

# Coping Resources, Coping Processes, and Mental Health

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## Key Words

coping resources and processes, genetic bases of coping, neural bases of coping, coping interventions, stress

## Abstract

Coping, defined as action-oriented and intrapsychic efforts to manage the demands created by stressful events, is coming to be recognized both for its significant impact on stress-related mental and physical health outcomes and for its intervention potential. We review coping resources that aid in this process, including individual differences in optimism, mastery, self-esteem, and social support, and examine appraisal and coping processes, especially those marked by approach or avoidance. We address the origins of coping resources and processes in genes, early life experience, and gene-environment interactions, and address neural underpinnings of coping that may shed light on evaluating coping interventions. We conclude by outlining possible intervention strategies for improving coping processes.

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## INTRODUCTION

Stress is a negative experience, accompanied by predictable emotional, biochemical, physiological, cognitive, and behavioral accommodations (Baum 1999). Coping is the process of attempting to manage the demands created by stressful events that are appraised as taxing or exceeding a person's resources (Lazarus & Folkman 1984). These efforts can be both action-oriented and intrapsychic; they seek to manage, master, tolerate, reduce, or minimize the demands of a stressful environment

(Lazarus & Launier 1978). Coping resources can aid in this process; these resources include relatively stable individual differences in optimism, a sense of mastery, and self-esteem, and in social support. Coping resources, in turn, affect coping processes, specifically ones marked by approach, such as taking direct action or confronting emotional responses to a stressor, and ones marked by avoidance, such as withdrawal or denial. Coping efforts may be adaptive or maladaptive, and the form that coping processes assume affects how successful resolution of a stressor will be.

In this essay, we focus on the origins and effects of coping resources and processes, describing how they develop over the lifespan, how they affect mental and physical health, and whether they can be taught through interventions. Although we focus primarily on mental health, we address physical health outcomes in certain places. The rationale for so doing stems from the strong comorbidities between mental and physical health outcomes and the likelihood that mechanisms relating coping to mental (or physical) health outcomes will have implications for physical (or mental) health as well. In addition, the major stress systems of the body implicate both mental and physical health risks. Stress-related changes in autonomic and neuroendocrine functioning include (*a*) activation of the sympathetic nervous system, which leads to increases in anxiety, heart rate, and blood pressure, among other changes; and (*b*) activation of the hypothalamic-pituitary-adrenal (HPA) axis, which leads to the production of corticosteroids, including cortisol, which are necessary for energy mobilization, but are implicated in both mental (e.g., depression) and physical (e.g., infectious disorders) health risks. Stress inductions have also been associated with changes in proinflammatory cytokine activity (e.g., Dickerson et al. 2004), effects that may be driven, in part, by autonomic and HPA axis activity. Proinflammatory cytokine activity (including interleukin-6 [IL-6] and tumor necrosis factor alpha [sTNF $\alpha$ RII]) is stimulated by stressful

conditions and has been tied to negative emotional states, including depression (Maier & Watkins 1998). Although these stress-related multisystem changes are protective in the short term, their chronic activation may negatively affect mental health over time, potentially elevating risk for depression and anxiety disorders and also enhancing risks for physical illnesses, including cardiovascular disease and Type II diabetes (see, e.g., Kiecolt-Glaser et al. 2002 for a review). Coping can intervene between stress and mental and physical health outcomes such as these, and thus merits consideration both as an intrinsically significant process in its own right and as a potential point of intervention for reducing adverse mental and physical health risks of stress. Note that we do not focus on stress-related processes and risk for specific psychological disorders, as these topics have been recently reviewed (e.g., Hammen 2005, Ozer et al. 2003), but rather on psychological outcomes more generally.

The empirical literature on coping is vast. A PsycINFO literature search of scientific journal articles from 2000 through 2005 using “coping” as a keyword generated 5151 documents. In a recent *Annual Review of Psychology* article, Folkman & Moskowitz (2004) reviewed the history of coping research, identified challenges for researchers (e.g., problems in measurement), and highlighted new developments. Commenting on the rapid expansion of research on coping over the past three decades, they noted, as we do, that the construct’s “allure is not only as an explanatory concept regarding variability in response to stress, but also as a portal for interventions” (p. 746).

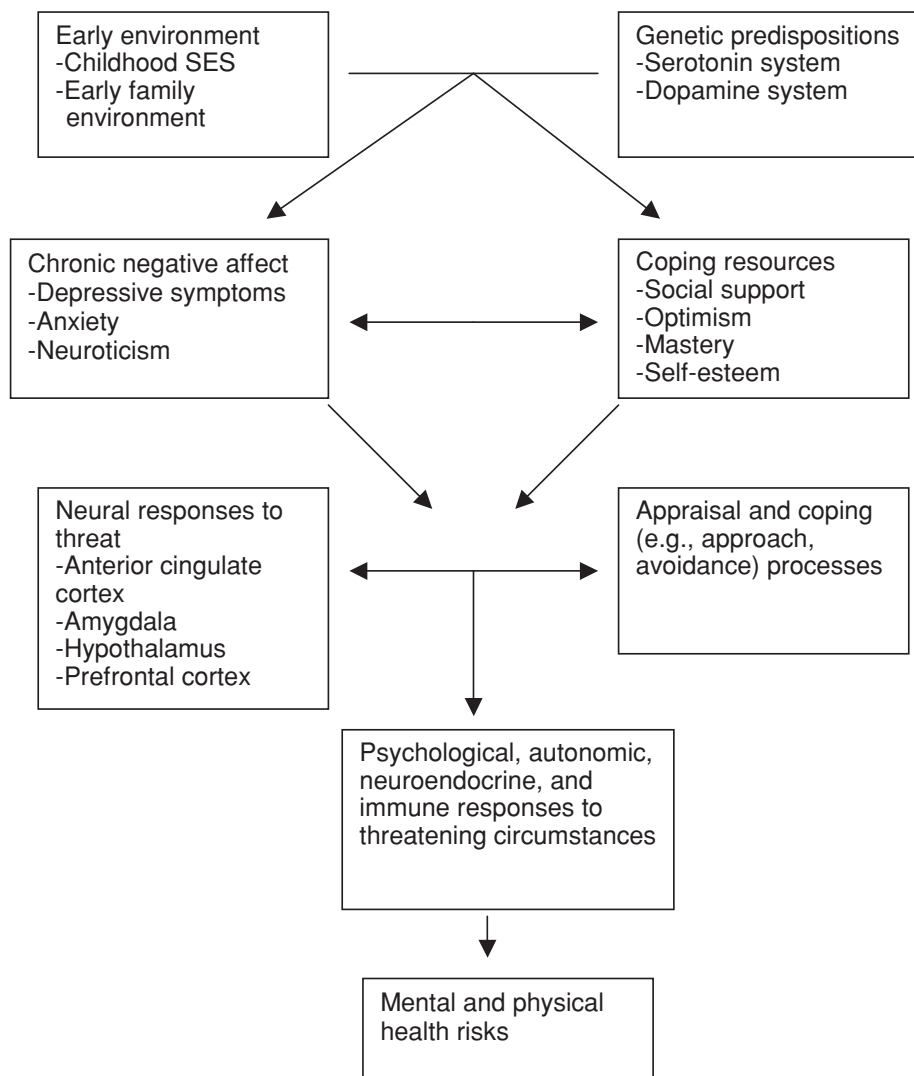
The model that organizes and characterizes our assessment of the origins and consequences of coping appears in **Figure 1**. **Figure 1** may be read both as a lifespan model that moves from the origins of coping resources and processes in early life to health and mental health outcomes later in life, and as a conceptual account of coping that occurs iteratively across episodes of stress.

We begin with the characterization of coping resources and processes.<sup>1</sup> We next consider the origins of coping resources and processes in the early environment, genes, and gene-environment interactions. We then consider neural mechanisms, which may link coping resources and processes to downstream mental and physical health outcomes. The literature on the origins of coping in genes, gene-environment interactions, and neural bases of coping is still in its infancy. But, as we note in the conclusions, we believe these directions represent important avenues for future research. Finally, we return to coping processes and resources as portals of intervention and close by posing directions for future study.

## COPING RESOURCES

It has long been known that people with a diverse array of mental disorders, including depression, schizophrenia, anxiety disorders, and autism lack coping resources for managing the challenges of daily living. Likewise, chronic psychological distress, which is related to lack of coping resources (Repetti et al. 2002), is implicated in more than half of the DSM-IV axis I disorders and in almost all of the axis II psychiatric disorders (Am. Psychiatr. Assoc. 1994). For example, depression is marked by pessimism, low self-esteem, a low sense of control, and adverse effects on social relationships (Beck 1967). The inability to establish and maintain normal social relations with others is central to autism (Med. Res. Council. 2001). The onset of schizophrenia is associated with a disruption in an individual’s sense of agency and perceived abilities to act intentionally (e.g.,

<sup>1</sup>We here distinguish between coping processes and emotion regulation. The term “coping processes” refers to thoughts and behaviors undertaken to manage the demands of stressful circumstances, which may include emotion regulation efforts. Emotion regulation involves the monitoring, evaluation, control, and expression of emotion, especially in challenging circumstances.



**Figure 1**

Origins and effects of coping resources.

Frith et al. 2000). The lack of coping resources associated with clinical disorders in some cases may represent symptoms, in other cases, developmental risk factors, and in other instances, risk factors for poor prognosis or recurrence.

Researchers have identified stable individual differences in coping resources that both improve the ability to manage stressful events and are tied to lesser distress and better health outcomes. Among these are optimism, psychological control or mastery, self-esteem, and social support. In addition to their roles as

antecedents of specific coping strategies, coping resources can also have direct effects on psychological and physical health.

Optimism refers to outcome expectancies that good things rather than bad things will happen to the self. Dispositional optimism, typically measured by the Life Orientation Test (LOT-R; Scheier et al. 1994), has been tied to a broad array of mental and physical health benefits, including greater psychological well-being (e.g., Kubzansky et al. 2002), faster recovery from illness (Scheier et al. 1989), and a slower course of physical

disease (e.g., Matthews et al. 2004) (see Carver & Scheier 2002 for a review). In addition, researchers have examined situation-specific optimistic expectations, which represent a potential target for intervention; they appear to have similar beneficial effects on stress-related mental and physical health outcomes (e.g., Reed et al. 1999).

Personal control or mastery refers to whether a person feels able to control or influence outcomes (Thompson 1981). Studies have shown a relationship between a sense of control and better psychological health (Haidt & Rodin 1999), as well as better physical health outcomes, including lower incidence of coronary heart disease (CHD; Karasek et al. 1982), better self-rated health, better functional status, and lower mortality (Seeman & Lewis 1995). As is true for optimism, situation-specific control expectations, which are often conceptualized as self-efficacy beliefs, are potential intervention targets and appear to have similar beneficial effects on managing stressful events (see Bandura 2006 for a review).

A positive sense of self or high self-esteem is also protective against adverse mental and physical health outcomes. For example, research consistently ties a positive sense of self to lower autonomic and cortisol stress responses (Seeman & Lewis 1995). Higher self-esteem has also been consistently tied to better psychological well-being (e.g., DuBois & Flay 2004), and interventions designed to enhance the self have beneficial effects on both psychological and biological responses to stress (e.g., Creswell et al. 2005).

The question has arisen as to whether these positive coping resources may be the mirror image of negative affectivity, such that people who are low in chronic negative affect have higher optimism, control-related beliefs, or self-esteem essentially by default. An emerging consensus is that although positive coping resources share overlapping variance with negative affectivity, they also account for unique variance in the prediction of mental and physical health out-

comes (Scheier et al. 1994; see also Neiss et al. 2005).

Social support, another significant coping resource, is defined as the perception or experience that one is loved and cared for by others, esteemed and valued, and part of a social network of mutual assistance and obligations (Wills 1991). Research consistently demonstrates that social support reduces psychological distress, such as depression or anxiety, during times of stress and promotes psychological adjustment to a broad array of chronically stressful conditions (see Taylor 2007 for a review). Social support also contributes to physical health and survival. For example, Berkman & Syme (1979) found that having a high number of social contacts predicted an average 2.5 increased years of life.

Recent research has tied coping resources to underlying mechanisms that may mediate their effects. For example, Taylor et al. (2003a,b) related a cluster of coping resources including optimism, mastery, self-esteem, and social support to clinical assessments of mental health (Taylor et al. 2003a) and to lower baseline cortisol levels and autonomic responses to challenging tasks in the laboratory (Taylor et al. 2003b). Thus, at least some of the beneficial effects of coping resources may be mediated by the lesser physiological toll that stress exerts among those high in coping resources. Social isolation and loneliness have been related to high stress reactivity and inadequate and inefficient physiological repair and maintenance processes (Hawkey & Cacioppo 2003). In an experimental laboratory investigation, Dickerson et al. (2004) found that a manipulation designed to induce social threat led to an increase in sTNF $\alpha$ RII activity, suggesting that social emotions (in this case, shame and guilt) may be associated with elevations in proinflammatory cytokine activity. These documented immunologic mechanisms may help to explain the relation of social support/isolation to both acute infectious disorders (Cohen et al. 1997) and to chronic emotional disorders implicating proinflammatory cytokine activity, such as depression.

Although the existing research suggests numerous qualifications to these generalizations as a function of type and duration of stressor, coping resources are generally regarded as helpful to managing stress and have both direct effects on mental health as well as indirect effects on mental health via their effects on coping processes and stress-reducing abilities. In particular, evidence suggests that these coping resources may foster more positive appraisals of potentially stressful situations and more approach-related coping (e.g., Scheier et al. 1989).

## COPING PROCESSES AND ADJUSTMENT UNDER STRESSFUL CONDITIONS

Coping resources in turn affect coping processes, that is, the specific intrapsychic or behavioral actions that people use for managing stress. In the following section, focusing on recent longitudinal and experimental research, we highlight major findings regarding coping as an explanatory construct in its links to mental and physical health outcomes in adults under stress (for a review of coping in childhood/adolescence, see Compas et al. 2001). We also examine coping processes as proximal mediators of the relations of other psychosocial parameters to stress-related adjustment.

In stress and coping theory (e.g., Lazarus & Folkman 1984), cognitive reappraisal processes regarding a stressful situation are considered important antecedents to coping processes. For example, in a longitudinal study of women seeking treatment for sexual assault, Frazier et al. (2005, Study 1) found that behavioral self-blame for the assault prompted coping through social withdrawal, which in turn predicted heightened distress. Women who perceived high control over their recovery made little use of social withdrawal coping and greater use of cognitive restructuring, which in turn predicted decreased distress. In a meta-analysis of 27 studies on causal attributions and coping with illness, Roesch

& Weiner (2001) found that internal, unstable, or controllable attributions were associated with positive adjustment through their relations with greater approach-oriented and emotion-focused coping processes. Stable and uncontrollable illness attributions were associated with maladjustment through avoidant coping. In a meta-analysis of 15 studies on cognitive appraisals and coping in cancer patients, Franks & Roesch (2006) concluded that individuals who appraise their disease as highly threatening are likely to use more problem-focused coping strategies, those who believe their disease has caused harm or loss engage in more avoidance, and those who appraise their experience with cancer as potentially carrying benefits use more problem-focused and approach-oriented coping. Research on coping resources also suggests that at least some of their benefits may operate via appraisals of stressful events as less stressful or as more amenable to change (e.g., Bandura 2006).

Numerous frameworks for delineating coping processes have been advanced (for a review, see Skinner et al. 2003). Coping strategies often are organized according to their intended functions: as directed toward resolving the stressful situation (i.e., problem-focused coping) or palliating event-related distress (i.e., emotion-focused coping; Lazarus & Folkman 1984), or as approaching or avoiding the sources of stress (approach-versus avoidance-oriented coping; Suls & Fletcher 1985). Reflecting a core motivational construct (e.g., Davidson et al. 2000), the approach-avoidance continuum maps easily onto broader theories of biobehavioral functioning. Examples of active and approach-oriented coping are problem solving, seeking social support, and creating outlets for emotional expression. Coping through avoidance includes both cognitive and behavioral strategies. Some approaches, such as spiritual coping, potentially can serve either approach-oriented or avoidance goals.

Coping processes are conceptualized as effective to the extent that they are responsive



to personal and situational contingencies (Lazarus & Folkman 1984). The empirical literature reveals that coping through avoidance can be useful in specific situations, particularly those that are short term and uncontrollable (Suls & Fletcher 1985). For example, Heckman et al. (2004) found that upon notification of a questionable mammography result, women's use of cognitive avoidance regarding the potential outcome predicted reduced anxiety after being informed that they did not have breast cancer. Early avoidance can presage longer-term problems when the stressor persists, however. For example, Levine et al. (1987) found that cardiac patients who denied their disease spent fewer days in the coronary care unit and had fewer indications of cardiac dysfunction during hospitalization than did nondeniers. However, deniers were less adherent to exercise training and had more days of rehospitalization in the year after discharge.

As demonstrated in longitudinal research, attempting to avoid thoughts and feelings surrounding persistent stressors predicts elevated distress across such samples as impoverished women (Rayburn et al. 2005), cancer patients (e.g., Stanton & Snider 1993), caregivers for individuals with chronic disease (Billings et al. 2000), hospitalized burn patients (Fauerbach et al. 2002), and individuals coping with terrorist attacks (Silver et al. 2002). Use of avoidance-oriented coping also predicts other important outcomes, including lower medical regimen adherence and subsequently greater viral load in HIV-positive individuals (Weaver et al. 2005), more risky behaviors in HIV-positive injection drug users (Avants et al. 2001), increased physical symptoms among AIDS caregivers (Billings et al. 2000), greater pain (Rosenberger et al. 2004) and compromised recovery of function following surgical procedures (Stephens et al. 2002), and lower likelihood of remission in depressed patients (Cronkite et al. 1998). Suggestive evidence that avoidant coping predicts chronic disease progression and/or mortality also exists for samples with cancer (Epping-

Jordan et al. 1994), HIV infection (Leserman et al. 2000), congestive heart failure (Murberg et al. 2004), and rheumatoid arthritis (Evers et al. 2003). Neuroendocrine parameters are associated with avoidant behaviors under stress (e.g., Roelofs et al. 2005, Rosenberger et al. 2004), and passive/avoidant coping during experimentally imposed stress also has been associated with tumor development in animal models (Vegas et al. 2006). Avoidance-oriented coping may preempt more effective coping efforts, involve damaging behaviors (e.g., substance use), or induce intrusion of stress-related thoughts and emotions.

Although findings are less consistent for approach coping, longitudinal research has revealed a link between approach-oriented coping strategies and positive psychological and physical health in stressful circumstances. For example, use of such strategies as positive reappraisal of stressors, social approach, and problem-focused coping predicts an increase in positive affect (Billings et al. 2000). In a daily process study (Keefe et al. 1997), use of coping through relaxation and active efforts to reduce pain contributed to next-day enhanced positive mood and reduced pain in rheumatoid arthritis patients. Use of approach-oriented strategies during military deployment also predicted a reduction in depressive symptoms in Army personnel after the Gulf War (Sharkansky et al. 2000). In adults caring for a family member with dementia, approach-oriented coping was associated with a more vigorous cellular immune response to pathogens at high levels of stress (Stowell et al. 2001) and with lower procoagulant activity under experimentally induced acute stress (Aschbacher et al. 2005).

The fact that approach-oriented coping strategies predict adjustment less consistently than avoidant strategies might be explained by several factors. Some approach-oriented processes, such as problem solving, are not useful for immutable facets of a stressor, but rather are effective only for stressors that are amenable to change (e.g., Park et al. 2001).

Further, avoidance- and approach-oriented strategies may differentially predict negative and positive indicators of stress-related adjustment, with approach-oriented strategies more likely to contribute to positive affect (e.g., Billings et al. 2000). Because maladjustment receives more attention in the coping literature than positive functioning, effective approach-oriented coping processes might be missed in such research.

### **Coping as a Mediator of Relations Between Psychosocial Parameters and Adjustment**

Ways of coping under stressful conditions do not operate on adjustment in isolation, but rather mediate the relations of other psychosocial parameters with adaptive outcomes. Antecedent psychosocial parameters include characteristics of the stressor, the social context, dispositional attributes, and cognitive appraisals. With regard to stressor characteristics, the experience of both distal (e.g., a history of childhood abuse) and proximal (e.g., living in a homeless shelter) relatively uncontrollable stressors predicts greater use of avoidant coping in impoverished women, and avoidance partially mediates their relations with subsequent depressive symptoms (Rayburn et al. 2005). An unsupportive social context also can prompt engagement in avoidance-oriented coping under stress, which in turn predicts an increase in distress in women with breast cancer (Manne et al. 2005a) and poorer adherence and higher viral load in HIV-positive individuals (Weaver et al. 2005). Holahan et al. (1997) found that a positive social context at study entry predicted greater relative use of approach-oriented coping by cardiac patients four years later, which in turn predicted a reduction in depressive symptoms.

Intraindividual factors, including coping resources and cognitive appraisals, also affect coping processes. Some research suggests that people high in optimism (Carver et al. 1993) or with high self-esteem (Aspinwall & Taylor

1992) use less avoidant and more approach coping, which are tied to better mental and physical health. Approach-oriented strategies such as positive reappraisal and active acceptance have been found to mediate the relation of optimism to better adjustment in stressful circumstances (Brissette et al. 2002, Carver et al. 1993).

In sum, mounting evidence suggests that coping processes play an important mediating role between contextual and individual variables and adaptive outcomes. A number of studies have suggested that coping strategies are not simply proxies for coping resources, but rather explain unique variance in adjustment (e.g., Murberg et al. 2002). However, some evidence suggests that coping strategies operate in tandem with other variables to affect outcomes. For example, Lancaster & Boivin (2005) found that low optimism, high trait anxiety, and use of avoidant coping were significant indicators of a latent construct, which predicted women's biological response to infertility treatment (e.g., number of oocytes). Although coping strategies share variance with dispositional and contextual variables, they are likely to provide a more malleable target for intervention.

In addition to their role as mediators, coping processes also can interact with contextual and individual parameters in their contribution to adjustment. For example, cancer patients who experienced low social support in tandem with the greater use of avoidant coping subsequently evidenced more severe symptoms of posttraumatic stress (Jacobsen et al. 2002). Emotionally expressive coping predicted decreased distress and fewer medical appointments for cancer-related morbidities in breast cancer patients high in hope (Stanton et al. 2000).

Newer models for conceptualizing the links among stressful life experiences, coping processes, and mental health outcomes also recognize their potentially reciprocal relations. Hammen's (1991) stress generation hypothesis points to the potential for the experience of depression to engender stressful



events, which in turn can exacerbate depressive symptoms. Holahan et al. (2005) recently integrated coping processes into the stress generation model. In a decade-long investigation of 1211 adults aged 55 to 65 years at study entry, avoidance-oriented coping at study entry predicted more chronic and acute life stressors four years later, which in turn predicted an increase in depressive symptoms at ten years. Thus, coping through avoidance played a stress-generating role.

## ORIGINS OF COPING RESOURCES AND PROCESSES

The relation of coping resources and processes to stress-related mental and physical health outcomes suggests that understanding their antecedents and consequences is pivotal for intervening to promote successful adjustment. Accordingly, we next turn to origins of coping resources in the early environment, in genetic predispositions, and in their interaction.

### Origins of Coping in the Early Environment

Both animal (e.g., Francis et al. 1999) and human (e.g., Repetti et al. 2002) investigations reveal that a harsh early environment affects mental and physical functioning across the lifespan, and research implicates coping in these relations. We focus here on the human literature, but note the important parallels to both rodent (e.g., Liu et al. 1997) and primate (e.g., Suomi 1997) studies. Aspects of early life that have been consistently tied to poor coping include two markers of a stressful or threatening environment, specifically low childhood socioeconomic status (SES) and a harsh early familial environment.

Substantial research links economic adversity (low SES) to mental and physical health disorders (Adler et al. 1999). Low childhood SES predicts exposure to a broad array of early stressful events, including neighborhood conflict, violence exposure, exposure to

pathogens, and other chronic stressors (Adler et al. 1999). Socioeconomic status in childhood has been related to problems in the enlistment or use of coping resources, including social support, optimism, mastery, and self-esteem (Adler et al. 1999, Repetti et al. 2002, Taylor & Seeman 1999). For example, there is an SES gradient in pessimism (Taylor & Seeman 1999), suggesting that harsh early life experiences contribute to the development of enduring pessimistic expectations. A sense of personal mastery appears to mitigate mental health risks conferred by low SES; among low-SES individuals with strong beliefs in personal mastery, mental and physical health outcomes are equivalent to those seen in high-SES groups (Lachman & Weaver 1998). To a lesser extent, self-esteem (Adler et al. 1999) shows an SES gradient, and perceived social support has a strong SES gradient (Kessler et al. 1992), such that those of higher SES in childhood and/or adulthood report greater social support resources. Low childhood SES has, in turn, been related to development of psychological distress (Gallo & Matthews 2003) and to a broad array of risk factors for mental and physical health disorders, including depression, anxiety disorders, coronary heart disease, cardiovascular disease, and immune-related disorders (Adler et al. 1999, Hemingway et al. 2003, Owen et al. 2003), although, to date, research has not examined the mediational role of coping in these processes.

Early family environments marked by harsh or conflict-ridden parenting are reliably associated with deficits in offspring coping resources and processes and with difficulty in managing challenging circumstances (see Repetti et al. 2002 for a review). Specifically, research suggests that offspring from harsh family environments may overreact to threatening circumstances, responding aggressively to situations that are only modestly stressful (e.g., Reid & Crisafulli 1990), but may also respond by tuning out or avoiding stressful circumstances, as through behavioral escape/avoidance or substance abuse

(Johnson & Pandina 1991, Valentiner et al. 1994). Poor coping related to early family environment may appear in latent form in early childhood and may contribute to chronic psychological distress and to a lack of coping resources, including optimism, mastery, self-esteem, and social support, in adulthood (Repetti et al. 2002). A harsh family upbringing has been related to higher levels of depression (Repetti et al. 2002); to preclinical risk factors for mental and physical health disorders, including elevated autonomic and cortisol responses to threatening circumstances (Seeman & McEwen 1996); to risk factors for mental and physical health disorders, including C-reactive protein (Taylor et al. 2006a); and to major mental and physical health disorders (Felitti et al. 1998). Thus, the existing literature provides a strong basis for a pathway linking a stressful early childhood to the compromised development of coping resources and processes and to risk for adverse stress-related mental and physical health outcomes.

### Genetic Origins of Coping

Although genetic bases of risk for major mental disorders have been explored for more than 15 years, potential genetic contributions to coping have received less empirical attention. Behavioral genetics studies have identified the fact that there are genetic contributions to coping, but not the specific genes that are implicated. Twin studies estimate that approximately 25% of the variance in optimism is genetically based (Plomin et al. 1992). There is moderate genetic influence on self-esteem (e.g., Roy et al. 1995) and a larger genetic contribution to social support (e.g., Kessler et al. 1992). To our knowledge, genetic bases of mastery have not been examined.

At least some of the genetic contribution to effective coping may stem from genetic bases of approach-related behavior underpinned by dopaminergic pathways (Reuter & Hennig 2005). Activity within the dopamine

system appears to be involved in regulating emotional responsivity to stressors (Giorgi et al. 2003). For example, the 48 base pair repeat within exon 3 of the DRD4 gene is related to novelty seeking (Ehstein et al. 1996) and to lower anxiety to potentially stressful events (Lakatos et al. 2003) and, thus, is a potential candidate for understanding coping processes. Similarly, COMT is implicated in prefrontal dopamine neural transmission, and the COMT val158met functional polymorphism has been related to positive emotionality and incentive motivation (Reuter & Hennig 2005). The relation of genetic polymorphisms in the dopamine system to executive functioning in the prefrontal cortex (PFC) more generally suggests that coping processes may reduce stress responses via PFC downregulation of activity in brain regions known to be activated in response to threat, including the amygdala, dorsal anterior cingulate cortex, and hypothalamus.

It is also possible that coping resources and processes operate via the moderation of genetic contributors to psychological distress. For example, studies have shown that the short variant of the serotonin transporter gene-linked functional polymorphic region (5-HTTLPR) is related to trait anxiety (Schinka et al. 2004); to depression in conjunction with life stress (e.g., Caspi et al. 2003); to neuroticism (Sen et al. 2004); and to amygdala hyperactivity to threat in healthy people (Hariri et al. 2005). The G allele of the serotonin receptor 1A (5-HT<sub>1a</sub>) gene has been tied to neuroticism and harm avoidance (Strobel et al. 2003). An SNP in the 5-HT<sub>2a</sub> receptor gene has been associated with anxiety-related traits and sociability, and the T allele of the 5-HT<sub>2a</sub> is associated with higher activity level and sociability and lower level of anxiety-related traits (Golimbet et al. 2004). The G-1438A polymorphism of the 5-HT<sub>2a</sub> receptor gene has been related to introversion and sociability and may thus be related to social support processes. Finally, the monoamine

oxidase gene has been tied to impulsivity and impulsive anger among other indicators of poor emotional control in response to stress (Huang et al. 2004).

Efforts to explore the genetic underpinnings of coping are in their infancy. The dopamine and serotonin systems by no means exhaust the bases for exploring genetic contributions to the development of coping resources or their deployment via coping processes. At present, they represent promising points of departure with a basis in the existing literature. Moreover, the existing literature has yet to examine the cumulative impact of multiple risk-related genes or gene-gene interactions as potential bases for the development or deployment of coping efforts.

## Gene-Environment Interactions

The effects of genes related to coping resources are likely to be moderated by environmental factors, suggesting possibilities for intervention. Researchers have long suspected that a harsh early family environment may contribute to poor coping and to lifespan risk for mental and physical health disorders, not only directly, but also via gene-environment interactions (Repetti et al. 2002). The fact that the same family characteristics (a harsh, conflict-ridden or chaotic early family environment) appear to fuel such a diverse array of adverse physical and mental health outcomes suggests that a risky early family environment may exacerbate preexisting genetically-based risks (Repetti et al. 2002). Animal studies have also suggested the likelihood that early environment interacts with genetic predispositions to affect behavioral outcomes. For example, maternal behavior moderates genetic risk for serotonergic dysfunction related to serotonin transport (Bennett et al. 2002) and behavioral concomitants of the *s* allele of the serotonin transporter gene (5-HTTLPR), specifically impulsivity and social competence (Suomi 2003). Thus, family environment may exert a moderating effect on genetically based

temperamental susceptibilities to poor coping and its adverse mental health outcomes.

Recent gene-environment interaction studies in humans have found that the relation between the 5-HTTLPR and depression is also moderated by early family environment. Specifically, a recent empirical study (Taylor et al. 2006b) reveals that individuals who grow up in a harsh early family environment or who are experiencing a current stressful environment are significantly more likely to experience depressive symptomatology if they have the *s/s* genotype of the 5-HTTLPR; however, those with the *s/s* genotype are significantly less likely to report depressive symptomatology if they are from a more supportive family environment and/or are currently in a nonstressful environment. Coping resources or processes are likely to mediate these effects, as they appear to do in the animal studies, but this link has not yet been made. Nonetheless, studies such as these suggest that there is significant environmental regulation of genetic contributions to susceptibility to adverse stress-related mental and physical health outcomes, with the potential for the quality of the environment to reverse the relation between a genetic risk and an outcome (in this specific instance, depression).

Using twin study methodology, behavioral genetics investigations have estimated the genetic contribution to coping strategies, including problem solving, emotion-focused coping, use of social support, and avoidant coping. Moderate genetic influences have been found for all four (e.g., Kato & Pedersen 2005, Kendler et al. 1991). Both shared and unshared environmental factors appear to contribute to these coping strategies as well (Mellins et al. 1996). However, research is mixed on whether genetic contributions to coping strategies overlap with genetic contributions to more stable coping resources, such as optimism, self-esteem, and other personality factors (Busjahn et al. 1999, Kato & Pedersen 2005).

## NEURAL LINKS FROM COPING TO STRESS-RELATED MENTAL AND PHYSICAL HEALTH OUTCOMES

Exactly how coping exerts protective effects on mental and physical health outcomes has been largely unknown. A particular lacuna concerns the neural mechanisms that may underpin these relationships. Knowledge of the neural underpinnings by which coping may exert protective effects on mental and physical health outcomes may suggest not only strategies for coping interventions, but also criteria by which interventions may be evaluated (e.g., Etkin et al. 2005).

### Neural Bases of Threat Detection and Coping

Recent research on neural bases of threat detection and emotion regulation help to clarify how stress affects brain functioning and how coping moderates those neural pathways. As noted, the amygdala and the dorsal anterior cingulate cortex (dACC) are associated with threat detection, serving an "alarm" function that mobilizes other neural regions, such as the lateral prefrontal cortex (LPFC) and hypothalamus, to promote adaptive responses to stress. The amygdala is sensitive to environmental cues signaling danger or novelty (e.g., Hariri et al. 2000) and predicts how unpleasant negative stimuli are reported to be (Lane et al. 1997). The dACC also serves as a threat detector, responding to conflict in incoming information (Carter et al. 2000). The dACC especially responds to social distress (Eisenberger et al. 2003).

Once activated, these neural threat detectors set in motion a cascade of responses via projections to the hypothalamus and lateral prefrontal cortex (Davis 1989, LeDoux 1996) aimed at amplifying or attenuating the threat signal and preparing to respond to the threat. Studies have shown connections between neural structures critical to threat detection and the hypothalamus, which is

the origin of both sympathetic and HPA responses to threat. The amygdala has dense projections to the hypothalamus (Ghashghaei & Barbas 2002), and the ACC projects to the paraventricular nucleus of the hypothalamus (PVN; Risold et al. 1997), the specific region of the hypothalamus that triggers the cascade of events ultimately leading to cortisol release. Stimulation of both the amygdala and the ACC has also been associated with increases in blood pressure and cortisol levels in both animals and humans (Frankel et al. 1978, Setekleiv et al. 1961).

A neural region that appears critical for regulating the magnitude of these threat responses is the ventrolateral prefrontal cortex (VLPFC) (Hariri et al. 2000, Ochsner et al. 2004). Specifically, activation of the right VLPFC can directly down regulate the activation of the amygdala and dACC (Eisenberger et al. 2003, Hariri et al. 2002, Lieberman et al. 2006). Thus, the VLPFC appears to be a self-regulatory structure that modulates the reactivity of the amygdala and dACC to threat.

The neural bases of threat detection and reaction are important to the study of coping because they provide clues as to how coping resources and processes regulate psychological and biological threat responses. For example, people with strong coping resources may show lower amygdala and/or dACC reactivity to threatening stimuli. Alternatively, people with stronger coping resources may show stronger VLPFC responses to threatening stimuli. A third possibility is that strong coping resources are manifested in the correlation between VLPFC and threat-responsive regions, such as the amygdala or the dACC; a strong negative correlation would be suggestive of better regulation of threat responsivity by the VLPFC.

Although investigations have documented the role of the medial PFC (MPFC) and the left VLPFC in the modulation of pathways contributing to stress responses, the mechanisms have remained elusive. A key neurotransmitter in MPFC functioning is dopamine, and animal research suggests that

the MPFC modulates responses to stressful tasks (Spencer et al. 2004). Using functional magnetic resonance imaging (fMRI) methodology, Smolka et al. (2005) reported that the number of COMT met158 alleles in the limbic system (specifically left hippocampus, amygdala, and right thalamus) and connected prefrontal areas (bilateral ventrolateral prefrontal cortex, right dorsolateral prefrontal cortex) were significantly positively correlated with reactivity to unpleasant stimuli. They interpreted these findings to suggest that increased limbic and prefrontal activation elicited by unpleasant stimuli in people with more met alleles may reflect poor emotion regulation. Note that these findings provide suggestive evidence consistent with the hypothesis implicating dopaminergic functioning in coping resources and implicating a negative relation between VLPFC and limbic functioning in the moderation of stress responses via coping resources.

Approach coping processes also link to patterns of brain activity suggesting involvement of dopaminergic pathways. The behavioral activation system (BAS), which is assumed to underlie approach-related coping, is organized largely by the dopaminergic neurotransmitter system and is associated with striatal dopamine projections to areas in the lateral and orbital frontal cortices (Rolls 1996). BAS is associated with goal-directed behavior, a promotion regulatory focus (Amodio et al. 2004), and positive emotions (Davidson et al. 1990), consistent with findings reviewed above on coping processes. By contrast, the behavioral inhibition system (BIS) may underlie avoidant coping. BIS is associated with a neural circuit organized by monoamine neurotransmitter systems, including noradrenergic and serotonergic networks, and their associated neural structures. The heart of the noradrenergic system is the locus coeruleus, located in the brainstem. In humans and monkeys, the locus coeruleus has modulatory noradrenergic effects on the anterior cingulate cortex (ACC) (Berridge & Waterhouse 2003). Polymorphisms in the serotonin transporter

gene have also been implicated in ACC function (Canli et al. 2005). Direct links from avoidant coping to ACC functioning via these pathways have not yet been made, however.

Research relating coping resources and processes directly to activity in brain regions is in its infancy. However, one such study (Eisenberger et al. 2007) found that people who interacted regularly with supportive individuals showed diminished dACC and Brodmann's Area (BA8) reactivity to social rejection in an fMRI laboratory task and diminished cortisol reactivity during the Trier Social Stress Task; individual differences in dACC and BA8 activity mediated the relationship between social support and cortisol reactivity. Thus, social support may influence downstream biological stress responses by modulating neurocognitive reactivity to social stressors, which in turn attenuates neuroendocrine stress response. Other coping resources may exert their effects via similar pathways, although this hypothesis has yet to be explored empirically.

Research also suggests that early family environment is related to the neural underpinnings of stress management and coping processes. For example, in a task involving the labeling of emotions pictured in faces, Taylor et al. (2006a) found that young adults who had grown up in supportive families showed expected and relatively modest amygdala reactions to threat cues (fearful/angry faces) and strong activation of the right VLPFC, which was negatively related to amygdala activity; this pattern suggests regulation of limbic response via cortical responses to threatening stimuli. By contrast, young adults from harsh early family environments showed a strong positive correlation between right VLPFC and amygdala activation, suggesting that early family environment may be associated with dysregulation in the neural pathways involved in regulating responses to threat. Research has also begun to integrate genetic and neural bases of threat, with concomitant implications for coping. For example, Hariri et al. (2005) used fMRI to examine the relation of

the 5-HTTLPR to amygdala responses to threat-relevant stimuli. As predicted, they found that people carrying the s allele of the 5-HTTLPR had stronger amygdala responses to fearful stimuli in comparison with those homozygous for the l allele.

Multilevel integrative efforts to relate genetic and/or familial origins of coping resources and processes to neural mechanisms that link to both emotional and physiological stress responses are in their infancy. But as these early studies suggest, such an approach can help to flesh out the pathways that relate the origins of coping and coping resources and processes to psychological and biological stress responses. Moreover, mapping such pathways may provide useful clues for intervention, an issue to which we next turn.

## **PATHWAYS FOR INTERVENTION**

On the surface, the likely origins of coping resources in genes and early family environment might suggest dismal prospects for their modification. Recall, though, the evidence indicating substantial influence of the current environment on genetically based risk for depression. In that case, a supportive environment entirely reversed the impact of a genetic risk factor. Thus, modifying coping resources, coping processes, and the current environment would seem to have significant potential for managing stress and avoiding stress-related compromises in mental health. Of course, biological interventions to modify neural function also are relevant, but we do not address that literature here.

### **Interventions Directed Toward Coping Resources**

Although long assumed to be relatively immutable, some coping resources evidence change across the adult life course (Roberts et al. 2006), and there is suggestive evidence that coping resources can change with psychosocial intervention. For example,

Chesney et al. (2003) found that optimism increased following coping effectiveness training for HIV-positive men (but changes in optimism in the control group were not assessed). Antoni et al. (2001) found an increase in optimism over time in breast cancer patients following cognitive-behavioral stress management, but not in control group participants.

Another approach to considering psychosocial interventions directed to coping resources is to investigate coping resources or deficits as moderators of intervention effects. For example, Antoni et al. (2001) found that cognitive-behavioral stress management was more effective for women low in optimism than those high in optimism. Psychosocial interventions may also be more effective for women who lack support than for those in highly supportive environments (Helgeson et al. 2000, Manne et al. 2005b). Among individuals undergoing stressful life circumstances, interventions that address specific skills and coping deficits might be more promising than attempts to change personal dispositions directly. The match between the content of an intervention and the recipients' characteristics also requires attention (e.g., Cameron & Nicholls 1998).

### **Interventions Directed Toward Coping Processes**

The large body of research on coping processes as contributors to adaptive outcomes under stress has not seen adequate translation into strategies for psychosocial intervention (Coyne & Racioppo 2000, de Ridder & Schreurs 2001). Some recent trials, however, illustrate the incorporation of findings from this body of work into psychosocial interventions, the impact of cognitive-behavioral interventions for managing stress on coping processes, and the mediating role of coping strategies on intervention outcomes. For example, Folkman et al. (1991) used coping effectiveness training (CET) that involves appraisal training to disaggregate global



stressors into specific coping tasks and to distinguish between malleable and immutable aspects of stressors, tailoring application of particular coping strategies to specific stressors, and training to increase effectiveness in selecting and maintaining support resources. In HIV-positive men, CET was successful in improving perceived stress, burnout, and anxiety (but not depressive symptoms) relative to control conditions, and coping self-efficacy mediated intervention effects on the first two outcomes (Chesney et al. 2003). In another trial with HIV-positive men, cognitive-behavioral stress management produced significant reductions in mood disturbance and depressive symptoms relative to a standard care control (Crueess et al. 2002). Improvements were predicted by increases in coping self-efficacy, active coping, and coping through acceptance, and by decreases in dysfunctional attitudes and coping through behavioral disengagement (see Carrico et al. 2006).

Relevant interventions also have been conducted with individuals coping with chronic pain. Incorporating intervention elements based on empirically demonstrated links between specific coping strategies and outcomes in populations with chronic pain, Keefe et al. (2004) found, in a sample of adults with persistent arthritic pain, that spouse-assisted coping skills training combined with exercise training improved physical fitness and strength, pain-related coping attempts, and self-efficacy for controlling arthritis. Rhee et al. (2000) compared stress management training with control conditions in patients with rheumatoid arthritis. Improvements in depressive symptoms and pain were mediated by changes in a composite of coping through pain control and rational thinking, coping self-efficacy, and arthritis-related helplessness. Gil et al. (2000) conducted a pain coping skills intervention and a disease education control condition in African American adults with sickle cell disease. The intervention produced a significant reduction in laboratory pain perception and an increase

in coping attempts. Moreover, daily diaries of intervention participants revealed that on days with significant pain during which participants practiced coping strategies, they had fewer major health care contacts (e.g., emergency room visits) than on days during which they did not use the strategies.

Investigations such as these suggest that psychosocial interventions can modify coping strategies and that increases in approach-oriented strategies and decreases in avoidance predict favorable intervention outcomes. A seemingly contradictory finding emerges from a study of couples coping with cancer (Scott et al. 2004), in which couples-based coping training and individual coping training for the patient were compared with a medical education control. The couples intervention was most successful in improving several outcomes. Assessed by totaling the number of coping strategies endorsed, coping efforts decreased in the couples intervention relative to the other conditions. This finding illuminates an important nuance to be considered in intervention research designed to change coping strategies. Active coping efforts are likely no longer to be necessary once they are successful in resolving the stressor. Chronic pain, for example, is likely to require persistent coping efforts, and thus increases in active coping strategies are likely to promote adaptive outcomes (Gil et al. 2000). But when resolution of aspects of a stressor is prompted through active coping, as might occur once cancer treatment is concluded, coping efforts are likely to decrease after intervention.

## Interventions Directed Toward Changing Environments

Macro-level environmental factors (e.g., socioeconomic status) are not modified easily through traditional psychosocial interventions. However, in a randomized trial, a program to increase parents' employment and reduce poverty (e.g., employment-contingent earnings supplements, extensive child-care assistance) has been shown to improve

children's academic achievement, motivation, and social behavior, particularly for boys, with effects on achievement particularly robust at five-year follow-up (Huston et al. 2005).

More proximal contexts, such as risky family environments, represent promising targets for preventive efforts. Specifically, such interventions as promoting parenting and family management skills in inner-city parents with young children (Tolan et al. 2004), conducting parent-child interaction therapy with physically abusive parents (Chaffin et al. 2004), and enhancing communication skills in adolescents with a history of maltreatment (Wolfe et al. 2003) have produced positive results in randomized trials, although contextual factors can moderate effects (Eron et al. 2002). Most such preventive programs have not examined their effectiveness on the recipients' coping attempts in later stressful contexts; however, such programs have yielded valuable

lessons for the design of effective evidence-based prevention programs for families and children (Kumpfer & Alvarado 2003, Weisz et al. 2005).

## TOWARD THE FUTURE

Until recently, research on coping was in disarray. In recent years, its bases, structure, origins, and neural underpinnings have begun to come into view. Important directions for future research include an increased understanding of the environmental and genetic inputs to the development of coping resources and processes over the lifespan and continued delineation of the neural and downstream biological mechanisms whereby coping contributes to mental and physical health outcomes. With this knowledge may come additional successful efforts to modify coping with concomitant mental and physical health benefits.

### SUMMARY POINTS

1. Coping resources and coping processes affect mental and physical health.
2. Stable individual differences in coping resources such as optimism, personal control or mastery, and a positive sense of self or high self-esteem, as well as high levels of social support, promote effective coping with stress and have direct effects on mental and physical health.
3. Approach-oriented coping strategies have been tied to positive psychological and physical health outcomes in stressful circumstances.
4. Although avoidance coping strategies can be successful for coping with short-term uncontrollable stressors, avoidance coping has generally been tied to increased distress and chronic disease progression and mortality.
5. The beneficial effects of coping resources may be heavily mediated by their relations to approach-oriented coping and negative relations to avoidance coping.
6. Coping resources have their origins not only in genetics but also in the early environment; a nurturant early environment promotes the development of coping resources, and a harsh early environment interferes with it; gene/environment interactions are also implicated in successful coping with stress.
7. The neural pathways in the brain that are implicated in coping are increasingly coming to be understood. In particular, the amygdala and dACC are implicated in threat detection, and regions of the prefrontal cortex are associated with adaptive responses to stress.

8. Interventions implied by these perspectives include ones directed to coping resources, to coping processes, and to the environments within which coping skills develop and coping takes place.

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## Errata

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