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Personality and Stress: Individual Differences in Exposure, Reactivity, Recovery, and Restoration

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INTRODUCTION

Throughout its history, research on psychological stress has reflected the assumption that the magnitude, consequences, and perhaps even the nature of the stress response are shaped by enduring traits of the person. Individuals vary greatly in the extent to which they are exposed to stress, the magnitude and patterning of their physiological and emotional responses to potentially stressful life events and circumstances, the length of time it takes to recover from stressful events, and the extent to which there is adequate restoration during or following times of stress. Each of these stress processes—exposure, reactivity, recovery, and restoration—is a potential pathway to poor health (Hawkley & Cacioppo, 2003; Uchino, Smith, Holt-Lunstead, Campo, & Reblin, 2007). Variability in these processes is generally believed to reflect, at least in part, an individual's personality.

In this chapter, we examine how personality—characteristic ways of thinking, feeling, and behaving—influences each of these stress processes. Mechanisms for these associations are considered, including recent findings regarding the genetic and neurobiological underpinnings of temperament and personality that influence stress. We present a theoretical framework that may inform personality–stress associations and discuss the relevance for stress research of central conceptual perspectives on personality and related methodological issues in personality science. As an exhaustive review of these topics is beyond the scope of the chapter, an overview of relevant research is presented, along with a conceptual guide to the role of personality in stress.

CONCEPTUALIZATION AND MEASUREMENT OF PERSONALITY

Many challenges in the study of personality and stress would become more tractable through consistent incorporation of concepts and methods of current personality science. For example, many different personality characteristics have been studied, often with minimal attention to their overlap with previously studied traits. Further,

basic issues in the measurement of personality, such as convergent and discriminant validity, are sometimes given minimal attention beyond an implicit assertion that scale labels and item content accurately and specifically identify the intended constructs. Hence, we echo prior warnings in noting that research in this area can unintentionally reinvent previously identified traits under new labels (Holroyd & Coyne, 1987) or fail to identify basic dimensions of risk and resilience within an illusory diversity of personality constructs (Smith & Williams, 1992). Personality constructs examined in the study of stress range from fundamental dimensions of personality (e.g., neuroticism) to much more specific traits (e.g., sense of coherence, rejection sensitivity), often without a conceptual framework to bridge the global-specific distinction. These constructs also range from broad elements of static personality structure (i.e., global traits) to more dynamic aspects of personality processes (e.g., appraisals, expectancies, goals). Personality variables included in studies of stress, therefore, vary widely in form as well as content. Finally, the study of personality and stress often suffers from a conceptual and empirical separation from research on interpersonal aspects of stress; examination of traits related to stress often involves the implicit removal of the person from the surrounding social context.

Three perspectives in current personality science are valuable in addressing these and other problems in conceptualization and measurement of personality in studies of stress. First, the five-factor model (FFM; see Table 18.1) is a widely accepted trait taxonomy (Digman, 1990) with well-validated measures (e.g., Costa & McCrae, 1992). As such, the FFM provides a nomological net (Cronbach & Meehl, 1955) for comparing, contrasting, validating, and integrating personality scales and concepts used to study stress (Marshall, Wortman, Vickers, Kusulas, & Hervig, 1994; Smith & Williams, 1992). The psychometric tradition in which the FFM is embedded includes well-established procedures for development and evaluation of measures (Ozer, 1999; West & Finch, 1997). Unfortunately, this essential aspect of personality science is used inconsistently in research on individual differences in aspects of stress. Examination of associations of individual scales used in stress research with the broad domains of the FFM and their components or facets (see Table 18.1) would help to

Table 18.1 ■ Elements of the Five-Factor Model of Personality

Trait	Opposite Pole	Facets
Neuroticism	Emotional stability	Anxiety, angry hostility, depression, self-consciousness, impulsiveness, vulnerability
Extraversion	Introversion	Warmth, gregariousness, assertiveness, activity, excitement-seeking, positive emotion
Openness	Closed mindedness	Fantasy, aesthetics, feelings, actions, ideas, values
Agreeableness	Antagonism	Trust, straightforwardness, altruism, compliance, modesty, tender-mindedness
Conscientiousness	Unreliability	Competence, order, dutifulness, achievement striving, self-discipline, deliberation

Note: Adapted from "Professional Manual: Revised NEO Personality Inventory (NEO-PI-R) and the NEO Five-Factor Inventory (NEO-FFI)" by Costa, P.T., Jr., and McCrae, R. R., 1992, Odessa, FL: Psychological Assessment Resources.

identify common dimensions of risk and resilience as well as more specific traits related to stress. This cataloging of scales and traits used in the study of personality and stress could help foster a more systematic, integrated, and cumulative literature.

In this chapter, the primary labels used to designate traits examined in stress research correspond to the domain labels of the Revised NEO Personality Inventory (NEO-PI-R) (Costa & McCrae, 1992), a frequently utilized measure of the FFM: neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness (see Table 18.1). Because of its longstanding association with stress and health, the Type A behavior pattern (i.e., competitiveness, achievement striving, impatience, hostility, excessive job involvement, and emphatic speech) must also be considered. Although articulation of the Type A behavior pattern arose out of medical and epidemiological research, as opposed to the personality tradition, the hostility aspect of this construct has been characterized in relation to the FFM. Costa, McCrae, and Dembroski (1989) presented evidence that hostility is related to aspects of neuroticism (especially the "angry hostility" facet) and to low agreeableness (i.e., antagonism). Similarly, other important traits in research on personality and stress, such as optimism, were also developed outside of the FFM, but they can be usefully related to elements of the FFM taxonomy (Marshall, Wortman, Kusulas, Hervig, & Vickers, 1992; Smith, Pope, Rhodewalt, & Poulton, 1989).

The FFM is particularly useful in clarifying *which* aspects of personality influence stress; it less useful in describing *how* personality influences stress. That is, the traits of the FFM primarily describe characteristics that people *have* rather than things they *do* (Cantor, 1990). The latter type of analysis can be useful in understanding the processes that might link personality with stress. There

have been important efforts to link FFM traits to dynamic personality processes (e.g., McCrae & Costa, 1996), but a second major aspect of personality science—the social-cognitive perspective (Mischel & Shoda, 1998)—is more useful in describing the processes through which enduring characteristics of individuals influence day-to-day stress and adaptation.

Theory and research within the social-cognitive perspective have not achieved the same level of consensus as the FFM in terms of a widely accepted taxonomy of these "middle units" of personality that lie between broad traits and specific behavior (McAdams, 1995). Yet, valuable descriptions of this domain have been offered (Mischel & Shoda, 1998). Examples of these more specific and active personality characteristics and processes include the following: mental representations of self, others, and relationships (i.e., schemas) or interaction sequences (i.e., scripts); appraisals, encodings, or attributions regarding people and situations; motivational constructs such as expectancies, goals, and life tasks; self-regulation and coping; and strategies, competencies, and tactics in goal-directed action.

In this perspective, personality is described through the content of such characteristics (e.g., positive versus negative representations of others) as well as the associations among them (i.e., easily and rapidly activated negative scripts and schemas following appraisals of threat). Beyond their relative emphases on personality structure versus process, a major difference between traditional trait approaches such as the FFM and the social-cognitive view involves the patterns of consistency in behavior that characterize personality. Rather than broad patterns described by trait approaches that essentially represent averages in the behavior that is displayed consistently across situations, the social-cognitive view focuses on patterns of variability in behavior that reflect consistent responses to variations in psychologically distinct situations (Mischel, 2004). "If . . . then . . ." patterns of situation-specific responses, or "behavioral signatures" (Mischel, 2004), are seen as more accurate descriptions of individual differences in behavior. The FFM traits generally describe broad regularities in behavior, or cross-situational main effects, in a person by situation interaction model of behavior. In contrast, elements of the social-cognitive approach provide a more contextualized and dynamic account of individual differences. For example, the personality of an individual who experiences considerable stress and anxiety when interacting with supervisors at work and while making presentations to coworkers, but not in interactions with significant others, clearly differs from that of someone who displays the opposite situational pattern of stress (i.e., tense in close relationships but relaxed at work)—even if on average they both experience similar overall levels of stress and anxiety.

The social-cognitive and trait (e.g., FFM) approaches are complementary rather than necessarily mutually exclusive, and there are a growing number of integrative efforts examining social-cognitive correlates of FFM

traits and similar personality dispositions (e.g., Gambone & Contrada, 2002; Graziano, Jensen-Campbell, & Hair, 1996). The social-cognitive perspective might be particularly useful in the development of stress-reducing interventions, by identifying psychological mechanisms linking personality traits to various aspects of stress.

Optimism versus pessimism is an example of a personality construct widely studied in the stress literature that falls within the social-cognitive perspective. Individual differences in optimism-pessimism reflect generalized outcome expectancies, such that optimists expect positive outcomes whereas pessimists generally expect negative outcomes. Based in social-cognitive models of behavioral self-regulation and related motivational processes (Scheier & Carver, 1992), this trait describes individual differences in responses to disruptions or difficulties in goal-directed behavior, such that optimists persist in goal-directed coping, whereas pessimists do not. This conceptual description is clearly more mechanistic or process-oriented than that of static trait constructs, and it involves a fairly specific, rather than global, individual difference.

Studies of personality are a major component of the broader study of psychosocial influences on stress. Generally, such psychosocial factors are separated into characteristics of people (i.e., personality traits) and characteristics of the social contexts they inhabit (e.g., social isolation, conflict in close relationships, chronic job stress). Yet personality characteristics and aspects of the social environment are reciprocally related; personality traits both influence and are influenced by experiences in personal relationships and at work (Roberts, Caspi, & Moffitt, 2003; Robins, Caspi, & Moffitt, 2002). Further, some social-environmental factors related to the experience and effects of stress, such as social support, demonstrate stability over time and across situations, significant correlations with personality traits, and evidence of heritability. In these ways, social-environmental characteristics examined in stress research often “behave” like personality variables. Traditionally, personality research conceptualizes personality and social circumstances as separate sources of influence on behavior, emotion, and stress, which interact only statistically (Endler & Magnusson, 1976). Yet, personality influences exposure to levels and types of stressors encountered at home and work, rather than only moderating responses to this hypothetically separate source of influence on stress responses. The conventional separation of social-environmental and personality variables could impede the development of integrative models of risk and resilience factors in stress research.

A third major perspective in current personality science—the interpersonal view (Kiesler, 1996; Pincus & Ansell, 2003)—can be valuable in this regard. Sullivan defined personality as “the relatively enduring pattern of interpersonal situations which characterize a human life” (1953, p. 111). In the interpersonal approach, personality and social situations are reciprocally related, as they are in the social-cognitive perspective (Bandura, 1978;

Mischel & Shoda, 1998). In interpersonal theory, the concept that describes the mechanics of this reciprocal influence is the transactional cycle (see Figure 18.1) (Carson, 1969; Kiesler, 1996; Pincus & Ansell, 2003), in which intraindividual components of personality (e.g., schemas, affect, expectancies, goals, appraisals) guide overt interpersonal behavior, as is the case in the social-cognitive approach. The actor’s behavior influences the covert or internal experience (e.g., affect, appraisals) of interaction partners, often specifically in ways that increase the likelihood that the partner’s responses will confirm the initial actor’s beliefs and expectations. Given their generally negative expectations, for example, characteristically cynical and distrusting persons are likely to behave in a cold, defensive, or quarrelsome manner, increasing the likelihood that interaction partners will respond similarly rather than disconfirm the initial actor’s expectancies by expressing warmth (Wagner, Kiesler, & Schmidt, 1995). This transactional process promotes consistency in

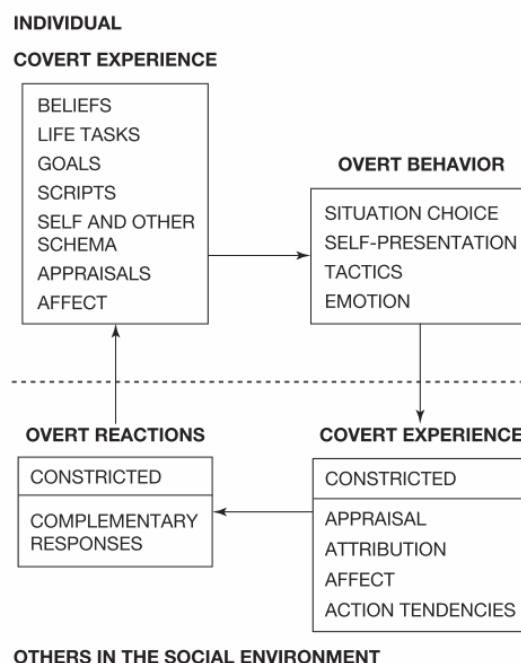


Figure 18.1 ■ The transactional cycle: An actor’s covert experiences or internal responses influence his or her overt behavior. The actor’s behavior, in turn, influences and restricts the interaction partner’s covert experiences, leading that partner to behave overtly in response in ways that complement the initial actor’s behavior, as when the actor’s hostile expectations and overt behavior evoke hostility in return, or expressions of warmth evoke warm responses. Originally adapted from “Contemporary Interpersonal Theory and Research: Personality, Psychopathology, and Psychotherapy,” by D. J. Kiesler (Ed.), 1996, New York: Wiley. Reprinted with permission from Gallo, L.C., & Smith, T.W. (1999). Patterns of hostility and social support: Conceptualizing psychosocial risk factors as a characteristic of the person and the environment. *Journal of Research in Personality*, 33, 281–310.

social interactions that represents stability in personality in the interpersonal approach (Caspi, Bem, & Elder, 1989; Smith & Spiro, 2002). As described later, these same transactional processes can foster generally high or low levels of daily stress and stable levels of social support or isolation.

In the interpersonal perspective, individual differences in social behavior (i.e., personality traits) and the tone of social situations or interactions are described using two basic dimensions (see Figure 18.2). The affiliation axis of the interpersonal circumplex (IPC) (Kiesler, 1983; Wiggins, 1979) is defined by friendliness or warmth versus hostility, quarrelsomeness, or coldness. The control axis is defined by dominance versus submissiveness. The IPC can be used (Gurtman & Pincus, 2003) to compare, contrast, and integrate both personality traits (Gallo & Smith, 1998) and aspects of the social environment that are related to stress (Trobst, 2000). This integrative function of the interpersonal approach can be enhanced with a version of the IPC that also includes the FFM (Trapnell & Wiggins, 1990). The IPC affiliation and dominance axes are rotational equivalents of the FFM traits of agreeableness versus antagonism and extraversion versus introversion (McCrae & Costa, 1989); extraversion reflects somewhat warm dominance, whereas agreeableness reflects somewhat submissive friendliness.

Overall, the interpersonal approach combines assets of the FFM and social-cognitive approaches in facilitating integrative research on personality and stress by including both structural and dynamic concepts and methods. It further expands this integrative potential by means of its applicability to both personality factors and social-environmental influences on stress. Of particular relevance to understanding personality and stress, a socially dominant interpersonal style, including loud, rapid, and emphatic speech and a tendency to “cut off” and “talk over” others during

social interaction, is associated with poorer health, particularly with regard to coronary heart disease (Houston, Chesney, Black, Cates, & Hecker, 1992), as are other indications of dominance (Smith et al., 2008). Further, effortful attempts to exert influence or control over others during social interaction evoke heightened physiological indicators of stress (Smith, Allred, Morrison, & Carlson, 1989; Smith, Ruiz, & Uchino, 2000), and subhuman primate models of atherosclerosis (e.g., Kaplan & Manuck, 1998) have demonstrated associations between social dominance, stress, and health. Hence, an additional potential contribution of the interpersonal perspective is its extension of influences on stress beyond the widely studied dimension of affiliation to the less frequently studied control or dominance dimension of personality and social life.

It is important to note that most studies of personality and stress have relied on self-report measures of personality. Hence, in addition to methodological issues involving convergent and discriminant validity of personality measures, recent research on the predictive utility of other methods of personality assessment could be usefully applied to stress research. Interview-based behavioral ratings or ratings provided by informants are used in some studies, but this is an exception to the general rule of self-reports. Importantly, interview-based or informant ratings are often better predictors of stress and health endpoints than are self-report measures (Miller, Smith, Turner, Guijarro, & Hallet, 1996; Smith et al., 2008). Self-report measures of personality and ratings by other informants or interviewers converge significantly, but only modestly, and often are differentially related to outcomes of interest (e.g., Oltmanns & Turkheimer, 2006). Hence, the nearly complete reliance on self-report assessments could be producing a misleading account of personality as an influence on stress, one that may underestimate the importance of personality variables.

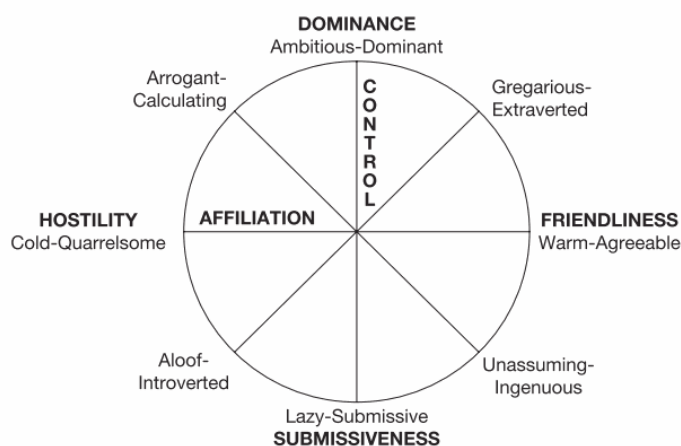


Figure 18.2 ■ The interpersonal circumplex: Individual differences in social behavior and specific interpersonal responses can be organized as blends of the two main dimensions of affiliation and control.

EMERGING PERSPECTIVES ON THE NEUROBIOLOGY OF PERSONALITY

Research on stress and adaptation has increasingly taken a brain-based approach (McEwen, 2007; Uchino et al., 2007). Similarly, our understanding of the associations between personality and stress processes can also be informed by recent developments in the neuroscience of personality and individual differences, through advances in molecular genetics, neuropsychological assessment, and functional neuroimaging techniques (Canli, 2006). In the modern era of neuroscience and behavioral genomics, research focuses on identifying specific biological pathways that contribute to complex cognitive and emotional behaviors. Research of this type contributes to our understanding of how individual differences in temperament and personality emerge and how such differences may confer vulnerability to poor stress regulation.

Temperament refers to individual differences in emotional, motor, and attentional reactivity and is often characterized as the initial state from which personality develops in interaction with experience (Rothbart, 2007). Importantly, temperament is considered to be biologically based, and identification of the underlying neural networks has become a focus of research (e.g., Posner, Rothbart, & Sheese, 2007). The FFM traits have been characterized with respect to the underlying temperament dimensions (Rothbart, 2007; Shiner & Caspi, 2003). Dimensions of temperament and FFM traits show significant heritability (e.g., Jang, McCrae, Angleitner, Riemann, & Livesley, 1998; Plomin et al., 1993), leading to research examining the genetic underpinnings of these individual differences. The “candidate gene association approach” involves testing the relationship between a particular phenotype (e.g., personality traits) and a specific allele of a gene. For example, relevant to personality associations with stress, variations in genes controlling serotonin are strongly implicated in individual differences in neuroticism–anxiety–depression. Moreover, variation in the serotonin transporter gene (5-HTTLPR) has been found to moderate the influence of stressful life events on major depression (Caspi et al., 2003), suggesting that this gene may underlie individual differences in stress responses.

Research utilizing neuroimaging techniques to examine brain activity among individuals with particular genetic variations and during particular cognitive–emotional tasks also holds promise for understanding personality associations with stress responses. For example, individuals with 5-HTTLPR S allele exhibit increased amygdala activity while processing emotional information (Hariri et al., 2002), suggesting that anxiety and fearfulness associated with the short allele may reflect hyperresponsiveness of the amygdala to relevant environmental stimuli. “Bottom-up” brain circuitry, mediated by the basal forebrain cholinergic system, has reciprocal connections with the amygdala and projections

to the cerebral cortex (Berntson, Sarter, & Cacioppo, 2003)—important potential pathways for the exacerbation and amplification of stress-related responses (Uchino et al., 2007). Recent research has also highlighted the brain circuitry involving connections between the limbic system, particularly the amygdala, and the prefrontal cortex (PFC) in emotion regulation. Regions of the PFC are involved in “top-down” processing of emotion input and are central brain regions for executive functioning in general. Executive functioning constitutes a multifaceted construct comprising a number of basic neurocognitive processes, including conceptual reasoning; working memory; cognitive flexibility; response selection, inhibition, and initiation; set formation; and set maintenance (Suchy, 2009). Together, these processes allow us to generate goals and plans, modify our behavior in response to changes in the environment, and follow through and execute necessary actions in order to achieve goals. The fact that serotonergic functioning has been linked to both depressive vulnerabilities and impulsive aggressiveness—seemingly very distinct individual differences—may reflect the fact that a serotonergic neurotransmitter system that underpins executive functioning or self-regulation is a common contributing factor in both (Carver, Johnson, & Joorman, 2008).

Importantly, individual differences in executive functioning have been identified and are associated with stress regulation as well as with personality traits (Williams, Suchy, & Rau, 2009). These same PFC circuits, for example, are associated with parasympathetic activation that is important in both dampening sympathetically mediated stress responses and in the rapid and efficient mobilization of coping behavior and resources through temporary release of inhibition of those sympathetic responses (Porges, 2007; Thayer & Lane, 2000; 2007; 2009). Thus, some neural structures or circuits (e.g., amygdala) clearly contribute to stress reactivity, whereas others (e.g., underpinnings of executive functions in the PFC) may influence the modulation of these responses. To the extent that executive functioning and associated parasympathetic activation contribute to effective coping and attenuation of sympathetic responses, these factors could influence levels of stress exposure, recovery, and restoration, in addition to the more commonly examined endpoint of stress reactivity. Overall, the emerging understanding of the neuropsychological underpinnings of personality, including associations with executive functioning, may elucidate mechanisms for personality–stress relations.

PERSONALITY AND STRESS REGULATION

Personality characteristics make individuals more or less vulnerable to the deleterious effects of stress. Although this proposition appears simple at first blush, the interrelations among personality, stress, emotional

maladjustment, and physical illness are quite complex. Personality might influence the experience of and response to stressful circumstances in a number of ways. For example, personality style might be related to stress by increasing the tendency to be exposed to stressors, by influencing an individual's reaction to life events and circumstances, by shortening or extending the length of time it takes an individual to "recover" from the effects of stress, or by affecting the restorative processes that are crucial to the body's ability to repair itself in response to stress (Uchino et al., 2007). Collectively, these processes comprise stress regulation.

STRESS EXPOSURE

A transactional stress moderation perspective on relations between personality and stress suggests a reciprocal association between individuals and their environments, consistent with the social-cognitive and interpersonal perspectives in personality discussed earlier. In this view, personality traits and stressful events are not independent influences on health; life stressors are not randomly distributed across levels of various personality traits. Rather, by the nature of personality style, individuals may be more or less likely to find themselves in, or create for themselves, stressful circumstances. Stress exposure may take the form of external events, often measured as "major life events" (e.g., divorce) or "daily hassles" (e.g., argument with a coworker). However, exposure may also involve cognitive processes such as anticipation of a stressor (worry) and mentally reimagined stressors (rumination).

Associations with Personality

There is considerable evidence that personality factors are related to differential stress exposure. Characteristic ways of thinking, feeling, and behaving will increase or decrease the probability of stressful circumstances. Within the FFM, neuroticism is the factor most consistently associated with increased stress exposure. Individuals high in neuroticism are more frequently exposed to major life events, daily hassles, and chronic stressors such as conflict in close relationships (Affleck, Tennen, Urrows, & Higgins, 1994; Bolger & Zuckerman, 1995; David, Green, Martin, & Suls, 1997; Gunthert, Cohen, & Armeli, 1999; Magnus, Diener, Fugita, & Pavot, 1993; Suls, Martin, & David, 1998). Neuroticism is also strongly associated with a propensity for worry and rumination (Kotov, Watson, Robles, & Schmidt, 2007). Thus, even in the absence of external events, anticipating events that have not yet occurred, and "reliving" prior events, increase the total stress exposure for neurotic individuals. Trait hostility, often considered to comprise components of neuroticism and of antagonism, is associated with social isolation and inadequate social support (Siegler et al., 2003) and increases in marital conflict over time (Baron et al., 2007).

Conscientiousness is associated with a variety of factors suggestive of *reduced* stress exposure. For example, conscientiousness is related to lower rates of divorce (Roberts & Bogg, 2004), a major life stressor among adults. It is also associated with greater educational attainment and career success, factors comprising socioeconomic status which is, broadly speaking, related to reduced stress exposure. Importantly, conscientiousness may moderate the effects of other emotional traits, such as neuroticism. Optimism is also associated with decreased stress exposure, particularly of an interpersonal nature. For example, in a diary study, Raikkonen, Matthews, Flory, Owens, and Gump (1999) found that optimism was related to less exposure to negative social exchanges. Similarly, optimism is associated with increasing levels of social support over time (Brisette, Scheier, & Carver, 2002).

Potential Mechanisms

Consideration of the hypothesized behavioral motivation systems that underlie neuroticism/negative affectivity can inform our understanding of why this personality factor is so strongly associated with stress exposure. Neuroticism/negative affectivity is thought to derive from a highly active behavioral inhibition system (Gray, 1987), increasing sensitivity to signs of threat or punishment. This sensitivity can, in turn, lead to defensive behavior that may create stressful situations. Greater sensitivity to threat is also associated with anticipatory anxiety and rumination, which will increase total stress exposure in vulnerable individuals. Moreover, characteristic coping strategies may also serve to diminish or prolong stress exposure, such as when emotion-focused strategies lead to amplification of negative affective states.

The interpersonal perspective may also provide a framework for understanding personality associations with stress exposure. Characteristic styles of interacting with others may either enhance social support, potentially reducing stress exposure, or provoke conflict, increasing stress exposure. For example, hostile individuals may interact with others in a quarrelsome manner that thwarts the probability of receiving social support. Thus, a hostile individual's style may both increase the probability of stressful circumstances and reduce the likelihood of having access to stress-buffering resources (Smith, Glazer, Ruiz, & Gallo, 2004).

Individual differences in executive functioning that underlie personality may also play a role in associations with stress exposure. This may, in part, explain associations between conscientiousness and reduced stress exposure. Individuals who are able to override dominant emotional tendencies or impulses, stay on task, stay organized, and meet goals will reduce the probability of experiencing stressful circumstances. Individuals with poor executive functioning, on the other hand, may struggle with substance use, impulsivity, risk-taking behavior,

time management, planning, and organization—all of which have the potential to be stress generating.

STRESS REACTIVITY

The term stress reactivity describes the immediate response to a potentially stressful event and involves one's perception of the event (i.e., appraisal; Lazarus & Folkman, 1984), subjective distress, and physiological arousal (e.g., increased heart rate [HR] and release of stress hormones, such as cortisol). The onset or progression of disease may be influenced through repeated activation of the sympathetic adrenomedullary (SAM) system and the hypothalamic–pituitary–adrenocortical (HPA) axis, which are central to the body's characteristic responses to stress. Studies of stress reactivity, therefore, often focus on cortisol, the stress hormone indicative of HPA axis activation, and systolic and diastolic blood pressure and HR, indicative of SAM-mediated cardiovascular activation. More recently, phasic changes in high-frequency HR variability (HF-HRV) or respiratory sinus arrhythmia (RSA), indicative of parasympathetic activation, have also been studied. Additionally, there are a variety of anatomical and neuroendocrine links between the nervous and immune systems, including immune cell receptors for neurotransmitters and hormones that are either produced or regulated by the nervous system (Ader, Felten, & Cohen, 2001), indicating that physiological responses to stress also include immune system changes (Segerstrom & Miller, 2004; Uchino et al., 2007).

It is also important to consider subjective distress responses to events as a component of stress reactivity, even if they occur in the absence of enhanced physiological reactivity. Subjective distress, particularly if communicated in social interactions, may serve to increase exposure to interpersonal conflict or prolong stress responses. Additionally, recent advances in neuroimaging provide an alternate perspective on “reactivity.” For example, enhanced amygdala activation during the processing negative emotional stimuli might also be considered stress reactivity.

Associations with Personality

Physiological reactivity to stress is reliably associated with traits reflecting propensity to negative affect. Anger, hostility, and depression have been associated with elevations of both SAM and HPA system activation in response to stress (Smith & Ruiz, 2002). Findings regarding relations between individual differences in hostility and cardiovascular reactivity to laboratory stressors are particularly robust (Smith et al., 2004), though the effects may be particular to interpersonal stress (Suls & Wan, 1993). A recent meta-analysis of laboratory stressor studies found that the constellation of hostility, aggression, or Type A behavior was significantly associated with cardiovascular reactivity, whereas the constellation of

anxiety, neuroticism, or negative affect evidenced associations with *decreased* cardiovascular reactivity (Chida & Hamer, 2008). However, chronic anxiety and depressive symptoms are associated with altered autonomic regulation of the cardiovascular system (Berntson et al., 2003; Carney, Freedland, Rich, & Jaffe, 1995; Watkins, Grossman, Krishnan, & Sherwood, 1998), which may be manifest in poorer cardiovascular recovery, as discussed later. Each of these negative affective traits, in turn, has been found to be associated with various aspects of immune functioning, both in terms of response to stressors and more enduring levels of immune activity (Segerstrom & Smith, 2006).

Historically, associations between openness to experience and stress have not received much attention; however, recent findings regarding openness and health outcomes in chronically ill populations (Ironson, O'Leirigh, Weiss, Schneiderman, & Costa, 2008; Jonassaint et al., 2007) suggest that this personality factor may influence stress responses. In support of this notion, Oswald et al. (2006) found that low openness was associated with blunted cortisol responses to laboratory stressors (i.e., speech task, mental arithmetic). Recent data also indicate that high-open individuals evidence lesser sympathetic activation (i.e., increased blood pressure) and greater parasympathetic activation (i.e., HF-HRV) in response to stress, whereas low-open individuals evidence parasympathetic withdrawal and greater sympathetic reactivity (Williams, Rau, Cribbet, & Gunn, 2009).

One concern about associations between personality traits and physiological responses to controlled presentations of laboratory stressors involves the extent to which they occur in “real life.” Ambulatory studies are particularly valuable in this regard. For example, optimism has been associated with lower ambulatory blood pressure during daily activities (Raikkonen et al., 1999), whereas hostility has been associated with higher levels (Benetsch, Christensen, & McKelvey, 1997; Brondolo et al., 2003; Guyll & Contrada, 1998). Although it is often difficult to determine which stress processes are most pertinent in daily stress studies, it is possible to disentangle exposure and physiological versus affective reactivity if diaries are appropriately structured (e.g., Uchino, Berg, Smith, Pearce, & Skinner, 2006). As noted earlier, individuals high in neuroticism/negative affectivity demonstrate both greater exposure and greater affective reactivity to daily events (Bolger & Zuckerman, 1995; Mroczek & Almeida, 2004; Suls & Martin, 2005). Additionally, neuroticism appears to confer vulnerability to depression primarily under conditions of high life stress (Kendler, Kuhn, & Prescott, 2004), suggesting greater affective reactivity to adverse life events. Neuroticism has also been consistently associated with activation of the amygdala and anterior cingulate cortex (ACC), a brain region with connections to the superomedial PFC, during processing of negative emotional information, particularly emotionally negative faces (Haas, Omura, Constable, & Canli,

2007). Thus, although neuroticism appears to be associated with less cardiovascular reactivity to stressors, it is associated with greater *emotional* reactivity.

Potential Mechanisms

A multitude of mechanisms have been proposed to explain the associations linking together the constellation of traits including hostility, aggression, and other Type A behaviors. Although the legacy of the Type A pattern has primarily focused on anger, hostility, and aggressiveness, research indicates that descriptions of this construct contained a second unhealthy trait—social dominance. One hypothesis for greater reactivity among individuals with these characteristics is that they make effortful attempts to exert control, particularly in interpersonal situations. As noted earlier, such effortful attempts to exert control or influence over others evoke increases in sympathetically mediated cardiovascular reactivity (Smith et al., 2000). Hostile-dominant individuals may also perceive hostile intent and threat to social status in ambiguous situations and respond with heightened anger (Smith et al., 2004).

It has been suggested that decreased cardiovascular reactivity to laboratory stressors among individuals high in neuroticism may be due to a heightened orienting response, which would result in decreased HR (Chida & Hamer, 2008). Indeed, increased vigilance to threat has been demonstrated to result in enhanced parasympathetic activation and decreased HR (Somsen, Jennings, & Van der Molen, 2004). In addition to imaging studies demonstrating enhanced activity of the ACC during processing of negative emotional information (Haas et al., 2007), neuroticism is also associated with ACC activation during cognitive conflict detection tasks that *do not* contain an emotional component (Luu, Collins, & Tucker, 2000). Moreover, individuals scoring high on a self-report measure of the behavioral inhibition system (Carver & White, 1994) evidence greater event-related potentials in conflict trials of the Go/No-Go task (Amodio, Master, Yee, & Taylor, 2008), which has been demonstrated to reflect greater ACC activity (Botvinick, Braver, Barch, Carter, & Cohen, 2001; Yeung, Cohen, & Botvinick, 2004). These findings suggest that neuroticism may reflect a cognitive vulnerability involving enhanced conflict monitoring.

STRESS RECOVERY

In the context of the stress response, recovery typically refers to levels of emotional or physiological arousal after termination of the stressor or to the time required for the individual to return to baseline levels after termination of the stressor. In the case of cardiovascular recovery, it has been hypothesized that the duration of stress-related cardiovascular responses may be as important as the magnitude of initial reactivity in the development of cardiovascular diseases (Brosschot, Gerin, & Thayer, 2006; Schwartz et al., 2003). Indeed, poor cardiovascular

recovery has been associated with increases in blood pressure over several years (Mosely & Linden, 2006; Stewart, Janicki, & Kamarck, 2006). In addition to recovery, researchers have noted that physiological responses to stress may also occur in anticipation of a stressor (worry) and when a prior stressor is mentally reimagined (rumination), leading to the suggestion of a more inclusive construct termed *prolonged activation* (Pieper & Brosschot, 2005).

Associations with Personality

Individual differences in hostility have been associated with delayed recovery of cardiovascular responses to stress, particularly anger provocation (e.g., Anderson, Linden, & Habia, 2005). Neuroticism and other anxiety-related traits are also associated with poorer cardiovascular recovery to laboratory stressors (Chida & Hamer, 2008). Moreover, individuals high in neuroticism tend to experience “negative emotional spillover” after the experience of a negative event and concomitant negative mood, meaning that negative mood states tend to persist over time (Suls & Martin, 2005). Thus, it takes longer for these individuals to recover from negative daily events.

Potential Mechanisms

Central to cardiovascular stress recovery is the activity of the parasympathetic nervous system. Of particular importance, parasympathetic activation, as indexed by HF-HRV (or RSA), is associated with PFC activity (Lane, Reiman, Ahern, & Thayer, 2001). PFC functioning figures prominently in the recently proposed neurovisceral integration model (Thayer & Lane, 2007; 2009). Specifically, this region supports stress-dampening self-regulatory activity through parasympathetic mechanisms, as reflected in higher RSA. For example, increases in RSA have been associated with self-regulatory effort (Segerstrom & Solberg-Nes, 2007) and with attempts to modulate negative emotions during stress (Butler, Wilhelm, & Gross, 2006). Thus, to the extent that personality factors are associated with PFC functioning, this may provide a mechanism for associations with prolonged activation in response to stressful events.

An additional mechanism central to stress recovery involves known associations between prolonged stress exposure and down-regulation of glucocorticoid receptors in the hippocampus (e.g., Sapolsky, 1996), which serve to terminate cortisol responses to stress. Thus, under conditions of persistent stress, normal regulatory feedback mechanisms can be disrupted, resulting in longer recovery. Further, animal research suggests that chronic stress also leads to glucocorticoid receptor down-regulation in the PFC contributing to decreased dopaminergic transmission and associated PFC cognitive deficits (Mizoguchi, Ishige, Takeda, Aburada, & Tabira, 2004). Thus, personality factors associated with chronic stress

exposure, such as neuroticism, may also confer vulnerability to prolonged cortisol responses to stress and PFC cognitive deficits that may lead to further decrements in parasympathetic tone.

Related to physiological recovery are the characteristic coping styles that accompany personality traits. Some coping strategies, such as rumination (Brosschot et al., 2006), may impede recovery following stressful events. To the extent that personality is reliably associated with stress-coping patterns, this may be an additional mechanism for prolonged activation. Indeed, prior research suggests that each trait of the FFM is significantly and independently related to different coping strategies and that personality interacts with type of stressor to predict coping responses (Lee-Baggley, Preece, & DeLongis, 2005). For example, individuals high in openness tend to engage in more adaptive, flexible coping when faced with stressors, which may serve to enhance physiological recovery. Neuroticism, on the other hand, is associated with emotion-focused strategies that may serve to prolong emotional and physiological responses to stress.

PERI- AND POSTSTRESS RESTORATION

During and after the experience of stress, restorative processes operate to “refresh, buttress, and repair various forms of cellular damage” and to return an individual to baseline levels of physiological activity (Cacioppo & Berntson, 2007). In a related conceptualization, “allostatic load” refers to the disruption of homeostatic mechanisms by repeated stress and/or system dysregulation, and it is restored by “allostasis” or a dynamic process of maintaining system balance (McEwen, 2007). Sleep, wound healing, and humoral immunity are examples of restorative processes. Additionally, one aspect of restoration corresponds closely to illness behavior—the capacity for some individuals to retreat from daily stress to recuperate following a time of increased stress and/or illness. A weakened immunological state may increase stress resulting in a positive feedback loop that may foster the development of more frequent or chronic illness (Cacioppo & Berntson, 2006). Although it has been less the focus of research compared with other aspects of the stress response, personality is associated with restoration, particularly sleep quality, making this another potential pathway by which personality may influence stress regulation.

Sleep quality has emerged as a potent predictor of poor health. Poor sleep, especially sleep deprivation, is related to impaired immune functioning (Lange, Perras, Fehm, & Born, 2003) and predicts all-cause mortality (Dew et al., 2003). Recent research suggests that even modest reductions in restorative sleep are associated with increased susceptibility to illness (Cohen, Doyle, Alper, Janicki-Deverts, & Turner, 2009) and coronary artery calcification (King et al., 2008) in otherwise healthy individuals. Importantly, sleep disruption appears to have negative effects on emotion regulation (Dinges et al., 1997; Yoo,

Gujar, Hu, Jolesz, & Walker, 2007) and cognitive functioning (Van Dongen, Maislin, Mullington, & Dinges, 2003), suggesting the potential for escalating stress regulation difficulties under conditions of poor sleep.

Associations with Personality

Of the traditional personality factors, neuroticism and other anxiety-related constructs have been most consistently implicated in the incidence of poor sleep (Gray & Watson, 2002). Moreover, high trait anxious individuals have been found to take longer to fall asleep, have greater percentage of and more frequent transitions to light sleep, and show lower rapid eye movement density compared with low trait anxious individuals (Fuller, Waters, Binks, & Anderson, 1997). Hostility is also associated with poorer reported sleep quality in response to interpersonal conflict (Brisette & Cohen, 2002). Individuals high in conscientiousness, on the other hand, report better sleep quality than their less conscientious counterparts (Gray & Watson, 2002). Moreover, conscientiousness appears to moderate the extent to which neuroticism is associated with adverse effects of poor sleep, such as depressive symptoms and functional impairment (Williams & Moroz, 2009).

Potential Mechanisms

The development of sleep problems is highly related to presleep arousal (Harvey, 2002), reflected in cognitive, affective, and/or somatic indications of anxiety or tension occurring during the period between when the individual goes to bed but before sleep onset. Thus, personality factors associated with presleep arousal will also predict the development of stress-related sleep disturbance. For example, prolonged recovery and perseverative cognition in response to stress may be a mechanism by which individuals high in neuroticism develop sleep problems. Relatedly, emotion-focused coping, which is associated with neuroticism, predicts greater stress-related sleep disruption (Sadeh, Keinan, & Daon, 2004).

The combination of propensity toward negative affect (underlying neuroticism) and poor effortful control (underlying conscientiousness) is hypothesized to be associated with poor emotion regulation. Thus, individuals with this personality profile are likely to have poorer self-regulatory abilities, with stress-related sleep disruption further limiting their regulatory capacity. Consistent with this notion, sleepiness (presumably reflecting poor sleep quality) is related to enhanced bias toward threatening interpretations in an information processing paradigm (Ree & Harvey, 2006). Thus, individuals who are particularly sensitive to signs of threat (i.e., high neuroticism) and have difficulty regulating this tendency (i.e., low conscientiousness) would be most vulnerable to an enhancement of this effect under conditions of poor sleep.

An Integrative, Developmental Model of Personality and Stress Regulation

It is clear that the components of stress—exposure, reactivity, recovery, and restoration—are not independent. An integrative model of personality and stress should consider the associations among various stress processes. Figure 18.3 provides a schematic for considering personality effects on stress regulation. Personality can be viewed as the phenotypic expression of genetic propensities to particular neurobiological characteristics that interact with environmental experience. Underpinning individual differences in personality and stress regulation at the phenotypic level are parallel individual differences in more basic psychobiological factors, or endophenotypes (Gottesman & Gould, 2003). These include individual differences in (1) cognitive processes (e.g., effortful control or executive functioning), (2) physiological processes (e.g., tonic parasympathetic tone, sleep architecture), (3) brain circuits (e.g., amygdala–PFC pathways), and (4) neurotransmitter systems (e.g., serotonergic or dopaminergic systems). Thus, personality reflects one level of a multilevel individual differences perspective.

As described earlier, personality characteristics act as risk or resilience factors for exposure to stress, a necessary precursor to stress reactivity (i.e., reactivity occurs in response to a real or imagined stressor). Personality factors also moderate the associations between exposure and reactivity. That is, given the occurrence of an event,

personality influences appraisal processes and physiological responses. Personality also moderates the duration of recovery, once a reactivity process has begun. Importantly, recovery, in turn, influences restorative processes. For example, individuals who have difficulty recovering from a stressful event (e.g., who experience prolonged distress and rumination) will be prone to high cognitive and somatic presleep arousal, which will influence sleep quality. Although associations among the stress processes are presented in a “feed forward” fashion (i.e., exposure is associated with restoration via reactivity and recovery) in Figure 18.3, there may be other potential pathways. For example, stress exposure may lead to behavioral adaptations (e.g., obtaining additional employment to cope with financial difficulties) that influence sleep quality, bypassing reactivity and recovery pathways. Regardless, once poor sleep quality is present, emotion regulation abilities and daily functioning are adversely affected, thereby creating fertile ground for further stress and illness. Consistent with this notion, sleep-deprived individuals exhibit greatly enhanced amygdala activity in response to emotional imagery, but decreased activity of the medial PFC, suggesting a disruption of the emotional modulation circuitry (Yoo et al., 2007). Through these multiple processes, personality may be related to the propensity for escalating difficulties under stressful circumstances. For example, neuroticism is associated with stronger negative reactions to recurring problems over time, a process Suls and Martin (2005) term the “neurotic cascade.”

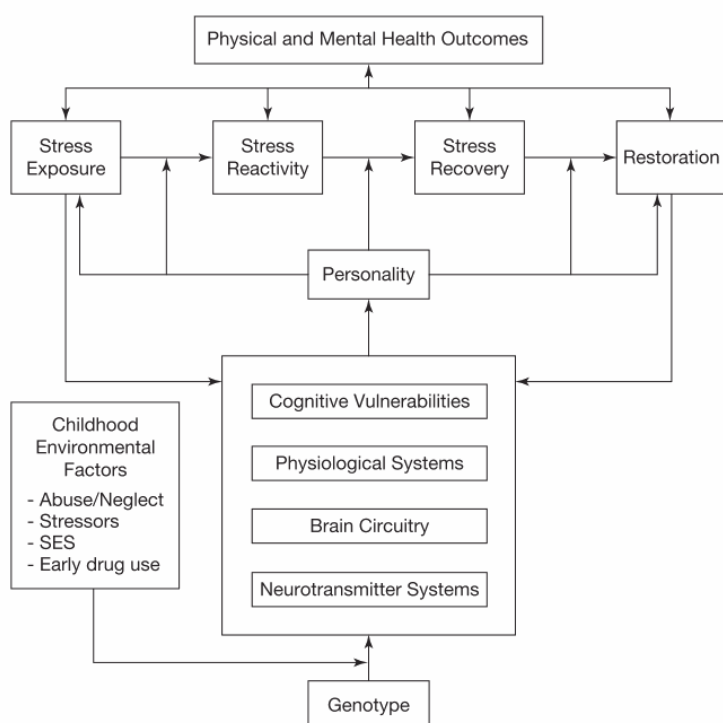


Figure 18.3 ■ Schematic of individual differences in stress processes: Personality is characterized as the phenotypic expression of genetic propensities to neurobiological characteristics that emerge in interaction with environmental experience over time. Dynamic reciprocal associations exist between these individual difference factors and stress exposure, reactivity, recovery, and restoration.

A developmental perspective is imperative to understanding personality associations with stress processes. Most studies examine personality–stress associations in a “slice” of time. As we have argued, particular personality profiles appear to place individuals at risk for negative stress-related trajectories, but the personality–stress relations may be different depending on when the association is measured. For example, early in the trajectory, individuals high in neuroticism may evidence increased cortisol reactivity. Later in the trajectory, after repeated exposure, enhanced mood response to events, prolonged recovery periods, and poor sleep quality, a level of allostatic load (and, potentially, depression) may be reached and anxiety-related traits will predict blunted cortisol responses.

Further, a growing body of evidence indicates that early-life experiences shape the physiological mechanisms identified as potentially linking personality and stress responses (Danese, Pariante, Caspi, Taylor, & Poulton, 2007; Gutman & Nemeroff, 2003; Luecken & Lemery, 2004; Taylor, Lerner, Sage, Lehman, & Seeman, 2004). For example, stress, particularly chronic traumatic stress, appears to undermine cognitive functioning through a variety of pathways including cortisol effects on the brain. Interestingly, Ellis and Boyce (2008) present evidence that highly protective environments may also result in high stress reactivity, in a process they term “biological sensitivity to context.” That is, there may be a curvilinear relationship linking genetic vulnerability and environmental stress exposure to phenotypic expression of stress reactivity. Hence, research on personality and stress could also benefit from incorporation of recent developmental approaches to the emergence, continuity, and change of personality characteristics (Caspi, Harrington, Moffitt, Milne, & Poulton, 2006).

CONCLUSION

Early discussions of the role of personality in stress were primarily concerned with individual differences in the magnitude of stress reactivity (e.g., Cohen, 1980). That is, personality was conceptualized as accounting for variability in emotional and physiological responses to stressors. Later work examined the role of personality in stress exposure and reactivity (e.g., Bolger & Zuckerman, 1995). Yet, personality traits and processes are also clearly important in recovery and restoration. To fully capture and clarify these multiple roles of personality in stress and to best facilitate future research, at least three approaches to personality are needed. Well-established trait taxonomies such as the FFM and related well-validated assessment inventories are needed to compare, contrast, and ultimately integrate the plethora of personality characteristics studied in stress research. Without such comparative and integrative efforts to contend with an otherwise piecemeal literature, it will be

virtually impossible to identify broad dimensions of risk and resilience. It will also be difficult to distinguish truly unique or specific personality influences on stress from those that seem unique on the basis of scale labels but are actually overlapping or redundant with similar traits studied under different names. In addition to the empirical referencing of personality variables used in stress research to established trait taxonomies such as the FFM, the further explication of associations of the FFM traits and their constituent facets with stress exposure, reactivity, recovery, and restoration constitutes an important agenda for both personality science and stress research.

In moving beyond evidence of associations between personality characteristics and aspects of the stress response to a more detailed understanding of underlying psychological mechanisms, the social–cognitive perspective in personality can be useful. The more dynamic and situation-specific individual difference concepts (e.g., schemas, scripts, appraisals) that comprise this perspective can help to clarify the proximal psychological influences on individual differences in various aspects of the stress response, perhaps in ways that facilitate the refinement of stress-reduction interventions.

The interpersonal perspective can also play a valuable role in explicating the specific and dynamic psychological influences on the stress response, especially because the most common sources of everyday stress involve social relationships and interactions (Bolger & Zuckerman, 1995). The interpersonal perspective also provides concepts and methods that facilitate the integration of personality and social influences on stress—two research domains that are often studied separately, to the detriment of both. Within the basic biopsychosocial framework underlying much of stress research, the interpersonal perspective can be seen as providing a bridge from the individual level of analysis in which most personality research typically occurs to the social level of analysis.

Similarly, emerging neuroscience perspectives on personality can provide a conceptual and empirical bridge between the psychological and biological levels of analysis. To the extent that the genetics and brain circuitry underlying personality constructs can be identified, along with individual differences in performance on cognitive and emotional tasks that reliably activate particular brain circuits, it will be possible to articulate neurobiological mechanisms for the effects of personality on stress responses over time. Individual differences in performance on such tasks and the patterns of neural activation that accompany them can be seen as endophenotypes underlying phenotypes involving personality and components of stress regulation. Yet, despite the promise of behavioral genetics and neuroscience in advancing our understanding of personality–stress relations, it is unlikely that single gene variations will have extensive explanatory value. Examining the contributions of multiple genes acting in response to environmental pressures is likely to be necessary for the development

of truly predictive markers that account for the majority of variance in any given phenotype, including personality factors related to stress.

Overall, a broad and inclusive view of personality science—ranging from the inherent and reciprocally determined social “embeddedness” of personality to its neurobiological underpinnings—has the potential to clarify individual differences in various aspects of the stress response. But this broader view of personality science also has the potential to provide an important integrative perspective on stress research in general. That is, while seemingly concerned exclusively with individual differences, the study of personality and stress can help identify the core biological, psychological, and social influences on stress by clarifying the nature and underpinnings of those individual differences (i.e., the study of “processes” and “individual differences” can exist together and inform one another in an integrative manner; see Posner & Rothbart, 2007). Thus, the concepts and methods in current personality science might prove to be useful in describing not just the individual differences in stress exposure, reactivity, recovery, and restoration that combine to characterize vulnerability and resilience but also the underlying nature of these key and universal components of human stress. A comprehensive perspective on personality includes accounts of both the universals of human nature and the myriad variations on this basic form (McAdams & Pals, 2006). Given this dual focus, personality science would seem to have much to offer in efforts to understand—and ultimately manage—human stress.

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