toward an ecological/transactional model of community violence and child maltreatment: Consequences for children's development. *Psychiatry*. 1993; 56:96–118. [PubMed: 8488217]
- Cicchetti, D.; Lynch, M. Failures in the expectable environment and their impact on individual development: The case of child maltreatment. In: Cicchetti, D.; Cohen, DJ., editors. *Developmental psychopathology: Risk, disorder, and adaptation*. Vol. Vol. 2. Wiley; New York: 1995. p. 32-71.
- Cicchetti, D.; Manly, JT. A personal perspective on conducting research with maltreating families: Problems and solutions. In: Brody, G.; Sigel, I., editors. *Methods of family research: Families at risk*. Vol. Vol. 2. Lawrence Erlbaum Associates; Hillsdale, NJ: 1990. p. 87-133.
- Cicchetti, D.; Pogge-Hesse, P. Possible contributions of the study of organically retarded persons to developmental theory. In: Zigler, E.; Balla, D., editors. *Mental retardation: The developmental-difference controversy*. Lawrence Erlbaum Associates; Hillsdale, NJ: 1982. p. 277-318.
- Cicchetti D, Rizley R. Developmental perspectives on the etiology, intergenerational transmission and sequelae of child maltreatment. *New Directions for Child Development*. 1981; 11:31–55.
- Cicchetti D, Rogosch FA. Equifinality and multifinality in developmental psychopathology. *Development and Psychopathology*. 1996; 8:597–600.
- Cicchetti D, Rogosch FA. The role of self-organization in the promotion of resilience in maltreated children. *Development and Psychopathology*. 1997; 9:797–815. [PubMed: 9449006]
- Cicchetti D, Rogosch FA. Diverse patterns of neuroendocrine activity in maltreated children. *Development and Psychopathology*. 2001; 13:677–694. [PubMed: 11523854]
- Cicchetti D, Rogosch FA. Personality, adrenal steroid hormones, and resilience in maltreated children: A multi-level perspective. *Development and Psychopathology*. 2007; 19:787–809. [PubMed: 17705903]
- Cicchetti D, Rogosch FA. Gene by environment interaction and resilience: Effects of child maltreatment and serotonin, corticotropin releasing hormone, dopamine, and oxytocin genes. *Development and Psychopathology*. 2012; 24 in press.
- Cicchetti D, Rogosch FA, Gunnar MR, Toth SL. The differential impacts of early abuse on internalizing problems and diurnal cortisol activity in school-aged children. *Child Development*. 2010; 25:252–269. [PubMed: 20331666]
- Cicchetti D, Rogosch FA, Lynch M, Holt K. Resilience in maltreated children: Processes leading to adaptive outcome. *Development and Psychopathology*. 1993; 5:629–647.
- Cicchetti D, Rogosch FA, Oshri A. Interactive effects of corticotropin releasing hormone receptor 1, serotonin transporter linked polymorphic region, and child maltreatment on diurnal cortisol

- regulation and internalizing symptomatology. *Development and Psychopathology*. 2011; 23:1125–1138. [PubMed: 22018085]
- Cicchetti D, Rogosch FA, Thibodeau EL. The effects of child maltreatment on early signs of antisocial behavior: Genetic moderation by Tryptophan Hydroxylase, Serotonin Transporter, and Monoamine Oxidase-A-Genes. *Development and Psychopathology*. 2012; 24:907–928. [PubMed: 22781862]
- Cicchetti D, Rogosch FA, Toth SL. Fostering secure attachment in infants in maltreating families through preventive interventions. *Development and Psychopathology*. 2006; 18(3):623–650. [PubMed: 17152394]
- Cicchetti D, Rogosch FA, Toth SL. The effects of child maltreatment and polymorphisms of the serotonin transporter and dopamine D4 receptor genes on infant attachment and intervention efficacy. *Development and Psychopathology*. 2011; 23:357–372.
- Cicchetti D, Rogosch FA, Toth SL, Sturge-Apple ML. Normalizing the development of cortisol regulation in maltreated infants through preventive interventions. *Development and Psychopathology*. 2011; 23:789–800. [PubMed: 21756432]
- Cicchetti, D.; Schneider-Rosen, K. An organizational approach to childhood depression. In: Rutter, M.; Izard, C.; Read, P., editors. *Depression in young people, clinical and developmental perspectives*. Guilford; New York: 1986. p. 71-134.
- Cicchetti, D.; Toth, SL., editors. *Child abuse, child development, and social policy*. Ablex; Norwood, NJ: 1993.
- Cicchetti D, Toth SL. A developmental psychopathology perspective on child abuse and neglect. *Journal of the American Academy of Child and Adolescent Psychiatry*. 1995; 34:541–565. [PubMed: 7775351]
- Cicchetti, D.; Toth, SL. Child maltreatment: Past, present, and future perspectives. In: Weissberg, RP.; Weiss, LH.; Reyes, O.; Walberg, HJ., editors. *Trends in the well-being of children and youth*. Vol. Vol. 2. CWLA Press; Washington, DC: 2003. p. 181-206.
- Cicchetti D, Toth SL. The past achievements and future promises of developmental psychopathology: The coming of age of a discipline. *Journal of Child Psychology and Psychiatry*. 2009; 50:16–25. [PubMed: 19175810]
- Cicchetti D, Tucker D. Development and self-regulatory structures of the mind. *Development and Psychopathology*. 1994; 6:533–549.
- Cicchetti, D.; Valentino, K. An ecological transactional perspective on child maltreatment: Failure of the average expectable environment and its influence upon child development. In: Cicchetti, D.; Cohen, DJ., editors. *Developmental psychopathology*. 2nd ed.. Vol. Vol. 3. Wiley; New York: 2006. p. 129-201.
- Cohen P, Brown J, Smaile E. Child abuse and neglect and the development of mental disorders in the general population. *Development and Psychopathology*. 2001; 13:981–999. [PubMed: 11771917]
- Collishaw S, Pickles A, Messer J, Rutter M, Shearer C, Maughan B. Resilience to adult psychopathology following childhood maltreatment: Evidence from a community sample. *Child Abuse & Neglect*. 2007; 31:211–229. [PubMed: 17399786]
- Curtis WJ, Cicchetti D. Moving research on resilience into the 21st century: Theoretical and methodological considerations in examining the biological contributors to resilience. *Development and Psychopathology*. 2003; 15:773–810. [PubMed: 14582940]
- Curtis WJ, Cicchetti D. Emotion and resilience: A multi-level investigation of hemispheric electroencephalogram asymmetry and emotion regulation in maltreated and non-maltreated children. *Development and Psychopathology*. 2007; 19(3):811–840. [PubMed: 17705904]
- Cyr C, Euser EM, Bakermans-Kranenburg MJ, vanIJendoorn MH. Attachment security and disorganization in maltreating and high-risk families: A series of meta-analyses. *Development and Psychopathology*. 2010; 22:87–108. [PubMed: 20102649]
- Dackis MN, Rogosch FA, Oshri A, Cicchetti D. The role of limbic system irritability in linking history of childhood maltreatment and psychiatric outcomes in low-income, high-risk women: Moderation by FKBP5. *Development and Psychopathology*. in press.

- Danese A, Moffitt TE, Pariante CM, Ambler A, Poulton R, Caspi A. Elevated inflammation levels in depressed adults with a history of childhood maltreatment. *Archives of General Psychiatry*. 2008; 65:409–416. [PubMed: 18391129]
- Davidson RJ. Affective style, psychopathology, and resilience: Brain mechanisms and plasticity. *American Psychologist*. 2000; 55:1196–1214. [PubMed: 11280935]
- DeBellis MD. Developmental traumatology: The psychobiological development of maltreated children and its implications for research, treatment, and policy. *Development and Psychopathology*. 2001; 13:539–564. [PubMed: 11523847]
- DeBellis MD. The psychobiology of neglect. *Child Maltreatment*. 2005; 10:150–172. [PubMed: 15798010]
- DeYoung C, Cicchetti D, Rogosch FA. Moderation of the association between childhood maltreatment and neuroticism by the corticotropin-releasing hormone receptor 1 gene. *Journal of Child Psychology and Psychiatry*. 2011; 52:898–906. [PubMed: 21438878]
- Dube SR, Fairweather D, Pearson WS, Felitti VJ, Anda RF, Croft JB. Cumulative childhood stress and autoimmune diseases in adults. *Psychosomatic Medicine*. 2009; 71:243–250. [PubMed: 19188532]
- Dumont KA, Widom CS, Czaja SJ. Predictors of resilience in abused and neglected children grown-up: The role of individual and neighborhood characteristics. *Child Abuse & Neglect*. 2007; 31:255–274. [PubMed: 17386940]
- Egeland B, Carlson EA, Sroufe LA. Resilience as process. *Development and Psychopathology*. 1993; 5:517–528.
- Egeland, B.; Farber, E. Invulnerability among abused and neglected children. In: Anthony, EJ.; Cohler, BJ., editors. *The invulnerable child*. Guilford; New York: 1987. p. 253–288.
- Egeland B, Jacobvitz D, Sroufe LA. Breaking the cycle of abuse. *Child Development*. 1988; 59:1080–1088. [PubMed: 3168615]
- Egeland B, Sroufe A. Developmental sequelae of maltreatment in infancy. *New Directions for Child and Adolescent Development*. 1981; 1981(11):77–92.
- Ellis BJ, Boyce WT, Belsky J, Bakermans-Kranenburg MJ, Van IJzendoorn MH. Differential susceptibility to the environment: An evolutionary-neurodevelopmental theory. *Development and Psychopathology*. 2011; 23:7–28. [PubMed: 21262036]
- Elmer, E. *Fragile families, troubled children*. University of Pittsburgh Press; Pittsburgh: 1979.
- Evans GW. The environment of childhood poverty. *American Psychologist*. 2004; 59(2):77–92. [PubMed: 14992634]
- Fang X, Brown DS, Florence CS, Mercy JA. The economic burden of child maltreatment in the United States and implications for prevention. *Child Abuse & Neglect*. 2012 (2012), doi: 10.1016/j.chiabu.2011.10.006.
- Feder A, Nestler EJ, Charney DS. Psychobiology and molecular genetics of resilience. *Nature*. 2009; 461:446–457.
- Felitti VJ, Anda RF, Nordenberg D, Williamson DF, Spitz AM, Edwards V, et al. Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults. The Adverse Childhood Experiences (ACE) Study. *American Journal of Preventive Medicine*. 1998; 14:245–258. [PubMed: 9635069]
- Flores E, Cicchetti D, Rogosch FA. Predictors of resilience in maltreated and nonmaltreated Latino children. *Developmental Psychology*. 2005; 41(2):338–351. [PubMed: 15769190]
- Ganzel BL, Morris PA, Wethington E. Allostasis and the human brain: Integrating models of stress from the social and life sciences. *Psychological Review*. 2010; 117:134–174. [PubMed: 20063966]
- Garnezy N. Vulnerability research and the issue of primary prevention. *American Journal of Orthopsychiatry*. 1971; 41:101–116. [PubMed: 5539483]
- Garnezy, N. The study of competence in children at risk for severe psychopathology. In: Anthony, EJ.; Koupernik, C., editors. *The child in his family: Vol. 3. Children at psychiatric risk*. Wiley; New York: 1974. p. 77–97.
- Gottesman II, Gould TD. The endophenotype concept in psychiatry: etymology and strategic intentions. *Am J Psychiatry*. 2003; 160:636–645. 2003. Gunnar, M. R., & Vazquez, D. (2006). Stress neurobiology and developmental psychopathology. In D. Cicchetti & D. Cohen (Eds.),

- Developmental Psychopathology (2nd ed.), Vol. 2: Developmental Neuroscience (pp. 533-577). New York: Wiley. [PubMed: 12668349]
- Hackman DA, Farah MJ. Socioeconomic status and brain development. *Trends in Cognitive Sciences*. 2009; 13:65–73. [PubMed: 19135405]
- Hackman DA, Farah MJ, Meaney MJ. Socioeconomic status and the brain: Mechanistic insights from human and animal research. *Nature Reviews Neuroscience*. 2010; 11:651–659.
- Hanson DR, Gottesman II. Biologically-flavored perspectives on Garmezyan resilience. *Development and Psychopathology*. 2012; 24:363–369. [PubMed: 22559119]
- Hart H, Rubia K. Neuroimaging of child abuse: A critical review. *Human Neuroscience*. 2012; 6 doi: 10.3389/fnhum.2012.00052.
- Haskett ME, Nears K, Ward CS, McPherson AV. Diversity in adjustment of maltreated children: Factors associated with resilient functioning. *Clinical Psychology Review*. 2006; 26:296–812.
- Heckman JJ. Skill formation and the economics of investing in disadvantage children. *Science*. 2006; 312:1900–1902. [PubMed: 16809525]
- Heim C, Newport JD, Mletzko T, Miller AH, Nemeroff CB. The link between childhood trauma and depression: Insights from HPA axis studies in humans. *Psychoneuroendocrinology*. 2008; 33:693–710. [PubMed: 18602762]
- Herrenkohl EC, Herrenkohl RC, Egolf M. Resilient early school-age children from maltreating homes: Outcomes in late adolescence. *American Journal of Orthopsychiatry*. 1994; 64:301–309. [PubMed: 8037238]
- Hinshaw SP, Cicchetti D. Stigma and mental disorder: Conceptions of illness, public attitudes, personal disclosure, and social policy. *Development and Psychopathology*. 2000; 12:555–598. [PubMed: 11202034]
- Juster RP, Bizik G, Picard M, Arseneault-Lapierre G, Sindi S, Trepanier L, et al. A transdisciplinary perspective of chronic stress in relation to psychopathology throughout life span development. *Development and Psychopathology*. 2011; 23:725–776. [PubMed: 21756430]
- Juster RP, McEwen BS, Lupien SJ. Allostatic load biomarkers of chronic stress and impact on health and cognition. *Neuroscience and Biobehavioral Reviews*. 2010; 35:2–16. [PubMed: 19822172]
- Karatsoreos IN, McEwen BS. Psychobiological allostasis: Resistance, resilience and vulnerability. *Trends in Cognitive Sciences*. 2012; 15:576–584. [PubMed: 22078931]
- Karg K, Burmeister M, Shedden K, Sen S. The serotonin transporter promoter variant (5-HTTLPR), stress, and depression meta-analysis revisited: evidence of genetic moderation. *Archives of General Psychiatry*. 2011; 68:444–454. [PubMed: 21199959]
- Kaufman, J.; Zigler, E. The intergenerational transmission of child abuse and the prospect of predicting future abusers. In: Cicchetti, D.; Carlson, V., editors. *Child maltreatment: Research and theory on consequences of child abuse and neglect*. Cambridge University Press; New York: 1989. p. 129-150.
- Kim JE, Cicchetti D. Social self-efficacy and behavior problems in maltreated and nonmaltreated children. *Journal of Clinical Child and Adolescent Psychology*. 2003; 32:106–117. [PubMed: 12573936]
- Kim-Cohen J. Resilience and developmental psychopathology. *Child and Adolescent Psychiatric Clinics of North America*. 2007; 16:271–283. [PubMed: 17349508]
- Kim-Cohen J, Caspi A, Taylor A, Williams B, Newcombe R, Craig IW, et al. MAOA, maltreatment, and gene-environment interaction predicting children's mental health: New evidence and a meta-analysis. *Molecular Psychiatry*. 2006; 11:903–913. [PubMed: 16801953]
- Kim-Cohen J, Gold AL. Measured gene-environment interactions and mechanisms promoting resilient development. *Current Directions in Psychological Science*. 2009; 18:138–142.
- Lenneberg, E. *Biological foundations of language*. Wiley; New York: 1967.
- Lieberman AF. Infant-parent psychotherapy with toddlers. *Development and Psychopathology*. 1992; 4:559–574.
- Lupien, SJ.; Ouellet-Morin, I.; Hupbach, A.; Tu, MT.; Buss, C.; Walker, D., et al. Beyond the stress concept: Allostatic load - a developmental biological and cognitive perspective. In: Cicchetti, D.; Cohen, D., editors. *Developmental Psychopathology (2nd ed.), Vol. 2: Developmental Neuroscience*. Wiley; New York: 2006. p. 578-628.

- Luthar SS. The culture of affluence: Psychological costs of material wealth. *Child Development*. 2003; 74:1581–1593. [PubMed: 14669883]
- Luthar, SS. Resilience in development: A synthesis of research across five decades. In: Cicchetti, D.; Cohen, D., editors. *Developmental Psychopathology* (2nd ed.), Vol. 3: Risk, Disorder, and Adaptation. Wiley; New York: 2006. p. 739-795.
- Luthar SS, Barkin SH. Are affluent youth truly “at risk”? Vulnerability and resilience across three diverse samples. *Development and Psychopathology*. 2012; 24 in press.
- Luthar SS, Cicchetti D. The construct of resilience: Implications for intervention and social policy. *Development and Psychopathology*. 2000; 12:857–885. [PubMed: 11202047]
- Luthar SS, Cicchetti D, Becker B. The construct of resilience: A critical evaluation and guidelines for future work. *Child Development*. 2000; 71:543–562. [PubMed: 10953923]
- Lynch M, Cicchetti D. Patterns of relatedness in maltreated and nonmaltreated children: Connections among multiple representational models. *Development and Psychopathology*. 1991; 3:207–226.
- Lynch M, Cicchetti D. Maltreated children's reports of relatedness to their teachers. *New Directions for Child Development*. 1992; 57:81–107. [PubMed: 1484612]
- Maestripieri D. Early experience affects the intergenerational transmission of infant abuse in rhesus monkeys. *Proceedings of the National Academy of Sciences*. 2005; 102:9726–9729.
- Main, M.; Hesse, E. Parent's unresolved traumatic experiences are related to infant disorganized/disoriented attachment status: Is frightened and/or frightening parental behavior the linking mechanism?. In: Greenberg, M.; Cicchetti, D.; Cummings, EM., editors. *Attachment in the preschool years: Theory, research, and intervention*. University of Chicago Press; Chicago: 1990. p. 161-182.
- Majewska MD. Neuronal actions of dehydroepiandrosterone: Possible roles in brain development, aging, memory, and affect. *Annals of the New York Academy of Sciences*. 1995; 774:111–120. [PubMed: 8597451]
- Manly JT. Advances in research definitions of child maltreatment. *Child Abuse & Neglect*. 2005; 29:425–439. [PubMed: 15970318]
- Masten AS. Humor and competence in school-aged children. *Child Development*. 1986; 57:461–473. [PubMed: 3956320]
- Masten AS. Ordinary magic: Resilience processes in development. *American Psychologist*. 2001; 56:227–238. [PubMed: 11315249]
- Masten AS. Resilience in developing systems: Progress and promise as the fourth wave rises. *Development and Psychopathology*. 2007; 19:921–930. [PubMed: 17705908]
- Masten AS. Resilience in children threatened by extreme adversity: Frameworks for research, practice, and translational synergy. *Development and Psychopathology*. 2011; 23:493–506.
- Masten AS, Best K, Garmezy N. Resilience and development: Contributions from the study of children who overcome adversity. *Development and Psychopathology*. 1990; 2:425–444.
- Masten AS, Cicchetti D. Developmental cascades. *Development and Psychopathology*. 2010; 22:491–495. [PubMed: 20576173]
- Masten AS, Obradovic J. Disaster preparation and recovery: Lessons from research on resilience in human development. *Ecology and Society*. 2008; 13:9–24.
- Masten AS, Tellegen A. Resilience in developmental psychopathology: Contributions of the Project Competence Longitudinal Study. *Development and Psychopathology*. 2012; 24:345–361. [PubMed: 22559118]
- McCrary E, De Brito SA, Viding E. Research review: The neurobiology and genetics of maltreatment and adversity. *The Journal of Child Psychology and Psychiatry*. 2010; 51:1079–1095.
- McEwen BS, Stellar E. Stress and the individual mechanisms leading to disease. *Archives of Internal Medicine*. 1993; 153:2093–2101. [PubMed: 8379800]
- McGloin JM, Widom CS. Resilience among abused and neglected children grown up. *Development and Psychopathology*. 2001; 13:1021–1038. [PubMed: 11771905]
- McCrary E, De Brito SA, Viding E. Research review: The neurobiology and genetics of maltreatment and adversity. *The Journal of Child Psychology and Psychiatry*. 2010; 51:1079–1095.

- Mersky JP, Topitzes J. Comparing early adult outcomes of maltreated and nonmaltreated children: A prospective longitudinal investigation. *Children and Youth Services Review*. 2009; 32:1086–1096.
- Miller GE, Chen E, Parker KJ. Psychological stress in childhood and susceptibility to the chronic diseases of aging: moving toward a model of behavioral and biological mechanisms. *Psychological Bulletin*. 2011; 137:959–997. [PubMed: 21787044]
- Moffitt TE, Caspi A, Rutter M. Measured gene-environment interactions in psychopathology: concepts, research strategies, and implications for research, intervention, and public understanding of genetics. *Perspectives on Psychological Science*. 2006; 1:5–27.
- Moran PB, Eckenrode J. Protective personality characteristics among adolescent victims of maltreatment. *Child Abuse and Neglect*. 1992; 16:743–754. [PubMed: 1393733]
- Moss E, Dubois-Comtois K, Cyr C, Tarabulsy GM, St-Laurent D, Bernier A. Efficacy of a home-visiting intervention aimed at improving maternal sensitivity, child attachment, and behavioral outcomes for maltreated children: a randomized control trial. *Development and Psychopathology*. 2011; 23:195–210. [PubMed: 21262048]
- Nanni V, Uher R, Danese A. Childhood maltreatment predicts unfavorable course of illness and treatment outcome in depression: A meta-analysis. *American Journal of Psychiatry*. 2012; 169:141–151. [PubMed: 22420036]
- Nelson CA, Furtado EA, Fox NA, Zeanah CH. The deprived human brain. *American Scientist*. 2009; 97:222–229.
- Nikulina V, Widom CS, Brzustowicz LM. Child Abuse and Neglect, MAOA, and Mental Health Outcomes: A Prospective Examination. *Biological Psychiatry*. 2012; 71:350–7. [PubMed: 22030358]
- Noll JG, Trickett PK, Harris WW, Putnam FW. The cumulative burden borne by offspring whose mothers were sexually abused as children. *Journal of Interpersonal Violence*. 2009; 24:424–449. [PubMed: 18451100]
- O'Connor TG. Natural experiments to study the effects of early experience: Progress and limitations. *Development and Psychopathology*. 2003; 15(4):837–852. [PubMed: 14984129]
- Polanczyk G, Caspi A, Williams B, Price TS, Danese A, Sugden K, et al. Protective effects of CRHR1 gene variants on the development of adult depression following childhood maltreatment. *Archives of General Psychiatry*. 2009; 66:978–985. [PubMed: 19736354]
- Prinz RJ, Sanders MR, Shapiro CJ, Whitaker DJ, Lutzker JR. Population-based prevention of child maltreatment: The U.S. triple p system population trial. *Prevention Science*. 2009; 10:1–12. [PubMed: 19160053]
- Reynolds, AJ. Success in early intervention: The Chicago Child-Parent Centers. University of Nebraska Press; Lincoln: 2000.
- Robins RW, John OP, Caspi A, Moffitt TE, Stouthamer-Loeber M. Resilient, overcontrolled, and undercontrolled boys. *Journal of Personality and Social Psychology*. 1996; 70:157–171. [PubMed: 8558407]
- Rogosch FA, Cicchetti D. Child maltreatment and emergent personality organization: Perspectives from the Five-Factor model. *Journal of Abnormal Child Psychology*. 2004; 32:123–145. [PubMed: 15164856]
- Rogosch FA, Cicchetti D. Child maltreatment, attention networks, and potential precursors to borderline personality disorder. *Development and Psychopathology*. 2005; 17:1071–1089. [PubMed: 16613431]
- Rogosch FA, Dackis MN, Cicchetti D. Child maltreatment and allostatic load: Consequences for physical and mental health in children from low-income families. *Development and Psychopathology*. 2011; 23:1107–1124. [PubMed: 22018084]
- Rogosch FA, Oshri A, Cicchetti D. From child maltreatment to adolescent cannabis abuse and dependence: A developmental cascade model. *Development and Psychopathology*. 2010; 22:883–897. [PubMed: 20883588]
- Rutter M. Psychosocial resilience and protective mechanisms. *American Journal of Orthopsychiatry*. 1987; 57:316–331. [PubMed: 3303954]

- Rutter M. Proceeding from observed correlation to causal inference: The use of natural experiments. *Perspectives of Psychological Science*. 2007; 2:337–395.
- Rutter M. Resilience as a dynamic concept. *Development and Psychopathology*. 2012; 24:335–344. [PubMed: 22559117]
- Sameroff, AJ. Developmental systems: Contexts and evolution. In: Mussen, P., editor. *Handbook of Child Psychology*. Vol. Vol. 1. Wiley; New York: 1983. p. 237–294.
- Sameroff, AJ.; Chandler, MJ. Reproductive risk and the continuum of caretaking casualty. In: Horowitz, FD., editor. *Review of child development research*. Vol. Vol. 4. University of Chicago Press; Chicago: 1975. p. 187–244.
- Sapientza JK, Masten AS. Understanding and promoting resilience in children and youth. *Current Opinion in Psychiatry*. 2011; 24:267–273. [PubMed: 21546838]
- Schneider-Rosen K, Cicchetti D. The relationship between affect and cognition in maltreated infants: Quality of attachment and the development of visual self-recognition. *Child Development*. 1984; 55:648–658. [PubMed: 6723453]
- Sedlak, AJ.; Mettenburg, J.; Basena, M.; Petta, I.; McPherson, K.; Greene, A., et al. Fourth National Incidence Study of Child Abuse and Neglect (NIS-4): Report to Congress. U.S. Department of Health and Human Services, Administration for Children and Families; Washington, DC: 2010.
- Shalev I, Moffitt TE, Sugden K, Williams B, Houts RM, Danaese A, et al. Exposure to violence during childhood is associated with telomere erosion from 5 to 10 years of age: A longitudinal study. *Molecular Psychiatry*. 2012 doi: 10.1038/mp.2012.32.
- Shields A, Cicchetti D. Emotion regulation among school-age children: The development and validation of a new criterion Q-sort scale. *Developmental Psychology*. 1997; 33:906–916. [PubMed: 9383613]
- Shonkoff JP, Boyce WT, McEwen BS. Neuroscience, molecular biology, and the childhood roots of health disparities: Building a new framework for health promotion and disease prevention. *The Journal of the American Medical Association*. 2009; 301:2252–2259.
- Sroufe, LA. The place of development in developmental psychopathology. In: Masten, A., editor. *Multilevel Dynamics in Developmental Psychopathology Pathways to the Future: The Minnesota Symposia on Child Psychology*. Vol. Vol. 34. Erlbaum; Mahway, NJ: 2007. p. 285–299.
- Sroufe LA, Rutter M. The domain of developmental psychopathology. *Child Development*. 1984; 55:17–29. [PubMed: 6705619]
- Teicher M. Scars that won't heal: The neurobiology of child abuse. *Scientific American*. 2002; 286:68–80. [PubMed: 11857902]
- Toth SL, Pickreign Stronach E, Rogosch FA, Caplan R, Cicchetti D. Illogical thinking and thought disorder in maltreated children. *Journal of the American Academy of Child and Adolescent Psychiatry*. 2011; 50:659–668. [PubMed: 21703493]
- Trickett PK, Noll JG, Putnam FW. The impact of sexual abuse on female development: Lessons from a multigenerational, longitudinal research study. *Development and Psychopathology*. 2011; 23:453–476.
- Trickett PK, Noll JG, Susman EJ, Shenk CE, Putnam FW. Attenuation of cortisol across development for victims of sexual abuse. *Development and Psychopathology*. 2010; 22:165–175. [PubMed: 20102654]
- Tyrka AR, Price LH, Kao HT, Porton B, Marsella SA, Carpenter LL. Childhood maltreatment and telomere shortening: Preliminary support for an effect of early stress on cellular aging. *Biological Psychiatry*. 2010; 67:531–534. [PubMed: 19828140]
- Tyrka, AR.; Price, LH.; Marsit, C.; Walters, OC.; Carpenter, LL. Childhood adversity and epigenetic modulation of the leukocyte glucocorticoid receptor: Preliminary findings in healthy adults. *PlosOne*. 2012. <http://www.plosone.org/article/info:doi%2F10.1371%2Fjournal.pone.0030148>
- von Eye A, Bergman LR. Research strategies in developmental psychopathology: Dimensional identity and the person-oriented approach. *Development and Psychopathology*. 2003; 15:553–580. [PubMed: 14582932]
- Waddington, CH. *The strategy of genes*. Allen & Unwin; London: 1957.

- Walsh WA, Dawson J, Mattingly MJ. How are we measuring resilience following childhood maltreatment? Is the research adequate and consistent? What is the impact on research, practice, and policy? *Trauma, Violence, & Abuse*. 2010; 11:27–41.
- Wang, CT.; Holton, J. Total estimated cost of child abuse and neglect in the United States. *Prevent Child Abuse America*; Chicago, IL: 2007. <http://www.preventchildabuse.org>
- Wegman HL, Stetler C. A meta-analytic review of the effects of childhood abuse on medical outcomes in adulthood. *Psychosomatic Medicine*. 2009; 7:805–812. [PubMed: 19779142]
- Werner, H. Comparative psychology of mental development. International Universities Press; New York: 1948.
- Werner, E.; Smith, R. Overcoming the odds: High-risk children from birth to adulthood. Cornell University Press; Ithaca, NJ: 1992.
- Widom CS. Posttraumatic stress disorder in abused and neglected children grown up. *American Journal of Psychiatry*. 1999; 156:1223–1229. [PubMed: 10450264]
- Widom CS, DuMont K, Czaja SJ. A prospective investigation of major depressive disorder and comorbidity in abused and neglected children grown up. *Archives of General Psychiatry*. 2007; 64:49–56. [PubMed: 17199054]
- Yoshikawa H, Aber JL, Beardslee WR. The effects of poverty on the mental, emotional, and behavioral health of children and youth: Implications for prevention. *American Psychologist*. 2012; 67:272–284. [PubMed: 22583341]

Key Points

- Because the vast majority of maltreated 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.
- Not all maltreated children develop maladaptively. Some abused and neglected children exhibit resilient functioning despite the pernicious experiences they have encountered and the ignominious treatment they have received.
- Most of what is known about the pathways to resilient functioning has been gleaned from empirical investigations that have focused predominantly on psychosocial variables.
- In order to advance the understanding of resilience, it is essential that more longitudinal research is conducted that investigates the pathways to resilient functioning and that simultaneously examines biological and psychological systems.
- Determining the multiple levels at which change is engendered through the design and implementation of resilience-promoting interventions will provide insight into the mechanisms of change, the extent to which neural plasticity may be promoted, and the interrelations between biological and psychological processes in the development of resilient functioning.