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Maximizing resilience through diverse levels of inquiry: Prevailing paradigms, possibilities, and priorities for the future

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Abstract

The study of resilience has two core characteristics: it is fundamentally applied in nature, seeking to use scientific knowledge to maximize well-being among those at risk, and it draws on expertise from diverse scientific disciplines. Recent advances in biological processes have confirmed the profound deleterious effects of harsh caregiving environments, thereby underscoring the importance of early interventions. What remains to be established at this time is the degree to which insights on particular biological processes (e.g., involving specific brain regions, genes, or hormones) will be applied in the near future to achieve substantial reductions in mental health disparities. Aside from biology, resilience developmental researchers would do well to draw upon relevant evidence from other behavioral sciences as well, notably anthropology as well as family, counseling, and social psychology. Scientists working with adults and with children must remain vigilant to the advances and missteps in each others' work, always ensuring caution in conveying messages about the “innateness” of resilience or its prevalence across different subgroups. Our future research agenda must prioritize reducing abuse and neglect in close relationships; deriving the “critical ingredients” in effective interventions and going to scale with these; working collaboratively to refine theory on the construct; and responsibly, proactively disseminating what we have learned about the nature, limits, and antecedents of resilient adaptation across diverse at-risk groups.

The study of resilience reflects two core characteristics of developmental psychopathology (Cicchetti, 2006; Luthar, 1993; Masten, 2001; Rutter, 1987, 2000). The first is that it is fundamentally applied in nature with the core aim of understanding, and thereby ultimately promoting, forces that maximize well-being among those at risk. Resilience researchers' central mission is to illuminate processes that significantly mitigate the ill effects of various adverse life conditions as well as those that exacerbate these, and thus to derive specific directions for interventions and social policies.

The second major characteristic is that the study of resilience is informed by methods and evidence from multiple scholarly disciplines. In the past, resilience researchers have drawn primarily from other social and behavioral sciences with little consideration of biology, largely because there just was not enough knowledge about biological indices potentially implicated (Cicchetti & Curtis, 2006). Recent scientific advances have elicited several exhortations for concerted attention to biological processes (see, e.g., Curtis & Cicchetti, 2003; Luthar, 2006; Masten & Obradović, 2006), and we now have a beginning body of studies on the potential biological foundations of resilient adaptation (Charney, 2004; Curtis & Cicchetti, 2003; Davidson, 2000; Southwick, Vythilingam, & Charney, 2005).

Bearing in mind these two central characteristics of the field—its fundamentally applied and interdisciplinary nature—the task we have set for ourselves here is to consider how we can best study resilience toward maximizing well-being among individuals at risk. We begin by considering biology (including aspects of genetics as well as brain and physiological functioning), as this is what has been most visibly missing in prior resilience research. In discussions that follow, we consider the interface between the two spheres of science in terms of two critical questions. First, what might evidence on biological indices contribute for behavioral researchers invested in fostering resilient adaptation? Second, what are the limits or constraints in applying this body of evidence?

Contributions of Biology for Applied Behavioral Science on Resilience: Establishing the Importance of Early Environments

For resilience researchers, the single most significant contribution of biological evidence thus far lies in the powerful evidence of the robust effects of the early caregiving environment. In the section that follows, we briefly describe the impact of harsh early environments on genetics, brain structure and functioning, and neurobiological systems; details of such processes are beyond the scope of this paper and are described in depth in other papers in this volume and elsewhere (cf. Cicchetti & Curtis, 2006; Curtis & Cicchetti, 2003).

Modern neuroscience has now clearly established the phenomenon of neural plasticity, where there is structural and functional reorganization of the brain in response to environmental inputs. Harsh early environments lead to decreases in neural networks and brain size, whereas beneficial early interventions result in enrichment of networks among neurons and increase in brain size (Curtis & Nelson, 2003). Physical changes in the brain, in turn, can have substantive implications for exacerbating or reducing vulnerability to future psychopathology (Cicchetti & Curtis, 2006).

Neurobiological studies provide similar evidence. Reviewing the literature on the role of the hypothalamic–pituitary–adrenal (HPA) axis among animals and humans, Gunnar and her colleagues conclude that the availability of supportive, sensitive, and responsive caregivers during infancy and childhood is critical in buffering the individual, and the developing HPA axis, from the negative effects of adversity and stress (cf. Gunnar & Fisher, 2006).

Biological research has also pointed to the possibility of sensitive periods in early development. Across various animal species, separation from the mother after birth can lead to permanent changes in neurochemistry and endocrine responsivity and to problem behaviors (Post & Leverich, 2006). Powerful evidence in this regard is seen in studies by Suomi and colleagues with rhesus monkeys (Suomi, 2006). After an initial month in a neonatal nursery, the monkeys were reared for 6 months away from their biological mothers but in the presence of three to four other infants. These peer-only raised monkeys came to display several maladaptive behaviors including greater aggression, greater consumption of alcohol during “happy hour” situations, and greater biological stress reactivity.

“Natural experiments” among humans corroborate the critical importance of the early environment, as seen in findings on Romanian orphans reassessed at the ages of 6 and 11 years. Kreppner et al. (in press) found that if institutional development lasted longer than the first 6 months of life, there were substantial psychological and behavioral ill effects at both assessments several years later, suggesting damage to underlying biological systems. Other evidence suggests that this sensitive period can last up to 1 year of life, and even through early childhood (see Gunnar & Fisher, 2006; van IJzendoorn & Juffer, 2006), with adolescence representing another discrete sensitive developmental period, given major physiological

changes and substantial reorganization and maturation of the brain (e.g., Romer & Walker, 2007).

It should be underscored that biological findings such as these can be extremely compelling in arguing for investment of resources in preventive interventions for at-risk children and youth (Cicchetti & Valentino, 2006; Zigler, Finn-Stevenson & Hall, 2002). For decades, psychologists have noted the long-term negative effects of deleterious caregiving environments on children's psychosocial, behavioral, and academic functioning. Evidence based on people's self-reports or behaviors, however, could be dismissed by some as partly reflecting personal choices or motivations. More persuasive as "objective evidence" are findings that significant early adversity has substantial ill effects on the developing brain architecture as well as on the chemical and physiological systems implicated in coping. Equally powerful is evidence that sensitive and responsive caregiving can substantially *reduce* these negative effects of toxic stress (National Scientific Council on the Developing Child, 2005).

Understanding Processes Implicated in Resilience

Research on biological indices is also providing important new insights about processes implicated in resilience: those that can increase vulnerability as well as those that might confer protection (Cicchetti & Curtis, 2006; Curtis & Cicchetti, 2003; Rutter, 2002). We briefly review here some relevant evidence on both *mediators* (biological pathways serving as conduits as it were, between the experience of stress and the manifestation of maladjustment) and moderators, or biological factors that in interaction with risk, confer heightened vulnerability versus resilience.

Regarding mediating vulnerability processes, neuroscience research has implicated particular regions of the brain in problems of substance abuse. In their study of cocaine addicts, for example, Volkow and colleagues (2006) demonstrated that when watching videotapes of people using the drug, addicts' brains showed spikes in dopamine levels in the dorsal striatum region of the brain, implicated in habit learning and initiation of action. Accordingly, the authors suggest that medications to inhibit the release of dopamine in the presence of salient cues could be valuable in treating cocaine addiction. Similarly, a study on cigarette smokers indicated the potentially critical role of the insula, a prune-sized region under the frontal lobes (Naqvi, Rudrauf, Damasio, & Bechara, 2007). Injuries to the insula, detected via magnetic resonance imaging scans, were associated with significant decreases in people's urges to smoke (but did not decrease patients' desire to eat). Again, this suggests the possible value of smoking-cessation medications that target the insula.

Considering adjustment outcomes more broadly beyond substance abuse, various biological processes can affect individuals' capacities to modulate negative emotions, a critical capacity in being able to deal effectively with adversities (see Cicchetti & Curtis, 2006; Curtis & Cicchetti, 2003). One of these is neuroendocrinal in nature. As noted earlier, chronic exposure to stressful experiences tends to lead to excessive activation of the HPA axis, and the resultant elevation of the stress hormone cortisol (Charney, 2004). Hypercortisolism, in turn, can damage neurons and can affect the synthesis and reuptake of neurotransmitters as well as the sensitivity of receptors, and is potentially implicated in psychiatric disorders such as depression and anxiety (Goodyer, Herbert, & Tamplin, 2003; Southwick et al., 2005).

In terms of protective processes, conversely, there can be benefits in the combined effects of cortisol and dehydroepiandrosterone (DHEA), the second major secretory product of the HPA axis and one that can counteract the harmful effects of high cortisol, potentially serving "neuroprotection" (Charney, 2004). Similarly, oxytocin has been implicated in the suppression of the HPA axis, and it may contribute to positive social interaction by reducing stress and

anxiety, and increasing levels of interpersonal trust (Carter, 2005; Kosfeld, Heinrichs, Zak, Fischbacher, & Fehr, 2005).

Biological protection may also derive from the capacity to recover relatively quickly from negative events experienced (Cicchetti & Curtis, 2006). Such “rapid recovery” tendencies can be assessed by employing the emotion-modulated startle reflex, which is an involuntary response (a fast twitch of facial and body muscles) to a sudden and intense visual, tactual, or acoustic stimulus. Finally, hemispheric EEG activity can be implicated in the capacity to regulate emotions. In general, the right hemisphere of the brain participates more heavily in negative affect and the left hemisphere more in positive emotion. Individuals who show relatively high activation of the left prefrontal cortex report more positive affect both when at rest and in response to positive stimuli and show less negative emotion in responding to negative stimuli (Curtis & Cicchetti, 2003).

Aside from these various examples of processes that could mediate the effects of stress, biological indices can also be involved in moderating, interactive effects. This is strongly evident in the accumulating research on gene–environment interactions (G×E), work grounded in the belief that behavior is determined by an interdependence between a specific identified variation in the DNA sequence and a specific measured environment (Rutter, 2006a). Studies with animals have shown that early rearing experiences can significantly alter gene expression and this expression affects later behavior (Francis, Szegda, Campbell, Martin, & Insel, 2003; Parent et al., 2005). Powerful evidence in this regard is seen, again, in Suomi's work with rhesus monkeys. This group found that monkeys carrying the “short” allele of the 5-hydroxytryptamine transporter (*5-HTT*) gene clearly show problems in behavioral and physiological functioning, but only if they were reared by peers, rather than by their biological mothers, in early life. Their counterparts with the same “bad” genes (short 5-HTT alleles), who had unrestricted access to their biological mothers, displayed functioning comparable to (or even better than) peer-reared counterparts with the “good,” long 5-HTT allele.

There is now an accumulating body of research on G×E interactions among humans as well (see Moffitt, Caspi, & Rutter, 2006; Rutter, 2006a). Noteworthy in this regard are the studies by Caspi and his colleagues, which identified specific genes implicated in protecting some maltreated children from developing psychopathology in adulthood. The first of these studies showed reduced likelihood of antisocial behavior in the presence of a genotype that confers high levels of the monoamine oxidase A enzyme (Caspi et al., 2002), and in the second study, likelihood of developing depression was lower in the presence of a genotype conferring the efficient transport of serotonin (Caspi et al., 2003).

Discussing these G×E findings among animals and humans, Suomi (2006) emphasizes that findings can be interpreted in two ways: not mutually exclusive, but with decidedly different implications for prevention strategies. One interpretation is that particular sets of “good” genes protect against “bad” environments. The other is that “good” environments significantly buffer individuals with “bad” genes, reducing deleterious developmental outcomes. Statistical interaction effects (which are what current G×E evidence rests on; cf. Moffitt et al., 2006) do not point to the merits of one conclusion over another, but experimental studies with animals do provide support for latter interpretation. This is evident in Meaney and colleagues' (Francis, Diorio, Liu, & Meaney, 1999) findings that different social experiences can actually lead to substantial and enduring changes in the expression of genes. Among rodents, differences in mothers' licking and grooming of their pups, during the second week after birth, altered gene expression in the pups' brain regions that regulate stress reactivity. Moreover, these changes were not only life long but also were transmitted to the *next* generation of offspring, leading to the conclusion that even “subtle variations within a normal range of parental care can dramatically alter development” (Parent et al., 2005, p. 230).

Applying Biology to Foster Resilience: Possibilities and Limits

Genetics research might suggest, for some, the potential to guide diagnoses and treatment of particular disorders, as understanding of biological pathways has obvious implications for pharmacotherapy. To illustrate, acute lymphoblastic leukemia, the most common childhood cancer, can be cured with chemotherapy that includes the drug mercaptopurine. However, although most children have two good copies of the gene for the enzymes that metabolize this drug, about 1 in 10 patients have only one good copy; these children should receive only half the dose. In about 1 in 300 children, both the copies of the gene are faulty, and these children cannot handle more than a small fraction of the usual dose. Genetic testing is of obvious value in such instances in indicating, *a priori*, the optimal dose for a given affected child (cf. Ansari & Krajinovic, 2007).

Such knowledge about indicated pharmacotherapies does not, however, readily generalize to treating psychological problems given the complexity of processes implicated. Rutter (2006a, p. 202) has cautioned against widespread and mistaken assumptions that the identification of susceptibility genes for a mental disorder will lead to appropriate interventions for those most at risk, emphasizing that this “simply will not work because of the plethora of other risk factors, both genetic and environmental.” Resonant are Kendler's (2005, p. 1250) conclusions: “The strong, clear, and direct causal relationship implied by the concept of ‘a gene for ...’ does not exist for psychiatric disorders. Although we may wish it to be true, we do not have and are not likely to ever discover ‘genes for’ psychiatric illness.”

Turning next to neurobiological studies, these also can have treatment implications for psychological disorders as targeting specific biological risk factors can promote resilience to stress-induced mood and anxiety disorders (Southwick et al., 2005). To illustrate, DHEA administration could have significant antidepressant effects in some patients with affective disorders (Wolkowitz et al., 1999). Obviously, such evidence is critical toward developing more effective pharmacotherapy treatment.

Once again, however, the intervention implications for behavioral, developmental scientists are less clear. For example, scientists increasingly warn against the temptation to infer that when particular areas of the brain “light up” this implies particular psychological states (e.g., that amygdala activity implies fear or hippocampal activity implies memory retrieval) because multiple processes are implicated in activation of particular regions, and many neurological combinations can underlie a given emotion (see Wager, 2006). Furthermore, experts caution that brain scan studies can have biased findings because of methodological issues (Dumit, 2004; Uttal, 2001; Wade, 2006) including small samples (sometimes only four or five participants), confounds deriving from time of day, participants' anxiety levels, and rates at which stimuli are presented. While acknowledging the considerable contributions of brain scans (and also the potential for several biases in self-reports), Wager (2006) concludes that for assessing people's emotional experiences, self-report remains the “gold standard” (see also Shuler & Bear, 2006). The fact that few brain areas are dedicated to a single process implies a “serious challenge for those who would like, for example, to assess your brand preferences or your political affiliation from a brain scan. And isn't it easier just to ask?” (Wager, 2006).

To Wager's question we would add another: is it not much less expensive to ask? Building further on this last question, what is the likelihood that biomedical advances will be harnessed, in the near future, toward fostering resilience among at-risk individuals (which, in the ultimate analysis, is our central mission)? Even if resilience researchers were to demonstrate, as suggested (Curtis & Cicchetti, 2003; Luthar, 2006) that well-adjusted and distressed youth, matched on adversity experienced, show differing patterns of brain structure and functioning,

will these findings be harnessed in preventive interventions, expeditiously and widely reaching those in need?

Relevant to these questions is Gunnar and Fisher's (2006) thoughtful analysis of how basic research on stress neurobiology can inform future interventions for maltreated children. Such research could, for example, identify therapeutic components of effective interventions (e.g., whether gains occurred because of reduced hyperreactive stress reactions or improvements in corticolimbic pathways to emotion regulation), and could help to tailor interventions to child characteristics (e.g., children with low sympathetic tone respond poorly to authoritative parenting patterns). Given the state of mental health care today, however, is it realistic to expect that such insights will be used to substantially reduce adjustment problems among today's most vulnerable youth? Consider the following statistics: one in five children today has a diagnosable mental disorder, and these rates are higher among children in poverty; *as many as 75–80% of American children and adolescents who need mental health services do not receive them*. Even among those with health insurance, mental health needs remain unmet among 75% of youth (National Center for Children in Poverty, 2006). For the thousands of at-risk children and families lacking any kind of health insurance, it would seem that there is limited hope, in the foreseeable future, that these expensive technologies will be harnessed for individualized tailoring of mental health treatments according to their unique psychobiological profiles.

There are similar issues of pragmatics to be considered vis-à-vis the promise of genetics research. Grigorenko (2007) has persuasively argued that the consideration of genomics knowledge can be critical for special education, in terms of tailoring pedagogical interventions to children with particular needs. She advocates team-based approaches in schools, including the expertise of *educogeneticists*, experts who can interpret both the genetic and educational information available on a given child and provide guidance on how to maximize learning for that child. Undoubtedly, teams such as this would be invaluable. Once again, however, it is unclear whether they will serve children with the most pressing needs: those in poverty, attending schools where resources are already abysmally low and professional training and support for teachers is scant at best.

The question of time is also relevant: as we seek more precise knowledge about biological processes, what of today's young? It would be entirely unreasonable if not preposterous to question the value of basic science on biological processes associated with stress, but as Post and Leverich (2006, p. 1205) note, “the processes of specification could prove relatively unending (perhaps requiring decades)” before results are viewed as convincing. Similarly, even as Rutter presents persuasive arguments for future research on $G \times E$, he cautions that “it will take time (many decades and not just months or a few years) and we are only just learning how to pursue the long path from gene discovery to determination of the causal processes” (Rutter, 2006a, p. 5). Meanwhile, the needs of the day are profound, as is outlined in a later section of this article on critical directions for future work.

Finally, in considering applications of biological evidence to promote well-being, we will inevitably confront thorny ethical questions as evident in Illes and Raffin's (2005) discussions on pediatric neuroethics. If scanning prenatally or at birth suggests potential developmental disability, families could initiate early interventions; but what if such interventions are not available? Should the government pay for scanning of children to detect not only those at risk, but also those with extraordinary potential? What financial resources should be devoted to these public policy issues? With regard to genetics research, similarly, Garcia Coll, Bearer, and Lerner (2004) ask whether it might be most expedient to change the environment that triggers a given problem in the presence of a given set of genes, rather than intensively focusing on the genes themselves. Braun's (2004) questions are resonant: what kind of knowledge will

be produced by research focused on the genotype, and what will be done with this knowledge? What knowledge will NOT be produced as a consequence of the focus on genetics?

We must emphasize that our point here is by no means to minimize the value of biological research—the recent groundbreaking advances carry much promise for pharmacotherapies and basic science research; our goal is simply to consider needs and priorities for behavioral scientists who can help improve the outcomes of today's at-risk children and families. Our central messages are for those whose scholarship and research, based in an understanding of transactional, developmental systems, have significant potential to guide effective “policies and programs pertinent to the promotion of positive human development” (Lerner, 2004, p. 14), where so very much remains to be done to understand and change environmental risks that we know well to have a profound influence.

Biobehavioral Transdisciplinary Research: Potential Benefits and Limitations

With evidence on the breadth of biological and behavioral factors implicated in human adaptation, an obvious direction for resilience researchers, and one increasingly exhorted, is to engage in transdisciplinary collaborations with biologically trained researchers: “such collaborations must be treated as an imperative for the continued vitality of the science of resilience in future years” (Luthar, 2006, p. 749). Greenberg emphasizes the need for prevention researchers to be involved in transdisciplinary collaborations with neuroscientists: “a central task for the next decade is to understand in much greater detail the relations between the multiple levels of the biological substrate and ... resilience processes involved in cognitive processes and emotional regulation” (M. Greenberg, 2006, p. 4). This can be important for reasons discussed earlier, that is, to understand biological processes implicated in psychopathology and potentially to get some answers regarding constraints within which environmental influences might operate.¹

However, there are some down sides to such collaborations, and the most obvious is costs: transdisciplinary research involving teams of biological and social scientists can be very expensive, calling for as much as \$5 million over the course of a 5-year funding period, and representing an overall investment, thus far, of several hundred million dollars (Abrams, 2006). At this point, furthermore, questions remain about the impact of these novel integrations (Dingfelder, 2007); it is unclear how successful such initiatives will prove to be not only in advancing knowledge but also in actually facilitating substantive positive change (Abrams, 2006).

In a thoughtful critique O'Brien (2005) has acknowledged the potential benefits of large-scale transdisciplinary research to enhance our understanding of developmental processes, but has also pointed to potential limitations. Given the breadth of scope, some of these studies lack theoretical and methodological rigor; several constructs are measured, but the conceptual links among them can be questionable. Complex psychological constructs are often poorly measured (with parenting satisfaction, e.g., assessed by a single item asking how often the individual would rather be childless). Such poor measurement obviously precludes any meaningful conclusions about the significance of the construct relative to others in the study. Finally, although such studies could encompass balanced measurement of constructs from the biological, psychological, interpersonal, and cultural levels, they are all too often designed and directed by scientists from only one or two disciplines, whose interests and knowledge do not encompass these diverse domains.

¹Gottlieb (2004), however, cautions that whereas genes can undoubtedly play a constraining role, the limits of these constraints are wide and, moreover, cannot be specified in advance of accidents of nature or experimental manipulation.

Similar concerns around measurement are raised by Zucker (2006b) in a review of seminal large-scale, longitudinal studies on psychopathology trajectories over time. Robust relationships between early childhood externalizing problems and later alcohol use disorders have been found across many of these studies including the Michigan Longitudinal Study (Fitzgerald & Zucker, 2006) and the Dunedin Health and Development Study (Caspi, Moffitt, Newman, & Silva, 1996). At the same time, Zucker (2006a) notes that in most of the prospective studies carried out to date "... the socialization environment is virtually uncharacterized ... Thus, it is not possible to determine the degree to which contextual factors may be moderating or mediating the environment" (Zucker, 2006a, p. 631).

Another limitation of transdisciplinary collaborations is that they can entail costs to social science research and its application in effective interventions. Even as behavioral scientists attempt to bring more biology into their research, it is not clear that the biological researchers are making comparable shifts in their science. Rutter (2006a, pp. 11–12) notes that, "It is quite striking that behavioral genetics reviews usually totally ignore the findings on environmental influences. It is almost as if research by nongeneticists is irrelevant" (see also Lerner, 2004). In the realm of treatments, Post and Leverich (2006) emphasize that in the treatment of affective disorders, different medications are frequently used based on highly preliminary evidence. Despite ample evidence for the critical need for, and benefits of, psychoeducation and psychotherapy, people's social needs (e.g., vis-à-vis family relationships) receive scant attention, with various medical societies viewing the assessment of such domains as "extra" work, the purview of some group other than their own.

We emphasize again that our central point here is by no means to be zealous in "turf protection," or to use Rutter's (2006a) term, to be "psychosocial evangelists" (2006, p. 224); it is simply to raise this question: if we as a body of applied social and prevention scientists collectively gravitate toward focusing on biology, who will pursue what we have been doing? Would a substantial shift in focus not detract substantially from bringing to scale promising behavioral interventions, which could further change troubling phenomena that preventionists understand well?

Of course, the direction and growth of all of our research programs rests largely on prevailing funding priorities. Resources for social/behavioral sciences have always been low; these are particularly threatened in a time of tight budgets for health-related research (Tolan & Dodge, 2005). The National Institutes of Health (NIH) budget soared from \$13.6 billion in 1998 to \$27.1 billion in 2003, but then, despite small increases, the real growth abruptly stopped (D. S. Greenberg, 2006). There are clear implications for life sciences research, for which NIH is the financial mainstay. NIH funds for basic behavioral and social science reached \$1.052 billion in 2004; for 2007 the White House proposed a ground-losing \$1.050 billion. Moreover, whereas Congress has long been the champion of strong budget growth for NIH, "Congressional guardianship of health research has been lost in partisan bickering over weightier matters, such as war, terrorism, and tax policy" (D. S. Greenberg, 2006).

Current priorities in mental health research overwhelmingly emphasize biology, as evident in the themes highlighted in the National Institute of Mental Health's (NIMH) Strategic Plans and Priorities (NIMH, 2007). The stated overall NIMH mission "is to reduce the burden of mental and behavioral disorders through research on mind, brain, and behavior." Achieving this, especially in a time of fiscal restraint, has called for setting strategic priorities for the institute, and in setting these priorities, the types of issues highlighted on the institute's Web site (<http://www.nimh.nih.gov/strategic/strategic-planmenu.cfm>) are "the neurobiology of adolescence," "new tools, such as high throughput genotyping or 2-photon imaging," and "tools to identify the major candidate genes, cells, and systems involved in emotion, cognition, and behavior."

Again, this heavy prioritizing of biology in mental health obviously comes at the cost of other research initiatives, and some of what is sacrificed is likely to be critically important. Consider, for example, research on marriage. There are profound risks, for both adults and children, if primary interpersonal relationships are acrimonious, lacking in stability and commitment (Rutter, 2006a). Yet enormous gaps remain in the use of relevant research to foster resilience. Noting the low rates of stable marriages among low-income women, for example, Karney and Bradbury (2005, p. 174) note the “unfortunate irony ... that just as this research is needed to inform policy, funding for research on marital outcomes has been explicitly removed from consideration at the National Institute of Mental Health, formerly the major source of support for marital research.”

Some might argue that it is appropriate to deemphasize themes such as marriage because despite several decades of research on this topic, divorce rates remain high in the United States. Rather than indicating limited value of research in this domain, however, continued strife in adult relationships might rest, in part, on chronic stressors of contemporary American life that inevitably compromise people's well-being, and thus their relationships. These “national stressors” include limited insurance for physical and mental health problems, lack of paid leave to care for children and the elderly, low access to quality child care, high rates of poverty, and high prevalence of community violence. Instead of reducing research on close relationships, therefore, it would seem prudent to promote studies on how it is that some adults can sustain the emotional and physical energy necessary to maintain close, healthy partnerships, critical if not indispensable for overall resilient adaptation (Luthar, 2006), despite personal stressors as well as these redoubtable additional stressors of a national character.

In setting priorities for future research, finally, it is important that our choices rest on what we have already learned about different types of diseases. Discussing the relative benefits of genomics research for ameliorating major public health problems, Merikangas and Risch (2003) argue that the cost- and labor-intensive tools of molecular genetics be prioritized for diseases that (a) are likely to have implicated genes and (b) cannot currently be prevented or treated with environmental changes, such as breast cancer or Alzheimer disease. Concomitantly, they recommend that preventive, public health efforts be intensively focused on disorders that are relatively common, linked with high levels of disability, and known to be significantly affected by environmental factors. To illustrate, the authors note that the dramatic reduction in cigarette use in America over time has resulted from widespread social changes including media campaigns and increased cigarette prices. For such high-risk health behaviors, accordingly, they argue for prioritizing research on the reasons for gaps between what people know about the dangers involved and their failure to incorporate this knowledge into their everyday lives (Merikangas & Risch, 2003).²

Beyond Biology: Collaborations Spanning Multiple Disciplines

We began this paper by focusing on the biology because this is what has been notably absent in prior studies of resilience, but there are many other disciplines within the behavioral and social sciences that can usefully inform developmental studies of resilience. In this section, we briefly outline below some possibilities that merit careful consideration.

Perhaps most importantly, we need greater collaboration with *qualitatively trained researchers*, as this is critical for meaningful hypothesis testing of processes in resilience (Luthar, Cichetti, & Becker, 2000). Developmental science typically involves tests of discrete hypotheses, but this presupposes that we know what to test. Rutter (2006b) emphasizes that qualitative data can point to new insights into protective processes, as Hauser, Allen, and

²For rebuttals from a distinguished group of scientists studying biological processes in addiction, see Berrettini et al. (2004).

Golden's (2006) narrative-based findings highlight adolescents' sense of agency, self-reflection, and investment in relationships, such attributes warrant tests, in future quantitative analyses, of their protective role relative to "competing constructs" in resilient functioning.

Commenting on a series of studies involving mixed methods research (Weisner, 2005), Huston (2005) has highlighted the various ways in which qualitative methods can contribute to developmental research: by revealing critical topics and contents for quantitative studies, by providing different points of view about the same questions, and by helping to understand quantitative findings. The value in revealing critical topics for assessments is exemplified in Gibson-Davis and Duncan's (2005) report on the New Hope antipoverty effort. Initial quantitative assessments had not included several dimensions later learned to be crucial for understanding program impact, such as the presence of troubled children and inflexibility in parents' jobs.

The potential to reveal different interpretations of the same phenomena is evident in the report by Kling, Liebman, and Katz (2005) on the Moving to Opportunity (MTO) experiment, where public housing residents, mostly single mothers of ethnic minority backgrounds, were helped to move to lower poverty neighborhoods. MTO movers did *not* show discernible gains in terms of less welfare use or higher earnings. However, qualitative data revealed substantial gains in freeing mothers from the highly constraining effects of fear of crime. While still in public housing, the dangers of ghetto life had led mothers to isolate themselves and organize their entire lives around protecting their children. Whereas moving to safer neighborhoods may not have resulted in increased earnings, qualitative data illuminated other substantial benefits for the mothers' lives, and thus their enhanced potential for future adaptive functioning across professional and parenting roles.

Qualitative research can promote understanding of processes not only among groups commonly thought of as nonmainstream Americans (people of color and those in poverty), but also for those that we have long assumed to understand well, calling into sharp question what "everybody knows" in science (Weisner, 2002). This is exemplified in recent work with children of highly educated, Caucasian, white-collar professionals, a group commonly spoken of as "low risk" by developmental scholars, yet now known to manifest elevated trouble across various domains, notably substance use (Luthar & Latendresse, 2005). Ethnographic data have been invaluable in pointing to potential stressors for these youth and permitting tests of their relative salience, revealing, for example, that "overscheduling" in extracurricular activities is unlikely to be a major risk factor; far more strongly implicated is perceptions of criticism and overly high expectations from adults (Luthar, Shoum, & Brown, 2006).

Aside from qualitative research, another discipline that we could usefully draw upon is *economics*, as illustrated by Foster (2002), who notes that in relation to resources pertinent to children, the economics model "treats the family as a 'little factory'" (p. 1905). Among the various implications for studying children, such a model would imply that the well-being of a child must be examined in the context of the overall well-being of the family. To illustrate, evidence on after-school activities shows that these can have psychological, behavioral, and academic beneficial effects for children. At the same time, there are potential consequences rarely considered by developmental psychologists that could collectively indicate "diminishing marginal returns" to the family system. These would include costs to parents' time, finances, and psychological and physical energy, and associated ramifications for the functioning of the family system as a whole.

Enhanced attention to family processes is indicated also by the *family systems* literature. Distilling the evidence, Walsh (2006) delineates specific three critical "keys to family resilience": family belief systems such as those affirming of family members, structural/

organizational patterns that include flexibility and adaptive changes in routines, and communication processes reflecting clarity and consistency of messages. The author also provides practical guidelines that clinicians can use to foster these key components in the context of multisystemic, community-based, flexible service delivery patterns: decreasing risk factors (e.g., minimizing overload of stress) reducing negative chain reactions (by altering maladaptive coping strategies); strengthening positive family processes (reorienting after life stressors); and bolstering family and individual efficacy.

Recent work in *counseling psychology* suggests novel approaches toward reaching “manifestly resilient” individuals: those who are behaviorally competent (academically or professionally) but struggle with inner emotional distress, yet resist seeking formal help (Luthar, 1991). Asian American college students, for example, tend to perform well academically but can be reluctant to admit unhappiness because of cultural stigmas and concerns about “losing face” (Yeh, Inman, Kim, & Okubo, 2006). Acknowledging these impediments, Chang and Yeh (2003) developed, implemented and evaluated an anonymous internet-based online support group for Asian American college students to discuss personal and interpersonal problems. Facilitated by an Asian American, the group lasted 4 weeks; over 100 students attempted to join and with daily participation, there were *no* dropouts.

Finally, it is critical that developmental scholars committed to fostering resilience learn more from *social psychology* work on discrimination and prejudices: potent “risks” affecting thousands of youth and families. Important in this regard is the work of Banaji and her colleagues (Banaji, Lemm, & Carpenter, 2004; Baron & Banaji, 2006) on implicit stereotypes, which are unconscious and contrast greatly from views that individuals experience consciously and express overtly. The pervasiveness of implicit prejudices, their considerable effects on human behavior, and the fact that people are unaware that they have them, jointly imply that they could substantially affect decisions in critical arenas like service delivery and in education.

Sensitizing people to such implicit biases could be particularly beneficial for individuals who work with children and youth of color, as seen in Spencer and colleagues' programmatic research. These authors emphasize that given racial stereotyping and prejudices, adults often overlook many instances of competence among these youngsters, thus denying them a sense of agency and efficacy (Spencer et al., 2006; Spencer & Harpalani, 2004). Such experiences with adults occur particularly often for Black boys who, because of relatively early physical maturity and negative stereotypes, are frequently perceived as threatening by adults and thus treated as fitting profiles for expected deviance. There is obvious potential for such prejudices to occur among teachers at school, and negative teacher expectations can profoundly affect students' outcomes over time (Raver, Garner, & Smith-Donald, in press).

A central task for resilience researchers, therefore, and one in which we have made limited progress thus far, is to attend more closely to contextual factors, drawing upon insights from various social science disciplines outside of traditional developmental psychology. Even as we are several years into the new millennium, there is still little commitment to broad, multilevel analyses of youth competence; careful understanding of the experiences of individuals in their own contexts of families, peers, and societal expectations will be essential to understanding resilience and devising effective interventions to promote it (Spencer et al., 2006).

Resilience Across the Life Span: Work With Adults

Resilience among children has now been studied for well over five decades; recent years have brought attention to this construct among adults as well. An exhaustive review of themes across the two literatures is beyond the scope of this article. However, we briefly appraise salient differences and similarities between them, continuing in the spirit of multiple levels of inquiry but perhaps more importantly, to foster theory development. As with any scientific discipline,

the maturation of science on resilience requires consideration of central tenets across various viewpoints, methods, and populations, and based on this diversity of approaches, striving for consensual agreement on definitions of major constructs and models of causes and effects (Pedhazur & Schmelkin, 1991).

The first set of differences between the existing developmental and adult literatures has to do with definitions of resilience, notably, how “doing well” is defined. Developmental researchers have traditionally emphasized overt behavioral success as judged by others, that is, “adaptive behaviors” as rated by teachers, classmates, friends, parents, or others. Sometimes considered are children's psychological symptoms but no attempts, to our knowledge, to ask them about their own feelings of happiness or psychological well-being. By contrast, adult resilience researchers typically focus on aspects of the individuals own distress or happiness; less commonly sought are *others'* opinions on whether the person is “doing well” (as a good spouse or parent, e.g., or a colleague at work). In future work, it would be useful if definitions of adults' resilience were expanded to consider significant others' judgments of their competence and responsiveness in major life roles, as it would be to consider whether children experience subjective happiness in addition to conforming to adults' expectations and having low symptoms (Luthar, 2006).

A second major difference surrounding definitions is whether resilience should be conceptualized only as positive adaptation following adversity, or also, as recovery following previous adaptive failures. Developmental theories encompass both; as Rutter (2006b, p. 8) notes, resilience “sometimes reflects later recovery, rather than an initial failure to succumb.” By contrast, some adult researchers, such as Bonanno (2005), suggest that positive adjustment following trauma is distinct from recovery. This conclusion apparently derives from findings of different trajectories of distress among adults following acute stressors: individuals classified as “resilient” are those who experience initial, brief spikes in distress but generally keep functioning well, whereas those called “recovered” reflect moderate to severe disruptions in functioning that only gradually come back to pretrauma levels (e.g., Bonanno, Moskowitz, Papa, & Folkman, 2005).

Findings of different degrees of postexposure distress, across time, do not necessarily establish that the trajectories are *qualitatively* different, however; they could simply reflect different levels on a continuum of relative resilience. In other words, after exposure to a trauma, the “resilient” group might just have had better overall functioning than the “recovered” group who faltered for a while, possibly because of more quick and ready access to various buffering resources. To establish that the two groups are qualitatively different would necessitate evidence that they have distinct sets of predictors or consequences (Cronbach & Meehl, 1955; Meehl, 1977). Without such evidence of distinct correlates, the groups could simply reflect a mathematically derived dichotomy based on relative distress scores over time.³

A third major difference between the adult and developmental literatures concerns implications that resilience resides largely within the person. Developmentalists explicitly emphasize that resilience derives from diverse forces, including aspects of the proximal and distal environments; even “protective child traits” such as good self-regulation or high self-efficacy are themselves affected by the quality of relationships in the family and community (for reviews, see Luthar, 2006; Luthar & Zelazo, 2003). Obviously, the relative contributions of one's personality characteristics versus environmental assets changes with development, but

³In the adult literature, some researchers have in fact suggested that “resilience” and “recovery” do have similar correlates, as seen in research on positive emotions: “Taken together, theoretical and empirical work indicate that positive emotions may have both a protective and restorative function, guarding individuals from negative emotions as well as quelling the aftereffects of such emotions” (Ong, Bergeman, Bisconti, & Wallace, 2006, p. 731).

even the well-being of adults depends substantively on access to supportive relationships as indicated by research on humans and animals alike (Engh et al., 2006; Taylor, 2007).⁴ Thus far, the adult literature has focused largely on individuals' personal attributes—personality traits and biology (cf. Bonanno, 2004; Yehuda, Flory, Southwick, & Charney, 2006)—with relatively little commentary on the degree to which these attributes are themselves dependent on external assets such as supportive relationships.

In a fourth difference, developmental scholars are extremely cautious about offering claims about the “prevalence” or rates of resilience, for this obviously depends on the criteria used to define resilience. Children facing adversities can excel in some areas (e.g., at school) but be quite troubled in other important spheres (such as relationships with peers; see Luthar, 2006). The adult literature, by contrast, reflects several statements about rates of resilience. To illustrate, following the September 11 terrorist attacks, it was concluded that “over 65% in the New York metropolitan area were resilient” (Bonanno, 2005, p. 135), with resilience defined as one or no posttraumatic stress disorder (PTSD) symptoms in the 6 months following the attack. There was insufficient consideration of other important domains of functioning that could be profoundly impaired by this type of trauma (cf. Nandi, Galae, Aheen, & Vlahov 2005; Vlahov et al., 2004; Walsh, 2006), including alcohol or drug abuse, troubled interpersonal relationships, conflicts in work functioning, and loss of jobs and homes (especially as many families were forced to relocate following the attacks, thus missing in this study's sample, recruited by telephone 6 months after September 11).

A fifth and final difference lies in attention to contextual influences: developmentalists are keenly attuned to societal inequities based on race/ethnicity, income, gender, or access to treatment services; considering these differences is, once again, critical in any conclusions about “rates of resilience.” To return to the example of postdisaster resilience, ethnic minority individuals generally show particularly high distress after major disasters as do people of low socioeconomic status (Norris et al., 2002). Following the World Trade Center attacks, Weissmann and colleagues (2005) reported that PTSD rates were much higher among women than men (13.2 vs. 8.4%), even though women had lower rates of exposure to the attacks than men. The highest rates of PTSD were among Hispanic women (15%), an effect mediated by their social and economic adversities such as living alone and having little education or income.

In future work on resilience among both adults and children, it is critical that we all carefully attend to the conclusions offered about the nature or “rates” of resilience, as political leaders, legislators, and policymakers are highly influenced by our research in considering resource allocation (Luthar & Cicchetti, 2000; Zigler et al., 2002). Consider, for example, the foci of the recent federally funded Defense Graduate Psychology Education Program to train civilian and military psychologists in evaluating and treating combat-experienced service personnel (APA Education Policy Office, 2006). Prominent among these is, “Psychology of trauma and resilience, with a specific focus on issues such as PTSD, Acute Stress reactions, and suicide.” The potential to affect major policy decisions renders the need for extreme caution in scientific statements suggesting the reduced use of “wholesale prophylactic psychological interventions in the aftermath of trauma” (Bonanno, Galea, Bucciarelli, & Vlahov, 2006, p. 185). For those of us whose scholarship can significantly affect social policy, with real implications for decisions to enhance or reduce external resources for the most vulnerable groups, it is imperative to maintain the very highest standards of self-scrutiny in our scientific research and conclusions (Kitcher, 1985; Sarason, 1993).

⁴In old age as in early childhood, aspects of the environment, including nonsocial aspects such as material and physical resources, come to constitute critical components of resilient adaptation (Greve & Staudinger, 2006).

Critical Future Directions: Understanding and Improving Relationships

Even as applied developmental researchers incorporate knowledge from other scholarly disciplines, it must be underscored that there are urgent needs in spheres of science that lie squarely within our domain of expertise: mitigating potent environmental risks. It is quite clear that the single most deleterious environmental risk is the sustained presence of neglect and abuse, and conversely, committed, loving relationships have high protective potential. We summarize below convergent conclusions in this regard from multiple domains of science.

The profound effect of maternal care on offspring has emerged as “a stunningly common theme in biology. Not only are maternal effects on defensive responses not unique to mammals, they are not even unique to animals. Plants also show maternal effects ...” (Cameron et al., 2005, p. 850). Among animals as well as humans, Meaney(2001, p.1181) concludes, “Chronic stress increases anxiety and fearfulness and, thus, decreases maternal responsivity, which in turn influences the development of stress reactivity in the offspring.” In discussing the $G \times E$ effects of various environmental risk indices, Rutter (2006a) notes abuse or neglect are “unambiguously negative” (p. 205), whereas the net effects of other risks may depend on other coexisting circumstances, both genetic and environmental.

The National Scientific Council on the Developing Child (2004), which has a distinguished set of members with expertise ranging from studies of human attachment, economics, and social policy to neurobiological bases of stress reactivity and cell and structural biology, reported the following:

Stated simply, relationships are the “active ingredients” of the environment's influence on healthy human development. They incorporate the qualities that best promote competence and well-being—individualized responsiveness, mutual action-and-interaction, and an emotional connection to another human being, be it a parent, peer, grandparent, aunt, uncle, neighbor, teacher, coach, or any other person who has an important impact on the child's early development.

In the literature on resilience among children and adults, a review of almost half a century of research led to the conclusion that “Resilience rests, fundamentally, on relationships” (Luthar, 2006, p. 780). Prolonged acrimony, hostility, neglect, or indifference in primary, proximal relationships profoundly impair the chances of resilient adaptation. Conversely, strong relationships with those in one's proximal circle serve vital protective processes, for children as well as adults. Intervention studies “provide some of the most compelling evidence for the power of the family environment for individual resilience” (Masten & Obradović 2006). Webster-Stratton and Reid (2006, p. 633) conclude that “parent intervention continues to be the single most effective avenue for preventing conduct problems and promoting social competence in young children” (see also Reid & Eddy, 1997).

However, so much remains to be done. Consider the following statistics on the pervasiveness of intentional acts of hurt to others:

1. Since 2001 the rate and number of children who received an investigation for child abuse or neglect in the United States has increased. In 2004, the rate was 47.8 per thousand children, resulting in an estimated 3,503,000 children who received an investigation; for 2001, the rate was 43.2 children: an estimated 3,136,000 investigated instances (US Department of Health and Human Services, 2006).
2. Nationally, 64.5% of child victims experienced neglect (including medical neglect), 17.5% were physically abused, 9.7% sexually abused, and 7.0% emotionally or psychologically maltreated (US Department of Health and Human Services, 2006).

3. Bullying among children and adolescents has negative long-term sequelae; in America, it is estimated that 10–20% of students have either been bullies, victims, or both (Sampson, 2002).
4. Despite the Hate Crime Statistics Act passed by Congress in 1990 (US Department of Justice, 2005), such crimes have shown no discernible reduction. In Los Angeles, for example, authorities indicated that hate crimes increased 34% in 2005 over the previous year (Archibold, 2007).⁵
5. In terms of violence between intimate partners, a national study found that 29% of women and 22% of men had experienced physical, sexual, or psychological violence during their lifetime (Coker et al. 2002).

Specific Tasks for Those Committed to Fostering Resilience

Knowing as we now do that abusive relationships, especially those early in life, profoundly threaten resilience, there is a prodigious set of tasks that lie ahead of us. Most urgently, we must focus on expanding efforts to help at-risk parents avoid maltreatment and display supportive parenting. This in turn will require concerted attention to (a) refining conceptual models of preventive interventions and (b) expanding our efforts to bridge science and practice.

With regard to refining models of intervention, we need to specify “key beneficial ingredients,” drawing on lessons from existing prevention programs. The literature contains evidence on many successful interventions that have emanated from distinct conceptual frameworks. To illustrate, Webster-Stratton's the Incredible Years intervention is founded on *social learning and attachment models* of development, and provides training to enhance parenting skills, fostering children's school readiness, and parents' coping with their own depression and marital problems (Webster-Stratton, 2001). Lieberman's toddler–parent psychotherapy, also used by the Mt. Hope Family Center group (Toth, Rogosch, Manly, & Cicchetti, 2006), involves changing the *quality of attachment* between mothers and young children. Dozier's Attachment and Biobehavioral Catch-Up Study for infant and toddlers (Dozier et al., 2006) and Fisher's Multidimensional Treatment Foster Care for Preschoolers (Fisher, Burraston, & Pears, 2005) both target foster parents' abilities to *help children modulate stress and arousal*, the former by improving caregivers' sensitivity to signals of infants' distress, and the latter by supporting caregivers to respond contingently to child behaviors.

Although clinical trials from each of these relationship-based interventions have shown promising results, two important and related questions must be addressed toward optimizing prevention in the future. The first involves understanding *mechanisms of change*: do these interventions each touch largely distinct aspects of mothers' functioning, or is there overlap in the underlying dimensions changed? The second entails a *prioritization of critical targeted dimensions*: what are the relative long-term gains of treatment components addressing different aspects of maternal functioning? Might there be synergistic benefits of combining salient ingredients across different effective interventions, ensuring, for example, provision of (a) information about child development, (b) help with concrete challenges around housing, employment, and health care, and (c) emotional support to mothers? The potential value of such integrative approaches is exemplified in Ammerman and colleagues' (2005) Every Child Succeeds Program, which combines in-home cognitive behavior therapy for depressed mothers with a home visiting component. Initial results have been impressive, with pre- and postintervention changes seen in maternal depression, mothers' reports of closeness to their children, and improvements in children's adaptive functioning (Ammerman et al., 2005).

⁵This is by no means just a phenomenon restricted to urban poverty. In Guilford College, Greensboro, a Quaker liberal arts college known for high tolerance for people's backgrounds and lifestyle choices, a group of 5 to 15 football players beat up three Palestinian students, leading to injuries ranging from concussions to nerve damage (Huffman, 2007).

As Post and Leverich (2006) suggest, there are also other creative, “face valid” interventions that merit systematic attention in clinical trials for parents, such as having someone available to provide brief respites at times when the mother is exhausted, demoralized, and depressed (much like sponsors do in Alcoholics Anonymous). Such supports could be relatively easily subsumed in existing infrastructures, as in Zigler's “School of the 21st Century,” a comprehensive program built into existing school systems providing not only child care but also support group meetings for parents (Zigler, Finn-Stevenson, & Stern, 1997).

The importance of distilling and prioritizing the most potent components of family-based interventions is seen in research on divorce. Reviewing the literature, Emery, Otto and O'Donohue (2005) have ranked, in order of relative salience, consistent predictors of children's well-being following parents' divorce: (a) a good relationship with an authoritative residential parent, (b) low conflict between parents, (c) economic security, and (d) a good relationship with an authoritative nonresidential parent. For those of us committed to fostering resilience, we must work toward such specification of key components in successful parenting interventions, to allow us to take, to scale, beneficial interventions that could reduce the distressingly high rates of child maltreatment and neglect.

Going to Scale: Bridging Science and Practice

As we think about multiple levels of analysis in the work on resilience, there is a pressing need for more collaborations with service providers toward bridging the science and practice of prevention and treatment. Noting the benefits of preventive interventions, Weisz, Sandler, Durlak, and Anton (2005) argue for an integrated model involving (a) identification of programs effective for a broadened array of disorders; (b) understanding the role of culture and ethnicity in intervention effectiveness; clarifying the (c) the conditions under which programs do and do not work, as well as (d) mechanisms underlying treatment effects; (e) testing interventions in real world contexts; and (f) making tested interventions accessible and effective in community settings. Similarly, Jane Knitzer (1982), pioneer in the field of children's mental health, emphasizes the urgent need to design and test interventions in real world settings. “The risk factors and their consequences are widely known and are routinely used in describing both research and programs.... The sad truth is that far more is invested in research to understand the consequences of risk factors for young children and parents than in designing, testing, and taking to scale interventions that might change the all too predictable negative trajectories” (Knitzer & Cohen, 2007, p. 358).

Particularly important is reorganizing systems of service delivery that continue to be highly fragmented, forcing families to negotiate multiple settings to obtain essential services (Skinner, Matthews & Burton, 2005). Discussing future directions in this regard, Knitzer emphasizes the largely unrealized potential for using primary care settings (including Head Start programs) to provide multiple critical services: supporting caregivers, especially those with mental health difficulties, in their parenting roles, and involving staff in early detection of children's problems with appropriate training and support (Knitzer & Cohen, 2007). The authors also note the value of bringing preventive efforts to environments where high-risk parents are overrepresented such as shelters, courts, and prisons, as well as clinics providing substance abuse services.

Beyond integration of service delivery systems, Knitzer and Cohen emphasize the vital importance of ensuring strong alliances with parents in community settings, using *relationship-based interventions* to target their distress in addition to attending to basic needs of food, housing, and health care. Resonant with their recommendations is empirical evidence that among mothers seeking mental health services for their children, 61% of the women themselves met criteria for a current Axis I diagnosis: most commonly depression and anxiety (Swartz et al., 2005).⁶ However, two-thirds of these women with current diagnoses were receiving no

treatment, and untreated maternal mental illness, unsurprisingly, was linked with higher levels of disturbance among children. Knitzer's emphasis on relationship-based interventions, similarly, is consistent with the following conclusion from the collaborative National Scientific Council on the Developing Child (2005): "The rich and growing scientific understanding of how individuals cope with stress should be used to strengthen a range of informal supports and formal services to bolster parents who are struggling to manage the challenges of raising their children. These could be provided through varying combinations of extended family support, community-based volunteer efforts, flexible workplace policies, and publicly funded programs."

Clinical trials provide further supportive evidence. Among low-income, drug abusing mothers, participating in a supportive, insight-oriented 6-month parenting intervention, the Relational Psychotherapy Mothers Group (RPMG; Luthar & Suchman, 2000), resulted in significant improvements among the women and their children at the end of treatment. In contrast, when participants were assessed 6 months after this treatment ended, gains previously seen had not only disappeared but in some cases, were even *reversed* (Luthar, Suchman, & Altomare, 2007). The RPMG intervention was designed to provide mothers with regular, dependable connectedness with empathic other women and a safe, supportive context in which to address personal and parenting concerns. In all likelihood, its abrupt withdrawal led to women's heightened awareness of what was all too absent in their personal lives and thus to increased distress (Luthar et al., 2007).

In addition to enhancing relationship-based interventions for at-risk mothers, we need to expand interventions for caregivers other than parents. There are clear benefits to early child care programs with supportive caregivers who foster learning as they interface with parents (see Zigler et al., 2002), and beyond advocacy efforts to increase the number of such programs, there is value, again, in bringing extant knowledge to bear in improving the *quality* of caregiver-child interactions. Particularly relevant in this regard are the promising treatments developed by Dozier et al. (2006) and Fisher et al. (2005), to promote foster parents' abilities to help their children regulate their emotions. Given evidence of treatment gains, much could be gained by providing such "training" to caregivers in child care centers, such as Early Head Start and Head Start, and systematically testing the benefits of such interventions.

For older children and adolescents, the need to harness teachers as protective resources in-resilience is increasingly noted but still infrequently addressed (see Luthar, 2006). There is recurrent evidence of the powerful benefits of supportive school teachers, not just for children's social and emotional adjustment but also for their academic performance (see Pianta, 2006). Although there are many rigorously evaluated programs addressing structure and discipline in the classroom, there are currently few programs built around the notion of strong attachments to teachers. Specific suggestions for interventions of this nature have been offered (e.g., Luthar & Zelazo, 2003; Noam & Hermann, 2002; Pianta, 1999) but little has been done to test and evaluate such attachment-based interventions in schools (Raver et al., in press). A related important direction is to increase programmatic, high-quality mentorship by adults outside of school. Three million young people are in formal one-to-one mentoring relationships in the United States, with the effects of mentoring most beneficial when "the two people involved feel connected—that there is mutual trust and a sense that one is understood, liked, and respected" (Rhodes & DuBois, 2006, p. 3).

Finally, for older youth, interventions must carefully attend to the power of relationships with peers. As Dodge, Dishion, and Lansford (2006) note, public and private programs as at-risk

⁶Among women enrolled in Early Head Start, 65% report symptoms of depression and more than 1 in 10 report clinically significant depression; 10% of all children live with parental substance abuse (Knitzer & Cohen, 2007).

youth frequently segregate deviant teens from their mainstream peers, but this practice can have harmful effects as young people often learn to become deviant by interacting with deviant peers. These authors provide various suggestions for alternative treatment approaches including family-centered treatment, social skills programs in schools, and community programs toward reducing the formation of gangs (Dodge et al., 2006).

The powerful influence of adolescent peers can also be harnessed beneficially within interventions; again, a possibility insufficiently explored in developmental science. The potential in this regard is evident in the “Names Can Really Hurt Us” antibias, antibullying program implemented with over 65,600 high school students in Connecticut over the last 11 years, under the sponsorship and supervision of the Office of the Anti-Defamation League. Guided by league facilitators, students speak candidly about diverse bullying behaviors and their consequences, covering topics ranging from gossip and physical harassment, to racism and homophobia, self-mutilation, substance abuse, and suicide. The goals are to empower victimized students to stand up for themselves, to teach bystanders to become allies, and to develop empathy among the bullies themselves. Qualitative data and the students' willing participation rates conjointly attest to the promise of the “Names” program (see Hirshey, 2007). It would be extremely useful for developmental scientists to systematically test the gains of such peer-based programs, given the ample evidence on bullying in American schools, the power of the adolescent peer group (Dishion & Patterson, 2006), and the potential for using adolescents themselves to foster positive changes in the peer community.

Beyond Interventions: Directions for Basic Science, Theory Development, and Dissemination

Just as intervention researchers can help prioritize salient protective processes so too can basic scientists, by testing hypotheses about the relative potency of different “modifiable modifiers,” or indices amenable to change toward maximizing well-being among those at risk (Luthar, 2006; Luthar & Cicchetti, 2000; Masten, 2007). Two points are worth emphasizing in this regard. One is that we are well past simply documenting that some people do remarkably well under adversity; pioneers like Garmezy, Rutter, and Werner brought this to our attention over 50 years ago. For this generation of resilience researchers, the central task is to discern the most promising intervention implications (Masten & Obradović, 2006) for children as well as adults. This effort, in turn, will require an expeditious prioritizing of potent risk modifiers: we must move beyond just adding to an already long list of “protective” factors or processes, including psychological attributes such as positive emotions, optimism, cognitive flexibility, and locus of control and now biological processes such as those implicating the amygdala, prefrontal cortex, cortisol, or DHEA. The need of the day is to focus, in a concerted way, on pinpointing risk modifiers that could have the most far-reaching impact not only on their own (i.e., with relatively substantial effect sizes), but also with the potential to generate other protective processes (as secure attachments promote feelings of efficacy, internal locus of control, and even intellectual and academic competence; see Luthar, 2006; Luthar & Zelazo, 2003).

The time is nigh as well for concerted efforts to refine theory on resilience. Given the breadth of extant empirical evidence across 50 years, with cross-sectional and life-span studies on adversities ranging from poverty and maltreatment to posttrauma recovery, among both children and adults, we are now well positioned to test what could be the “hard core” of resilience theory: central tenets that are relatively impervious to challenge (Lakatos, 1978). Based on what we have learned thus far, there are at least two central postulates that warrant systematic testing, to providing validating or refuting evidence as the case may be:

1. Relationships lie at the “roots” of resilience: when everyday relationships reflect ongoing abuse, rancor, and insecurity, this profoundly threatens resilience as well as the personal attributes that might otherwise have fostered it. Conversely, the presence of support, love, and security fosters resilience in part, by reinforcing people's innate strengths (such as self-efficacy, positive emotions, and emotion regulation) with these personally attributes measured biologically and/or behaviorally.
2. The major antecedents or predictors of resilience are largely similar rather than distinct when resilience is defined as (a) sustained positive adjustment following traumas and (b) recovery displayed after initial maladjustment following negative life events.

Finally, resilience researchers must proactively disseminate extant scientific knowledge to the public and policymakers, always ensuring caution and responsibility in presenting research conclusions (Luthar & Cicchetti, 2000). It is critical that we convey, in easily understood terms, not only what we have learned about resilience but also how preventive interventions harnessing this knowledge can yield substantial benefits for society, leading to enhanced productivity and reducing costs in health and legal systems (Zigler et al., 2002). As Epstein (2006, p. 397) notes, “the medical fields barrage the public daily with reminders of what they have accomplished in the past, with reports of their recent successes (however modest), and with extravagant promises of advances to come. Our own efforts to reach the public ... are modest by comparison” (see also Tolan & Dodge, 2005). Similarly, Petersen has emphasized that with appropriate information, “hard” scientists, like lawmakers, typically appreciate the important discoveries deriving from the social and behavioral sciences. Her recommendation: “Seize every opportunity to educate. Let other colleagues and the broader public know what it is we do, how we do it, and why it is important ... If we do not advocate our work, who will?” (Petersen, 2006, pp. 19–20).

Summary and Conclusions

For resilience researchers who seek, ultimately, to maximize the well-being of individuals facing adversities, recent groundbreaking findings in the biological sciences provide extremely powerful evidence on how harsh early caregiving environments lead to long-lasting problems in the brain, in neuron–endocrine functioning, and in the expression of genes. In our future work attempting to foster resilience, these findings unambiguously attest to the urgent need to improve early environments and to advocate for support for preventive interventions (Zigler et al., 2002).

What remains to be established, at this time, is the degree to which insights on biological processes (as mediators or moderators) can or will be harnessed, in truly meaningful ways, to enhance the well-being of today's most vulnerable children and adults. There are significant constraints on this front, partly because these areas of inquiry are still new (Gunnar & Fisher, 2006), and partly because of major pragmatic considerations: lack of health insurance and the high costs involved in high-technology techniques such as brain scans or genotyping. In transdisciplinary research involving teams of biologically and behaviorally trained investigators, similarly, the potential gains must be weighed with potential costs. Such studies are extremely expensive, a nontrivial concern when research funds are constrained as they are now. Being relatively new, such collaborative studies have not yet been evaluated in terms of whether they lead to meaningful reductions in mental health disparities. Finally, breadth of inquiry inevitably entails some loss of depth; we must not lose sight of the “enduring value of *unidisciplinary* science; strong TD [transdisciplinary] science is not possible without depth within each of the component disciplinary perspectives” (Abrams, 2006, p. 516).

In future developmental research on resilience, we would do well to learn from the methods and findings from other social science disciplines. Ethnographic, qualitative studies can be invaluable in guiding our hypothesis: testing of salient protective and vulnerability processes in different subcultural contexts. Advances in the family systems literature point to several postulates that should be quantitatively examined, and interventions in counseling psychology can be helpful to sustain resilient trajectories. Social psychology findings on implicit prejudices could usefully be applied toward trying to reduce the pervasive inimical effects of discrimination affecting ethnic, racial, and sexual minorities. In future work, it is vital that resilience researchers studying children, adults, and families all remain vigilant of the lessons learned, and the missteps made, by our respective counterparts as our work has extremely high potential to affect social policies and allocation of resources (McCall & Groark, 2000; Zigler et al., 2002).

For behavioral and social scientists invested in resilience, so very much remains to be done in discerning how we can best address the single most critical deleterious environmental risk: the sustained presence of harshness, abuse, and neglect in relationships. Particularly urgent is the need to distill the most critical ingredients, from existing promising interventions, that reduce parents' risk for maltreatment and promote positive parenting. Such prioritizing will be essential in allowing us to take these interventions to scale in an expedient and cost-effective manner. In bringing successful parenting interventions to real world settings, furthermore, there must be explicit attention to providing relationship-based alliances with at-risk mothers, who typically serve as primary caregivers for children, often with few resources of their own.

Given the incontrovertible importance of good relationships with adults in early childhood and the fact that we will not be able to reach all parents, we need translational efforts that will bring critical components of successful parenting interventions to caregivers in child-care settings as well (e.g., in enhancing abilities to foster children's emotional self-regulation). In efforts to foster resilient adaptation among older children and adolescents, there is tremendous and still largely unexplored potential to use attachments with teachers at school, as there is to use peers to avert intentional hurtfulness in relationships, and to promote empathy and support.

Like prevention and intervention researchers, "basic scientists" can also contribute substantially to the enterprise of fostering resilience, by focused testing of hypotheses on the relative salience or potency of different risk modifiers. In addition, scholars engaged in the study of resilience must work to refine theory on this construct and also to disseminate extant knowledge, to the public and policymakers, proactively and responsibly.

In concluding, we revert to the theme of biology with which we began this paper, and we acknowledge that we (e.g., Luthar, 2006; Luthar & Zelazo, 2003) like others have urged greater attention to biological indices in studies of resilience (and like others, are seeking to study biological processes in our own research). It seems time, however, for collective vigilance, among applied scientists, against having the pendulum swing too far (Zigler et al., 2002): biology should not be *the* new dimension in developmentally based resilience research; it should be one of the new dimensions that receives additional scientific attention, along with ethnography, family studies, intervention research, community services, social psychology, life span studies, and gerontology.

We close this paper with statements from biological researchers on the many critical questions and issues that lie largely, if not solely, within the domain of developmental, behavioral scientists and urgently require our attention.

1. Reviewing results from animal studies on maternal care, Parent et al. (2005, p. 232) assert that in understanding mechanisms of risk transmission, "Or particular interest are the parent-child relations that define family life." It is only when these are well

understood that can we understand the mechanisms by which these relationships might affect biology.

2. Even as the National Institute of Drug Abuse is intensively focusing on brain pathways implicated in drug addiction, Director Nora Volkow has noted the strong protective potential of positive, nurturing early environments, and the considerable risks of childhood neglect and abuse (see Denizet-Lewis, 2006).
3. Delineating the potential of genetics research in the postgenomic era, Steven Hyman, former director of the NIMH, exhorted sustained attention to “real and immediate social issues” (Hyman, 2004, p. xiii) and cautioned against misguided thinking that if a behavioral disorder is genetically influenced, then amelioration must involve biological means such as pharmacology: a great deal can be accomplished by changing individuals' life contexts.
4. Reviewing basic neuroscience evidence on anxiety disorders, McClure and Pine (2006, p. 495) note that whether or not particular perturbations in brain systems will manifest themselves in clinical disorders depends on broader contextual influences, and surprisingly little is known about these. “For example, do youth at high risk for social anxiety by virtue of parental psychopathology differ from peers at lower risk in their patterns of attachment, peer relations, or conceptions of self?”
5. In the realm of $G \times E$ research, Kendler (2005) noted that whereas we are unlikely to ever find gene that cause mental disorders, “environmental factors have, for several disorders, been shown to have causal specificity” (p. 1250). Kaufman et al. (2004) note the urgent need for attention to reducing child maltreatment and working collaboratively with protective services to reduce recurrent abuse, as Rutter (2006b, p. 4) emphasizes that “It is crucially important that a focus on the importance of genetic influences does not lead to a neglect of ... vitally important societal influences. We need to understand better how they operate and we need to take appropriate societal actions.”

Clearly, our work is very, very far from being done. Recent biological research has only confirmed what behavioral research has shown for decades (Gunnar, 2007; Zigler et al., 2002): the early environment has a profound impact on development, and consistent, contingent care and love are critical for healthy development. Even as we seek ever greater understanding of the mechanisms underlying particular psychological problems, we must use the knowledge that we already have to avert these. The economic recession of current times, coupled with the high investment of resources in war and defense, implies greater jeopardy of the needs of youth and families “which have never—even in the best time of peace and prosperity—received the attention they merit” (Zigler et al., 2002, p. 203). As a profession, we must ensure that their needs do not slip further down on the national agenda. Let us remain steadfastly attentive to the central mission of resilience research: to use existing scholarship and research toward maximizing the well-being and life chances of vulnerable children and families.

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