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THE ROLE OF EMOTION ON PATHWAYS TO POSITIVE HEALTH

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Many of the core questions in affective science (e.g., Are there basic emotions? What are the antecedents and functions of emotion? How do individuals differ in emotional reactivity?) have developed without explicit connection to the realm of human health. Alternatively, when emotion has entered the health realm (e.g., Does anger increase cardiovascular risk? Is optimism protective?), it has frequently been with little connection to mainstream research in affective science. This separation is not a state of affairs to lament, but rather represents opportunities for the future in which the fields of emotion and health can enrich and extend each other.

Our objective in this chapter is to bring the nexus between these realms into focus via discussion of five guiding premises for relating emotion to health. These serve as conceptual guideposts for examining past, current, and future empirical studies, and do so with an emphasis on testable hypotheses. The five premises are: (1) emotions consequential for health are about something; (2) health requires a focus on co-occurring discrete emotions; (3) health is biopsychosocial in nature and necessitates integration of phenomenology and neurophysiology; (4) cumulative, chronic emotions are consequential for health; and (5) emotion can be protective and promote positive health. Each premise is illustrated via separate substantive studies, although a unifying theme across them is the need for integrative endeavors that put together psychosocial experience, underlying biological mechanisms, and health outcomes.

A second generic observation setting the stage for what follows is the relative paucity of knowledge about positive emotion-health linkages. Our goal is to bring greater attention to salubrious connections between affective experience and health, mental and physical. An emphasis on positive health, we note, does not translate simplistically to a focus on exclusively positive affective experience. As we will argue, one of the intriguing challenges of future work is to unearth basic processes whereby negative emotions, ubiquitous in human experience, can be transformed into benign, or even beneficial, influences on health. Finally, while we seek to underscore the positive health theme, much in our chapter deals with the role of emotion in illness as that is where most prior work has been conducted.

Premise I. Emotions Consequential for Health Are *About Something*

In building connections between affective experience and health, we propose that it is particularly valuable to anchor emotion in the life contexts in which they occur. This is a call for greater emphasis on what gives rise to emotion. Ekman's (1992) description of basic emotions emphasized that they "evolved for their adaptive value in dealing with fundamental life-tasks" (p. 171). He drew on numerous works of others to summarize the universal predicaments (achievements, losses, frustrations), the com-

mon adaptational tasks (facing danger, progressing toward a goal), the recurrent situations (fighting, falling in love, escaping predators, confronting sexual infidelity) that catalyze emotion. Simply put, emotions are designed to deal with "inter-organismic encounters" (p. 171)—they are fundamentally *about something*.

To those outside the field of affective science, calling for attention to what emotions are about may seem gratuitous—indeed, an obvious point. However, extant work in the affective field reveals that it is the exception, not the rule, to focus on the fundamental life-tasks described above. In examining the origins and functions of positive and negative affect, Carver and Scheier (1990) make the point that how good and bad feelings arise is a pervasively neglected question: "Indeed, it is remarkable how rarely anyone ever asks where affect comes from" (p. 22), and go on to note that many formulations discuss only what happens once affect is already present. Likewise, the literature addressing the basic structure of emotion and affect (Green, Salovey, & Truax, 1999; Russell & Barrett, 1999; Watson, Wiese, Vaidya, & Tellegen, 1999; Yik, Russell, & Barrett, 1999) is primarily about momentary, free-floating assessments of reported feelings. At the level of neural substrates the focus is also "more on the architecture and operating characteristics of the affect system than on the antecedent condition for arousing positive or negative affect" (Cacioppo, Gardner, & Berntson, 1999, p. 849).

Drawing on these distinctions, Russell and Barrett (1999) distinguish between *core affect* as the most elementary consciously accessible affective feelings (and their neurophysiological counterparts) that "need not be directed at anything" (p. 806), and *prototypical emotion episodes*, which are feelings concerned with a specific object—"one is afraid *of*, is angry *with*, is in love *with*, or has pity *for* something" (p. 806). Most parsing of affective space has been about the former, not the latter (see later discussion of discrete versus dimensional models in Premise II). Moreover, when feelings about something have been considered, the focus is typically on "temporary events and slices of time" (p. 805). They note that love and hate, prototypical exemplars of emotion, as in lifelong love of an offspring, are not part of their purview.

Why do we advocate for greater focus on the fundamental life tasks that give rise to emotion in building bridges to health? A first reason is that emotional reactions to core life challenges are, we propose, powerful elicitors of affect—both phenomenologically and physiologically. It is grinding feelings of defeat or exhilarating triumph in pursuing sought-after goals, along with the comforting security or tormenting despair in primary social relationships, that leave a great imprint on psyche and soma. Further, given our advanced cognitive capacities, these poignant, sometimes elevating, sometimes debasing human feelings may well be reactivated simply by thinking about them. Elie Wiesel (1999) wrote about being haunted over the course of his life by his inability to come to the assistance of his father as he called for help in the concentration camp. He was, in fact, unable to speak at the Nobel Peace Prize ceremony in his honor in 1986 because of the following recollection.

> I see myself once again with my father on the last day of his life, the last night. I was near him as he agonized, but not at the hour of his death. I speak of it in "Night." He called me. My father called me, gently, weakly. I heard him moaning. I heard him calling. His cries tore me apart; they tear me apart still. In spite of the danger I should have gone to him, run to him. I should have said to him: "I'm here Father. Your son will never leave you." I should have told him something, anything. But we were forbidden to speak. I would have been beaten, beaten to death. I would have been killed. I was afraid then. I am afraid now. (pp. 270–271)

Early on in the affective field, Darwin asked whether we can feel anger, fear, sadness, and enjoyment when we are alone (1872/1998). For the human species, the answer seems a resounding yes; we suggest that this capacity is consequential for health.

A further reason for focusing on what emotions are about intersects with studies of life stressors that have been previously linked to intervening neuroendocrine, cardiovascular, and immunological mechanisms implicated in health outcomes (McEwen & Schmeck, 1994; Sapolsky, 1992; Weiner, 1992). That is, notable benefits regarding the explication of mechanisms follow from focusing on the fundamental life-tasks that give rise to emotion. This interface between the psychobiology of life stress and the emergent field of affective science represents another promising nexus for cross-fertilization and interdisciplinary inquiry. Emotion, it can be argued, has been insufficiently elaborated in the stress literature. Concomitantly, anchoring the study of affect in fundamental life-tasks provides connection to neurophysiological mechanisms implicated in stress.

Yet another reason for emphasizing what emotions are about pertains to the challenge of discerning whether particular emotional responses are adaptive, maladaptive, healthy, unhealthy, warranted, or unwarranted. Davidson, Jackson, and Kalin (2000) argue that to answer these questions, it is critical to know the context in which the affect is experienced—that is, what the feelings are about. They further suggest that "context-inappropriate responding," a hypothesized product of hippocampal dysfunction, is a hallmark of certain forms of psychopathology.

To illustrate the consequential nature (for health) of feelings *about something*, we offer two examples below. The first pertains to emotions about significant others, and the second involves emotions about racism. We select

these examples because they bring into high relief the extent to which health questions may lead to distinct ways of organizing affective experience from currently available models. For example, most key social emotions (e.g., love, hate, affection, attachment, jealousy, envy) are notably absent in formulations of core affect (Russell & Barrett, 1999; Watson, Wiese, Vaidya, & Tellegen, 1999; Yik et al., 1999). Similarly, the experience of racism may not be fruitfully captured by two-dimensional models of valence (positive, negative) and activation (low, high). This is not a criticism of such models, as they were not designed with health questions in mind, but rather an observation that pushing forward agendas on emotions and health may require novel conceptualizations of the affective realm. A further reason for selecting these two illustrations is that both have been previously linked to health outcomes.

Emotions About Significant Others

By significant others, we refer to those individuals (children, parents, spouses, co-workers, friends) deemed central players in one's life. Affective experience surrounding interaction with such individuals constitutes a primary category of the inter-organismic encounters described by Ekman. Moreover, a large and growing literature has documented links between the social relational realm and morbidity and mortality (Berkman & Breslow, 1983; House, Landis, & Umberson, 1988; Ryff & Singer, 2000; Seeman, 1996; Seeman, Berkman, Blazer & Rowe, 1994; Uchino, Cacioppo, & Kiecolt-Glaser, 1996). A review of eight major epidemiological studies (Berkman, 1995) indicated that, in each case, mortality was significantly lower among persons who were more socially integrated.

This research has frequently emphasized structural features of social relationships, such as the size and proximity of one's social network (e.g., whether one is married or living alone, whether one has a close confidant; number of close friends or relatives and frequency of contact with them). Notably less concern has been given to the emotional texture and depth of such social relations, although limited questions about emotional support are sometimes included (e.g., Berkman, Leo-Summers, & Horwitz, 1992; Glass & Maddox, 1992). The nature of the emotions that actually constitute such emotional support is rarely elaborated.

There are nonetheless separate literatures dealing with intimacy, attachment, marital interaction, and parent-child relations, wherein the emotional texture of key social relationships is extensively probed (e.g., Berscheid & Reis, 1998; Carstensen, Gottman, & Levenson, 1995; Carstensen, Graff, Levenson, & Gottman, 1996; Cassidy & Shaver, 1999; Fitness, 1996; Fitness & Fletcher, 1993; Hazan & Shaver, 1994; Reis & Patrick, 1996; Ryff, Singer, Wing, & Love, 2001). These agendas are, however, rarely connected to studies of health (Ryff & Singer, 2000).

Still other literatures map the biological processes associated with social interactions, be they affiliative experiences, social isolation, or social conflict (e.g., Carter, 1998; Coe, 1993; Cohen & Herbert, 1996; Kiecolt-Glaser et al., 1997; Knox & Uvnäs-Moberg, 1998: Panksepp, 1998b; Seeman & McEwen, 1996; Uchino et al., 1996; Uvnäs-Moberg, 1998). This is where biological sequelae at multiple physiological levels (cardiovascular, neuroendocrine, immunological) are examined.

Illustrating what emotion is about *and* its links to physiology is the growing literature on marital conflict. Kiecolt-Glaser et al. (1997) have shown that among adults in long-term marriages, 30 minutes of conflict discussion was associated with changes in cortisol, adrenocorticotropic hormone (ACTH), and norepinephrine in women, but not men. Both husbands and wives showed poorer immunological response during conflict. Among newlyweds, Kiecolt-Glaser et al. (1996) also found higher cortisol and epinephrine levels among wives, but only those whose husbands had high probabilities of withdrawal response in their negative communication. More frequent positive behaviors were also associated with lower epinephrine and higher prolactin levels among wives, but not husbands. Other studies have linked marital conflict with high blood pressure (Ewart, Taylor, Kraemer, & Agras, 1991), pituitary and adrenal hormones (Malarkey, Kiecolt-Glaser, Pearl, & Glaser, 1994), and physiological arousal (Levenson, Carstensen, & Gottman (1994).

Taylor, Repetti, and Seeman (1997) have also explored the nature of "unhealthy environments" at the family level and how they get under the skin. Their review points to three characteristics of the social environments that undermine the health of children and adolescents: a social climate that is conflictual and angry, or even violent and abusive; parent-child relationships that are unresponsive and lacking in cohesiveness, warmth, and emotional support; and a parenting style that is either overly controlling and dominating, or uninvolved with little imposition of rules and structure. Such characteristics were linked to depression and maladaptive ways of coping in children as well as health-threatening behaviors in adolescents.

Emotion is a critical ingredient in putting together the pieces of social experience and biology. That is, the affective experiences in proximal and primary social relationships—that is, feelings of love, nurturance, intimacy, affection, and attachment in the positive scenario, or experiences of anger, bitterness, resentment, humiliation, and withdrawal in the negative case—are likely central activators of physiological mechanisms that subsequently feed into health outcomes. This is not to overlook the important behavioral routes through which social support impacts health, such as how significant others promote and encourage positive health practices (Berkman, 1995; Spiegel & Kimerling, 2001; Taylor et al., 1997). Rather, it is a call to sharpen and heighten the emphasis on the emo-

tional features of key social interactions and their attendant neurophysiological underpinnings.

Emotions of Oppression: The Affective Experience of Racism

A second illustration draws on broader social structural influences on affective experience, a realm largely missing in current studies of emotion. Here we consider the emotions associated with being a member of a group that is socially denigrated and denied fair opportunities in life. These are the feelings tied to the experience of racism. An emergent literature is exploring the stress associated with racism and its biopsychosocial sequelae (Clark, Anderson, Clark, & Williams, 1999). African Americans are disproportionately exposed to environmental stimuli that are sources of stress (chronic and acute), and they have a higher prevalence of hypertension and all-cause mortality than do Caucasians of comparable levels of education (Pappas, Queen, Hadden, & Fisher, 1993). While such differences may reflect an unequal distribution of wealth, they are also likely linked to differential exposure to stressors like racism and unfair treatment (Krieger, 1990; Williams, Yu, Jackson, & Anderson, 1997). Perceived racial discrimination, we note, has also been investigated with other ethnic minority groups, such as Southeast Asian refugees (Noh, Beiser, Kaspar, Hou, & Rummens, 1999).

Numerous responses may follow the perception that one has been subjected to racism, such as anger, anxiety, frustration, fear, helplessness-hopelessness, paranoia, and resentment. The ways in which African Americans cope with anger—the affective state most commonly reported to follow perceptions of racism—have been related to cardiovascular reactivity and resting blood pressure (Armstead, Lawler, Gorden, Cross, & Gibbons, 1989; Johnson & Browman, 1987). Investigating the efficacy of general coping strategies as moderators of perceived racism, Armstead et al. (1989) found that as outward expression of anger increased, blood pressure levels decreased after viewing racist video scenes. Other responses to racism include suppression of anger and use of alcohol or other substances to blunt angry feelings (Armstead et al., 1989). Chronic feelings of helplessness or hopelessness may evoke depression and other feelings of frustration, resentment, and distrust, themselves leading to maladaptive health behaviors (overeating, passivity, avoidance).

Recent work by McNeilly et al. (1996) outlines a broad range of emotional and coping responses to racism and methods for measuring them. One hypothesis is that over time, chronic perceptions of racism coupled with more passive coping may lead to frequent increases in and prolonged activation of sympathetic functioning, resulting in higher resting systolic blood pressure levels. Krieger (1990) found that African-American women (more than 45 years old) who responded to unfair treatment (racism and gender discrimination) with passive coping responses (e.g., keeping quiet and accepting treatment) were 4.4 times more likely to have self-reported hypertension than African-American women whose coping techniques were more active. The links between the emotional reactions to racism, coping styles, and subsequent health sequelae in the immune system and stress-induced neuroendocrine responses (see Clark et al., 1999) constitute important directions for future inquiry.

Our objective in including racism as an illustration of the importance of assessing what emotions are *about* underscores the need to anchor affective experience in the challenges, sometimes chronic, of individual lives. We posit that these are what elicit powerful, and frequently recurrent, human emotions. It is the purported intensity and persistence (both subject to empirical scrutiny) that makes these affective experiences relevant starting points for building bridges to health outcomes via diverse neurophysiological mechanisms.

Although our emphasis has been on emotions about racism, we note that such inquiry has broader relevance. Gallo and Matthews (1999), for example, have proposed that negative emotions (specifically, depression, hopelessness, anxiety, hostile attitudes, and affect) may mediate the association between socioeconomic status and health. Thus, it is not ethnic/racial status, but rather social inequalities, even among minority groups, that are consequential for health. Carroll et al. (1997) also emphasize the links between socioeconomic status, hostility, and blood pressure reactions to mental stress.

Finally, underscoring the high prevalence of perceived discrimination in the general U.S. population and its strong associations with mental health, Kessler, Mickelson, and Williams (1999) argue that perceived discrimination needs to be taken much more seriously in future studies of stress and mental health. The perception that one has been discriminated against is, we submit, an experience prompting significant, perhaps powerful, emotional response.

Premise II. Health Requires a Focus on *Co-Occurrence* of Discrete Emotions

Dimensional and Categorical Models of Emotion

Those who study affect give considerable attention to structural questions, such as whether positive and negative affect are best construed as independent or bipolar dimensions (e.g., Diener, Smith, & Fujita, 1995; Russell & Barrett, 1999; Watson et al., 1999; Yik et al., 1999), and the extent to which measurement error obscures understanding of these questions (Green, Goldman, & Salovey, 1993; Green et al., 1999). Comparison of multiple models (e.g., Barrett & Russell, 1998; Larsen & Diener, 1992; Wat-

son & Tellegen, 1985; Thayer, 1989) reveals a convergent emphasis on two dimensions of valence (positive and negative) and two dimensions of activation (high and low), with differing positions as to where to place the axes in this dimensional space (Russell & Barrett, 1999).

Juxtaposed with such dimensional models are models of discrete or basic emotions, which focus on distinguishable (by their facial signals, temporal profiles, presence in other primates) features of anger, fear, sadness, enjoyment, disgust, surprise, and possibly contempt, shame, guilt, embarrassment, and awe. The question thus arises as to whether those who study links between emotion and health are best served by dimensional or discrete models. Watson and Pennebaker (1989) advocated a dimensional model, arguing that a substantial body of data show positive correlations between measures of negative affect and reports of somatic symptoms, with the further suggestion that this correlation is independent of various components (anxiety, depression, anger) constituting the affective pole. Leventhal and Patrick-Miller (1993) challenged this position, arguing that it is essential to disaggregate the negative affect pole. Differential models do a better job of accounting for changes in symptomatology over time (e.g., depression shows a positive association with increases in symptoms, but anxiety does not).

Additionally, Leventhal and Patrick-Miller (1993) pointed out that differential negative affects are necessary to understand the mediation of stress-disease relationships. Although measured in different ways, hostility is implicated in the long-term development of atherosclerosis leading to coronary occlusions and increased probability of acute coronary events during environmental crises (see Matthews, 1988; Smith, 1992). Depression, however, is not predictive of coronary disease (Matthews, 1988), although depression, hopelessness-helplessness, repressive coping style, and deficient social support have been associated with cancer outcomes, such as cancer diagnosis, patient prognosis at time of diagnosis, rate of cancer recurrence, years survived, and patient mortality (Contrada, Leventhal, & O'Leary, 1990). Drawing on animal models, Leventhal and Patrick-Miller (1993) offer possible formulations of physiological mechanisms: Helpless animals show depletion of brain norepinephrine and activation of the hypothalamic-pituitary-adrenal axis, resulting in release of corticosteroids in the bloodstream, with the latter linked to increased growth of implanted tumors, decreased T-lymphocyte proliferation, and decreased natural killer (NK) cell activity.

As these summaries indicate, legitimate arguments can be made for bringing both dimensional and discrete models of emotion to the study of health. To some extent, however, the dichotomy itself is problematic. That is, dimensional approaches cover wide territory, but for health purposes, they reduce affective experience to overly generic components (e.g., feeling good or bad, feeling aroused or unaroused) that may be of limited value for probing differentiated responses to fundamental life-tasks. Alternatively, discrete models offer greater focus on differentiated emotional states, but lack scope regarding a larger panoply of responses that may ensue from engagement in life challenges. Thus, what may be critical for health outcomes is a third alternative—namely, the *co-occurrence of discrete emotions*. Further, recalling our prior emphasis on what gives rise to emotion in the course of living, we suggest that few significant experiences prompt only single emotions or can be adequately captured by only two dimensions (valence and activation).

Racism, for example, likely prompts a constellation of affective experiences that include diverse emotions—anger, fear, resentment, perhaps along with sadness and hopelessness (see prior discussion of Clark et al., 1999). Alienation, a likely component of discrimination, itself involves multiple feelings, including the sense of powerlessness, social isolation, normlessness, and lack of meaning (Seeman, 1959, 1975). Moreover, different individuals likely have different combinations of these negative responses, and these variations can be empirically exploited by assessing co-occurring discrete emotions.

Similarly, emotions about significant others (spouse, children, parents), when they are positive, may involve love, affection, pride, intimacy, security. Fredrickson (1998) argues that love involves a fusion of many positive emotions, the combination of which broadens the scope of thought and action as well as builds personal, social, and physical resources. Alternatively, negative family dynamics may involve combinations of hostility, bitterness, and anger, or despair, detachment, and loneliness, with differing configurations having different physiological sequelae. Miller, Dopp, Myers, et al. (1999), in studying marital conflict, found that displays of anger in husbands high in cynical hostility were associated with greater elevations in systolic and diastolic blood pressure, cortisol, and increases in natural killer cell numbers and cytotoxicity, whereas for men low in cynical hostility, anger was associated with smaller increases in heart rate and natural killer cell cytotoxicity. None of women's affect scores were related to cardiovascular, neuroendocrine, or immunologic outcomes, leading the authors to suggest that other emotions (e.g., sadness) may be more relevant for wives' physiological responses. Finally, the affective experience of illness (e.g., cancer, heart disease) may also involve blends of discrete emotions (fear, anger, sadness combined with heightened levels of intimacy and connection—see Spiegel & Kimerling, 2001).

Thus, a key reason for attending to co-occurring affective responses to life challenges is that they provide more accurate rendering of the subjective experiences—the emotional phenomenology—prompted by fundamental life-tasks. A second reason relates to mapping the neurophysiological mechanisms on the route to health and the

argument that more differentiated assessment of subjective experience will provide greater precision in understanding individual differences in the neural substrates and downstream endocrinological and immunological sequelae of emotion. (See Premise III on the phenomenology and physiology of emotion for further elaboration of this point).

What of Emotional Dispositions and Affective Style?

Our advocacy for the study of co-occurring discrete emotions, anchored in fundamental life tasks, may seem at odds with the emerging evidence of the links between personality traits and affect, such as neuroticism and negative affect, or extraversion and positive affect (Emmons & Diener, 1985; Watson & Clark, 1992), or dispositional optimism (Scheier & Carver, 1992), characterizations of affective style (Davidson, 1998). Collectively, these formulations emphasize the stable, recurrent ways in which individuals experience affect and respond to stimuli from the environment. From this perspective, a focus on co-occurring discrete emotions may seem empirically unwieldy and even unnecessary. Knowledge of an individual's characteristic way of reacting to life challenges may be all that is required, thereby obviating the need for more tedious assessment of diverse, person-specific combinations of affective response to life tasks.

To this issue we bring insight from another realm regarding the question of whether personality is stable or changing (Block, 1982). Drawing on years of longitudinal data, Block empirically documented that some individuals are stable in their personality profiles over time and others are not. Given established connections between personality and affect, it is likely that in the affective realm, some individuals will similarly show stable, dispositional affective profiles, while others will reveal more affective variability, depending on the life challenges confronted. Mapping detailed emotional responses to different tasks will thus be fundamental to distinguish between the two.

Parenthetically, this observation raises the question as to whether prior claims that emotional responses are dispositional and traitlike have been premature. Why might this be the case? At the level of self-report, studies of affect variability (Watson & Walker, 1996) and related arguments for the traitlike nature of intra-individual variability in affect (Eid & Diener, 1999) may overstate the case for stability by virtue of the free-floating assessments of affect. That is, respondents are not asked to report their subjective feelings *about anything*, but rather to indicate how often they felt particular emotions at particular temporal intervals. For some, this may be a particularly difficult task, given that on a specific day, or at a specific moment, one might have a host of different feelings depending on whether they were about the current situation at work, recent family dynamics, new developments in the stock market, or the weather. Similarly, laboratory studies of affective style may inflate profiles of dispositional differences as a function of the standardized nature of the stimuli employed. Such standardization is, of course, necessary to draw meaningful conclusions across respondents, but it may at the same time mask the variability evident in emotional reactivity to challenges of daily life.

From the health vantage point, stable, traitlike affective dispositions are nonetheless likely to be of consequence in the recurrence, or chronicity, of emotional experience and its neurophysiological substrates. The above observations do not dispute this point; rather, they underscore the need to attend to what emotions are about in the interest of better discerning those who are, and are not, stable in their affective responses.

Premise III. Health Is Biopsychosocial in Nature and Requires Integration of Phenomenology *and* Neurophysiology

From multiple vantage points comes the argument that human health is fundamentally a matter of interacting biological and psychosocial processes. In the field of psychosomatic medicine, Engel's (1977) biopsychosocial model of illness emphasized interacting systems at cellular, tissue, organismic, interpersonal, and environmental levels. Similarly, Liposki (1986; see also Fava, 1999a) defined the scope of psychosomatic medicine as a scientific discipline concerned with the study of the relationships of biological, psychological, and social determinants of health and disease. Fava and Sonino's (2000) history of the psychosomatic field clarifies its dramatic growth in recent decades, now spanning numerous realms at the interface of behavioral science, basic biology, and clinical medicine. They underscore the leitmotif of this work—namely, that the mind and body are two inseparably linked aspects of health that, although distinguished for methodological and communicative purposes, require integrated points of observation.

Within clinical medicine, Engel (1998) also understood, with remarkable depth and eloquence, that the physician, as scientist, must operate concurrently in two modes, one observational, the other relational. The observational mode is where data are collected in the classical empirical-analytic approach with its emphasis on careful measurement and accurate description. The relational mode, however, requires attending to the human realm, in which language, symbols, thoughts, and feelings are the means by which private experience is organized and communicated. "It is through dialogue that the physician learns the nature and history of the patient's experiences and clarifies on the one hand what they mean for the patient, and on the other, what they might mean in terms of

other systems in the natural hierarchy, be they biochemical and physiological, or psychological and social" (p. 8). Engel's wisdom was in understanding that the two modes constitute, not separate alternatives, but a single, integrated means for data disclosure, clarification, and interpretation.

Among those studying health from more mechanistic, biological corners there is also recognition that phenomenology and physiology must ultimately be linked. Walter Cannon (1942), using observations from other cultures and centuries, clarified that the experience of fear can, in itself, induce death. Selye (1956) emphasized environmental stressors that produce a disease-producing adaptational syndrome, with subsequent researchers elaborating wide variability in the extent to which environmental changes are appraised as threatening or stressful (Folkman et al., 1986; Pearlin, Lieberman, Menaghan, & Mullan, 1981; Thoits, 1995). Recently, the concept of allostatic load (McEwen, 1998; McEwen & Stellar, 1993; McEwen & Seeman, 1999) has been described as the price paid by the body for chronic overactivity or underactivity of multiple physiological systems (autonomic, HPA axis, cardiovascular, metabolic, and immune). Central to the formulation of allostatic load is the *interpretation of and reaction to* life challenge as benign or threatening. That is, while primary emphasis is given to the interacting physiological systems that constitute the response to challenge, the process begins with the perception of the challenge—a pivotal juncture that determines, depending on the construal, whether physiological systems will be activated.

In the field of affective science, Davidson (1998) also draws attention to "one of the most striking features of human emotion" (p. 307), which is the variability across individuals in the quality and intensity of dispositional mood and emotional reactions to *similar* incentives and challenges. He then elaborates features of "affective style" to organize these individual differences. Parameters of affective chronometry include: threshold for reactivity, peak amplitude of response, rise time to peak, and recovery time. These neural substrates are core components of emotion regulation and are consequential for understanding what underlies, at the level of brain function, psychopathology. Activation of these responses begins with subjective experience—sometimes conscious, other times not, sometimes expressed in words, other times in behavior (e.g., the face) and physiology (e.g., heart rate). Probing the phenomenology of how individuals experience their life challenges is thus essential to understand what sets this chronometry in motion.

Parenthetically, it is useful to recall that the emotion field has not always been receptive to the phenomenological realm as a fundamental part of its purview. Ekman (1992) acknowledged that "the subjective experience of emotion, how each emotion feels, is for some at the centre of what an emotion is" (p. 175), but he nonetheless excluded subjective experience from the core characteristics that distinguish basic emotions on the grounds that "too little is known about how subjectivity maps on to other aspects of an emotional experience" (p. 175). This line of reasoning and related criticisms, or dismissal, or self-reported emotion, are problematic for the study of human health, which requires attending simultaneously to phenomenology *and* neurophysiology. Accordingly, we examine below the issues revolving around self-reported emotion, underscoring its essential role in the process linking the psychosocial realm to health. In addition, we call for explicit examination of points of convergence and discrepancy between the felt experience of emotion and underlying neurophysiological substrates. The fit, or lack thereof, between these two constitutes a critical nexus for understanding individual differences in how emotion influences health. Further, the juxtaposition of the phenomenology and neurophysiology offers important opportunities to understand how one side might afford protective features to offset the vulnerabilities of the other.

The Perils of Self-Reported Affect

Despite the fact that much of the work on the structure of the affective domain has been conducted with self-report measures (Watson et al., 1999; Yik et al., 1999), recurrent criticisms plague these data. The call to "move beyond self-report data in exploring the structure of affect" (Diener, 1999, p. 804) reflects concerns with self-report biases, motivational influences, and the fact that language does not always capture affective experience (Cacioppo et al., 1999; Green et al., 1999). Thus, individuals are viewed as unreliable reporters of their own affect because they engage in distortion (conscious or unconscious), sometimes responding carelessly or randomly, or even not actually knowing (or remembering) how they feel, or felt.

Those who study emotion via language only further complicate matters. English emotion words have been described as falling into 25 categories of synonyms (Shaver, Schwartz, Kirson, & O'Connor, 1987). This taxonomy has been used to probe emotion nomenclature universals in major geographical and linguistic groupings (Hupka, Lenton, & Hutchison, 1999). Four basic linguistic emotion categories were identified—the first pertaining to categories of anger and guilt (which exist in all languages); the second to categories of adoration, alarm, amusement, and depression (which also exist in all languages); the third to categories of alienation, arousal, and agony; and the fourth to the category eagerness. Many of these linguistic basics (e.g., guilt, adoration, alienation, agony) are, we note, missing in current self-report instruments of affect.

In addition to the linguistic parsing of affective space, individual differences in language use, referred to as linguistic styles, have also been put forth as an independent and meaningful way to study personality (Pennebaker & King, 1999).

That is, people verbally express themselves in stable and unique ways. This observation raises the further wrinkle that structured, self-report inventories of affect may not include the terms spontaneously selected by individuals to describe their feelings, thus forcing ratings on a host of terms that may exist outside an individual's linguistic style. Even if individuals choose similar terms to describe their feelings as those on self-report instruments, there is the additional quandary of not knowing whether particular words *mean* the same thing to different individuals.

Given these difficulties, it is not surprising that attempts to build knowledge of emotion on a foundation of words (the affective tower of Babel?) are greeted with suspicion. Some argue for alternative approaches to the assessment of subjective states, such as measures of "objective happiness" (Kahneman, 1999, 2000), which seek to minimize the biases of self-report. Using the example of "How happy was Helen in March?" Kahneman argues that Helen's retrospective judgment is a "fallible estimate of her objective well-being" (1999, p. 4), which is contrasted with objective happiness defined as the cumulative record of "instant utility" (i.e., being pleased or distressed at a particular moment) over the relevant period of time.

This bottom-up construction of happiness requires that momentary experiences be characterized on a good/bad dimension. Kahneman further suggests that a promising approach to the measurement of this dimension may reside in neuropsychology and the psychophysiology of affect:

> It is conceivable, if not likely, that a composite physiological measurement of the good/bad response could eventually be constructed, and that this measurement would be quite highly correlated with subjective experience of pleasure and distress. Continuous records of affective state could possibly be derived from non-invasive measures of localized brain activity eventually leading to accurate assessments of well-being over time. The movement from science fiction to practical application is likely to be rapid in this domain. (1999, p. 10)

Regarding the fallibility of Helen's retrospective account of her happiness in March, we note that the prior field of subjective well-being has rarely, if ever, been interested in recalled accounts of particular prior moments or periods (see Diener, 1984; Diener, Suh, Lucas, & Smith, 1999; Veroff, Douvan, & Kulka, 1981). The self-report questions that constitute this realm pertain to how individuals feel *now*, or how they feel *generally*. The former cannot suffer from retrospective bias because they are not retrospective. Global or general assessments are also not retrospective, although some individuals may draw on past feelings to make such judgments, or others may be influenced by current mood states (Schwarz & Clore, 1983). Moreover, when asked, retrospective questions have typically been comparative (e.g., how would you rate your happiness/life satisfaction now compared to five years ago?).

For present purposes, the central question is the extent to which such data (whether based on current, global, or retrospective reports) are plagued by distortion. Remarkably little research has actually documented the scope of this problem. Note that studies showing the variability of well-being depending on external factors, such as whether it is a rainy or sunny day, or whether the individual is in a pleasant or unpleasant room (Schwarz & Strack, 1999), are not in themselves evidence for the fallibility of self-reported subjective states, but rather may be testimony to finely tuned human capacities for discerning subjective states. Nonetheless, some have advocated for the use of informant reports or aggregated daily emotion reports (Diener, Smith, & Fujita, 1995) to address potential bias, while others have focused on behavioral assessments (e.g., facial expressions of emotion). Kahneman, as noted above, calls for measures based in neurophysiology. There are difficulties, however, with each alternative. Regarding the use of informants, the major challenge is deciding what to do when there are discrepancies, which frequently occurs, between the targeted respondent and his or her informant. Who to believe in such cases—whose report is to be taken as *true*? Observational tools are extremely valuable, but some emotional experiences (e.g., love, despair, alienation) may not have clear facial or behavioral displays. Moreover, many core life challenges involve co-occurring emotions. Other biologically based measures suffer from the same conundrum as informant reports—namely, what to do when the measures inside the skin, or brain, do not square with self-reported states? What, in such contexts, constitutes the *true* measure of the affective state—what people say they feel, or what the EEG readings show?

We raise these diverse questions to underscore the point that there is no single, final arbiter of affective experience. Human emotion is both internal and external, phenomenological and physiological—both are ultimately required to capture the phenomena. Moreover, the two are jointly needed to clarify the significance of the other. Whatever their failings, self-report measures have been, and will continue to be, *essential* to validate newly emergent assessments of affect on the biological side. Kahneman, in fact, noted that for the brain-based measures of momentary affect to work they would need to be highly correlated with subjective reports. Less hypothetically, Davidson and colleagues (Davidson, 1998; Sutton & Davidson, 1997; Tomarken, Davidson, Wheeler, & Doss, 1992) have dramatically advanced the interpretive significance of asymmetric prefrontal activation by showing that left-frontally activated people report more positive and less negative affect than their right-frontally activated counterparts, and similarly that those with greater left-sided pre-

frontal activation report more behavioral activation (relative to behavioral inhibition) compared to those exhibiting more right-sided prefrontal activation. Measures of prefrontal asymmetry also predict reactivity to elicitors of emotion—those with more left-sided prefrontal activation at baseline report more positive affect to positive film clips, while those with more right-sided activation reported more negative affect to the negative film clips (Wheeler, Davidson, & Tomarken, 1993).

Thus, across these studies, it is the *correspondence* between the reported states (via self-report instruments) and the electrical signals in the brain that are key to advancing understanding of the neural substrates of affective vulnerability or affective strengths. In fact, it is not possible to make sense of the affective system at the biological level *without* showing meaningful connections at the level of subjectively experienced and reported emotion. The conundrum is that the two levels rarely perfectly match. Thus, it is the *discrepancies* between the self-reported states and the biological indicators that are cause for concern. It is to these that we now turn.

Probing the Discrepancies Between Self-Reported Affect and Biology

When phenomenological and neurophysiological data do not line up, what does it mean? We suggest that it is useful to make distinctions between discrepancies that are the result of measurement problems, on either, or both sides, and discrepancies that are meaningful and substantive. Larsen and Fredrickson (1999) provide a comprehensive overview of the reliability and validity of numerous techniques (self-report, observer ratings, facial measures, autonomic measures, brain-based measures, vocal measures). These issues are consequential; Green, Goldman, and Salovey (1993) showed that claims that positive and negative affect are independent were obscured by measurement error that, once taken into account, revealed a bipolar structure. We concur with Larsen and Fredrickson that the emotion field is advanced by increased emphasis on simultaneous use of multiple measures. As noted above, much of the validation of assessments in one realm (self-report, behavioral, autonomic, brain-based) requires showing convergence with the others.

Nonetheless, there are instances in which the self-report data do not square with the neurophysiological measures, and the discrepancy is meaningful. In fact, we submit that the degree of "fit" between these two levels may be a useful dimension of individual differences in affective experience. For example, one instance of poor correspondence pertains to the situation in which the individual, via self-report, puts forth a strongly positive evaluation, but clinical judgments suggest otherwise. Shedler, Mayman, and Manis (1993) refer to this as the "illusion of mental health." They argue that the defensive denial of distress is, however, physiologically costly, and further show that those with illusory mental health have greater coronary reactivity to laboratory tasks than those with genuine mental health. The point we draw attention to is that the biological (heart rate) measures are essential to distinguish between the two types of self-reported mental health. That is, distortion of true subjective states becomes evident via the nexus with physiology. Similarly, Weinberger, Schwartz, and Davidson (1979) probed the phenomenon of repression (experiencing little anxiety on a conscious level but adopting a highly defensive approach to life) by juxtaposing self-reported levels of anxiety and social desirability with physiological measures of arousal.

Alternatively, it is useful to consider the possible juxtaposition of those who have biological (perhaps genetic) predispositions to show greater right-sided prefrontal activation (Davidson, 1998) in response to environmental stimuli, but who have psychosocial strengths and generally positive phenomenology. A useful question in this instance is whether these compensating influences on the psychosocial side afford protective benefits offsetting otherwise adverse downstream consequences (endocrinological, immunological). To push forward scientific agendas that follow from the convergence or divergence of phenomenology and neurophysiology, we present the cross-classification summarized in Figure 57.1. This two-by-two scheme illustrates various mind/body types for which useful predictions regarding health outcomes can be made. The rows of the table make a distinction between those showing generally positive versus negative profiles at the phenomenological (self-report) level; the columns pertain to distinctions between positive versus negative profiles at the neurophysiological level. We consider cerebral activation asymmetry from the work of Davidson, with its distinctions between greater left (+) versus right (−) activation (Davidson, 1998; Sutton & Davidson, 1997) as an example of brain-based assessment, while distinctions between low (+) versus high (−) levels of allostatic load (McEwen & Stellar, 1993; Seeman, Singer, Rowe, Horwitz, & McEwen, 1997) serve as instances of downstream physiological processes.

The convergent cells, positive and negative fit, correspond to those whose phenomenology and physiology match at equivalently valenced levels. These constitute the most straightforward cases from which to make predictions about health, with the positive subjective states, greater left-sided activation, and low allostatic load constituting a mind/body integration, described as positive fit, which predicts positive health outcomes (resistance to disease, delayed onset of disease, quicker recovery from acute health challenges). Alternatively, negative fit refers to those with the configuration of negative phenomenology, greater right-sided activation, and high allostatic load, which is predictive of poor health (vulnerability to mental and physical pathology).

Neurophysiology*

Phenomenology	+	−
+	Positive Fit Predicts: Good Health	Discrepancy b) Is denial costly for health? b) Is hope protective?
−	Discrepancy Toll of life adversity on the biologically advantaged? Precursor to Negative Fit?	Negative Fit Predicts: Poor Health

*At the level of brain-based assessment, "+" refers to greater left-sided prefrontal activation and "−" to greater right-sided activation. At the level of downstream physiology, "+" refers to low allostatic load and "−" refers to high allostatic load.

Figure 57.1 Mind/body typology neurophysiology. At the level of brain-based assessment, + refers to greater left-sided prefrontal activation and − refers to greater right-sided activation. At the level of downstream physiology, + refers to low allostatic load and − refers to high allostatic load.

The off-diagonal, discrepant cells are also informative for making health predictions. Among those reporting positive subjective states, but showing negative neurophysiology, there are potentially two important types. The first corresponds to individuals engaged (consciously or unconsciously) in defensive denial and distortion (Shedler, Mayman, & Manis, 1993; Weinberger, 1990), and the second to those with dispositional optimism (Scheier & Carver, 1992; Taylor, Kemeny, Reed, Bower, & Gruenewald, 2000). Both have adverse biological profiles, but with possibly distinctive long-term health sequelae. That is, defensive denial may be physiologically costly and thus ultimately predict physical health problems, whereas positive phenomenology of the hope variety may be a protective factor. Taylor et al. (2000) document that HIV patients with greater hope show slower disease progression and delayed mortality. In both instances, what needs to be elaborated are the mechanisms whereby denial or suppression of distress can contribute to disease progression or help provide protection against it.

Alternatively, there can be discrepant types wherein individuals report negative emotions and low well-being, but their biological measures appear generally positive (i.e., left-sided prefrontal activation, low allostatic load). These may be individuals who are biologically hardy or genetically advantaged, but who, because of profiles of cumulative life adversity, have come to have negative psychological outlooks. Those who are biologically advantaged, but phenomenologically disadvantaged, would be expected to have more positive health profiles over the long term than individuals having negative profiles on both. However, given the likely plasticity of the neurophysiology (Davidson et al., 2000), what may be the relevant prediction for this cell is that it is a *precursor* to negative fit. That is, the central question is whether persistent negative phenomenology can ultimately shift neuophysiology in comparably negative directions.

Are these types believable? Indeed, they are. In the Wisconsin Longitudinal Study where we have obtained data on asymmetry, allostatic load, and reported well-being on a biological subsample, we have identified individuals who reside in each of these cells. Figure 57.2 summarizes the frequencies for those who are in the top, middle, and bottom quartiles of purpose in life (one dimension of self-reported well-being), and are also classified as having greater left-, or right-sided prefrontal activation. Figure 57.3, in turn, summarizes the frequencies of those having high or low levels of allostatic load, along with high, medium, or low levels of life purpose. Thus,

Purpose	Asymmetry: Left	Asymmetry: Right
Quartile 1	9	9
Quartiles 2-3	18	20
Quartile 4	12	9

Note: Neutral cases of asymmetry are excluded from the above table

Figure 57.2 Cerebral activation asymmetry and purpose in life (frequencies). *Note*: Neutral cases of asymmetry are excluded from this figure.

Purpose	Allostatic Load: Low (≤ 3)	Allostatic Load: High (≥ 3)
Quartile 1	15	11
Quartiles 2–3	31	23
Quartile 4	16	10

Figure 57.3 Allostatic load and purpose in life (frequencies).

the convergent types are evident, but discrepancies are also part of the empirical reality. Longitudinally, our objective is to track the health predictions following from the preceding typology. The work underscores the importance of constructing life pathways that simultaneously monitor what is occurring phenomenologically and neurophysiologically, as the different combinations may provide routes to understanding variation in health trajectories through time.

Premise IV. Cumulative, Chronic Emotions Are Consequential for Health

To date, much of the field of affective science has focused on momentary, short-term emotions. Ekman (1992), in fact, defined basic emotions in part by their temporal profiles—namely, that they have quick onset and brief duration. He argued that it is adaptive for the organism to be able to mobilize quickly and for such mobilization to not last very long. "If one emotion-arousing event typically produced a set of response changes which endure for hours regardless of what was occurring in the external world, emotion would be less responsive than I think they are to rapidly changing circumstances" (p. 185). Ekman further distinguished emotions from moods, which last for hours or days, noting that moods are "highly saturated with one or another emotion—irritability with anger, dysphoria with sadness, apprehensiveness with fear, euphoria with a type of enjoyment" (p. 186). States that endure for weeks or months were not moods, however, but more properly identified as affective disorders (Ekman, 1994). Significantly, enduring positive feelings (e.g., love) were omitted from this classification scheme.

The persistent emphasis on emotion as brief experience is illustrated by Russell and Barrett's (1999) formulation of prototypical emotional episodes, which are "limited to temporary events and slices in time. We omit temperament, attitudes, sentiments, emotional dispositions of any kind, prolonged mood states, psychiatric symptoms, simple evaluative responses, perception of emotion in others, perception of emotion-eliciting qualities of events, and even emotional episodes that are not prototypical" (p. 805). Despite this pervasive and long-standing emphasis on emotions of brief duration, we suggest that the linkage to health *requires* a shift to a different time scale. That is, what is consequential for health are those features of affective experience of long duration: *prolonged mood states and emotional dispositions, and more important, chronic, recurrent emotions and their cumulation over time.* Why does a focus on health call for this temporal shift? Primarily, it is because the neurophysiological mechanisms that are the nexus between the emotional experience and health outcomes will be chronically, or repeatedly, activated. It is this physiological wear and tear that is hypothesized to be costly for the organism. To illustrate these ideas, we summarize an emerging program of research on the topic of allostatic load and its connection to emotion via assessment of cumulative relationship profiles.

Allostatic load is derived from the concept of allostasis, which captures at the biological level the capacity of the organism to adapt to oncoming challenges and thereby prevent the unfolding of pathophysiological processes (Sterling & Eyer, 1988). Emphasis is on the dynamism of internal physiology and the fact that healthy functioning requires ongoing adjustments and adaptations to the internal physiological milieu. Through allostasis, the autonomic nervous system, the hypothalamic-pituitary-adrenal (HPA) axis, the cardiovascular, and metabolic systems protect the body by responding to internal and external stress. The long-term price of overactivity or underactivity of these systems is referred to as allostatic load (McEwen & Stellar, 1993), representing the cumulative wear and tear from chronic stress. Allostatic load has been operationalized with multiple indicators from the above systems, including blood pressure, waist-hip ratio, total and HDL cholesterol, glycosylated hemoglobin, cortisol, epinephrine, norepinephrine, and DHEA-S (Seeman, Singer, Rowe, Horwitz, & McEwen, 1997).

Allostatic load has been shown in longitudinal research to predict incident cardiovascular disease and later life decline in physical functioning and memory loss (Seeman et al., 1997). Recent findings over a 7.5-year period further show that high allostatic load was predictive of subsequent mortality (Seeman, McEwen, Rowe, & Singer, 2001). Such findings document the linkage from this multiple-system construct to morbidity and mortality. The question on the other side of the equation is, What *contributes to, or protects one from,* high allostatic load? We hypothesized that social relational experiences—in particular the emotional features of key significant relationships (i.e., parents, spouse)—*and* their cumulation over time would contribute to differences in allostatic load; with those on more negative relationship pathways more likely to have high load than those on more positive relationship path-

ways. This formulation illustrates the need to focus on emotions that are about something as well as the importance of tracking recurrent, cumulative profiles of emotion.

These questions were examined in the context of a longitudinal study of midlife adults (Ryff, Singer, Wing, & Love, 2001). For a biological subsample of members of the Wisconsin Longitudinal Study on whom measures of allostatic load were obtained, we created relationship pathways based on self-reported assessments of quality of relationships with mother and father (in childhood) and with spouse in adulthood. The Parental Bonding Scale (Parker, Tupling, & Brown, 1979) probes multiple aspects of caring and warmth in the mother/child and father/child bond (e.g., "S/he was affectionate to me. S/he spoke to me with a warm and friendly voice. S/he seemed emotionally cold to me. S/he frequently smiled at me. S/he made me feel I wasn't wanted."). For adult spousal relationships, four different aspects of intimacy were assessed with the Personal Assessment of Intimacy Relationships (PAIR, Schaefer & Olson, 1981). The emotional and sexual subscales included the most intimate forms of connection between spouses, while the intellectual and recreational subscales emphasized mutually enjoyed experiences, companionship, and the scope of shared communication.

We defined the individual to be on a negative relationship pathway if she or he had large negative evaluations of both mother and father in childhood and/or had largely negative evaluations of emotional/sexual and intellectual/recreational ties to spouse. The majority of those who experienced negative childhood ties (both men and women) also reported negative spousal ties. We defined an individual to be on a positive pathway if she or he rated at least one parent as caring and reported at least one combined category of intimacy (emotional/sexual; intellectual/recreational) with spouse.

Using a sample of 101 midlife adults (46 women, 55 men), we found that, indeed, those on the negative relationship pathway were significantly more likely to have high allostatic load than those on the positive relationship pathway (see Figure 57.4). The effects were stronger for men than women, but nonetheless supported the guiding hypothesis in both cases. In a subsequent analysis (Singer & Ryff, 1999), the potentially protective features of persistently good social relationships vis-à-vis life adversity was examined. The targeted life challenge was economic disadvantage. Drawing on the growing interest in the health consequences of socioeconomic inequalities (see Adler et al., 1994), we hypothesized that persistent economic disadvantage would increase the likelihood of high allostatic load, thereby illuminating possible mechanisms in the SES-health link.

Again, with the WLS biological subsample, diverse economic pathways were constructed depending on whether respondents were above or below the median on household income in childhood and/or adulthood. Those with persistently low economic profiles had greater likelihood of high allostatic load compared to those with persistently high economic profiles, although the differences were not statistically significant. When cumulative relationship profiles were combined with economic data, clear patterns emerged. Specifically, those with economic disadvantage in childhood *and* on the negative relationship pathway were significantly more likely to have high allostatic load than those with economic advantage in childhood *and* on the positive relationship pathway. Illustrating the protective role of good social relationships, we also found that those with economic disadvantage in childhood *but* persistently positive social relationships were also significantly less likely to have high allostatic load than those with similar economic beginnings but negative relational experiences. These findings underscore the possible socioemotional routes through which health resilience vis-à-vis life challenge is achieved.

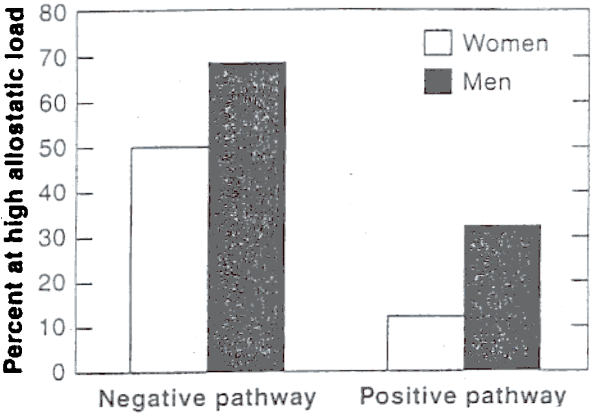

Figure 57.4 Social relationship pathways and allostatic load

The above findings represent but one attempt to link cumulative emotional experience to a composite of physiological mechanisms implicated in later life morbidity and mortality. They also illustrate the use of more person-centered analytic methods (Singer, Ryff, Carr, & Magee, 1998), which may be critical in establishing biopsychosocial models of health. Typological, person-centered analyses are, we note, of growing interest in the behavioral sciences (Bergman, 1998; Magnusson, 1998; Robins, John, & Caspi, 1998). There are, in addition, numerous important avenues for extending these preliminary results. At the level of the emotional experience, there is need for improved measures that probe the relevant depths of significant social ties. We drew on the lives of famous couples (i.e., Leo and Sonya Tolstoy, Elizabeth Barrett Browning and Robert Browning, Freida Kahlo and Diego Rivera) to illustrate the texture and detail required to capture the lived experience of emotion (both positive and negative) with significant others (see Ryff, Singer, Wing, & Love, 2001).

At the level of intervening biological mechanisms, we also underscored the need to examine brain oxytocin, opioids, and prolactin systems as key participants in experiences of social solidarity, warmth, and nurturance. Oxytocin, in particular, has been shown to increase in response to the onset of pair-bonding in adults, maternal attachment, infant attachment, maternal responsivity, positive social behaviors or contact, onset of sexual behavior, and exploration or approach to novelty (Carter, 1998; Panksepp, 1998a; Uvnäs-Moberg, 1998). As an underscore to the theme of cumulative effects, social bonds lead to repeated exposures to positive social stimuli and, thereby, to repeated release of oxytocin (Uvnäs-Moberg, 1998). In humans, such positive experiences can be stored in memories, which in themselves may reactivate physiological processes. Pertinent to health outcomes, evidence from animal models further suggests that chronic oxytocin release is capable of producing long-term reductions in blood pressure and heart rate (Petersson, Alster, Lundeberg, & Uvnäs-Moberg, 1996). Such findings point to a host of new research directions at the human level.

Finally, while our focus on the health significance of cumulative emotional experience has been elaborated with a focus on social ties, we emphasize the need to extend this formulation to a wider realm. Chronic emotional experience in the workplace, where most hours of the day are spent, constitutes one important domain. Occupational stress has, of course, been linked to physical and mental health (Jackson & Warr, 1984; Link, Lennon, & Dohrenwend, 1993; Lundberg, 1999; Karasek, Baker, Marxer, Ahlbom, & Theorell, 1981), but the emotional features of work life (e.g., feeling harassed, demeaned, or chronically criticized on the job; feeling energized and engaged by work demands; worrying about hazardous work conditions) are not well understood. Our prior emphasis on emotions associated with racism and discrimination are another direction for probing prominent and likely persistent feelings of daily life that may be consequential for health.

Premise V. Emotion Can Be Protective and Promote Positive Health

Extensive prior emphasis has been given to the links between emotion and illness (see Leventhal & Patrick-Miller, 1993). The topic of how anger, anxiety, dysphoric affect and depression, and hopelessness-helplessness contribute to dysfunction of various biological systems and, thereby, to disease has constituted a large segment of the science to date. Moreover, the pathways through which affective disturbances influence physical disorders have been increasingly specified (Cohen & Rodriguez, 1995). These pathways include biological, behavioral, cognitive, and social processes. An important message in current work is the likely bidirectionality between affective responses and illness behavior or disease.

Emphasis on the adverse consequences of negative emotion neglects the potentially consequential influences of emotion on positive health promotion (Ryff & Singer, 1998a, 1998b, 2000, 2001). Salubrious psychosocial factors, such as having good-quality relations with others or a sense of engagement and purpose in one's life, may be central contributors to the "physiological substrates of flourishing" that, in turn, help maintain the optimal human functioning of the organism. New interest surrounds questions of what it means to thrive (Ickovics & Park, 1998) and what the possible benefits are of positive emotions (Fredrickson, 1998). Our final premise thus is that emotion can, in fact, be protective and promote positive health.

We divide this section into three parts. The first examines extant research on recovery and resilience, probing the extent to which emotion (phenomenologically and neurophysiologically) may be a part of the story. The second addresses positive health promotion and the extent to which emotional experience can be protective, aiding in the prevention or delay of mental and physical health problems. The third section considers the "intermingling" of positive and negative emotion in understanding optimal mental and physical health. The argument is that good health does not ensue from simplistic models wherein positive emotions are maximized and negative emotions minimized. Rather, optimal functioning requires refined formulations of how the two work beneficially together.

The Role of Emotion in Recovery and Resilience

Mounting evidence points to the importance of *optimism* and *hope* in the face of health challenge. Positive expectations have been shown to predict better health after heart transplantation (Leedham, Meyerowitz, Muirhead, & Frist, 1995), and optimists show more rapid recovery from coronary bypass surgery and have less severe anginal pain than pessimists (Fitzgerald, Tenn, Affleck, & Pransky, 1993). In the HIV model, optimism predicts disease course and mortality. HIV men who were asymptomatic and did not have negative expectations showed less likelihood of symptom development in the follow-up period (Reed, Kemeny, Taylor, & Visscher, 1999). Importantly, HIV men with unrealistically optimistic beliefs about their own survival actually lived longer (Reed, Kemeny, Taylor, Wang, & Visscher, 1994). Moreover, those who were able to find meaning in their loss of a close partner maintained CD4 T help cells over the follow-up period and were less likely to die (Bower, Kemeny, Taylor, & Fahey, 1998). Thus, optimism, hope, and meaning emerge as resources that may preserve not only mental but also physical health (Scheier & Carver, 1992; Taylor, Kemeny, Reed, Bower, & Gruenewald, 2000).

What is the link between optimism and the affective realm? Dispositional optimists (who expect positive outcomes) show less mood disturbance in response to various stressors, including adaptation to college (Aspinwall & Taylor, 1992; Scheier & Carver, 1992), breast cancer biopsy (Stanton & Snider, 1993), and breast cancer surgery (Carver, Pozo, Harris et al., 1993). Exploring the relationship between optimism and immune parameters, Segerstrom, Taylor, Kemeny, and Fahey (1998) found that in a sample of law students in their first semester of study, mood (measured with the Profile of Mood States, POMS; McNair, Lorr, & Droppleman, 1971) partially accounted for the relationship between optimism and helper T cells. Avoidant coping also partially accounted for the relationship between optimism and mood. This line of reasoning thus views optimism as a largely cognitive phenomenon, which is linked to affect via mood assessments. Alternatively, a hopeful life outlook might be viewed as affective experience in its own right—this observation draws on the recognition that positive emotions may have their own defining features and time course (Fredrikson, 1998).

Other factors contributing to differential survival profiles pertain to *social and emotional support*. Group psychotherapy programs, which promote support and emotional expression among women with breast cancer, show multiple effects: reductions in anxiety and depression as well as increased survival time and lower rates of recurrence (Spiegel, 1998; Spiegel & Kimerling, 2001). Survival after myocardial infarction has also been significantly associated with emotional support, after controlling for severity of disease, comorbidity, and functional status (Berkman, Leo-Summers, & Horwitz, 1992). The role of emotional factors in survival processes has also been shown with regard to negative factors, such as anger in the context of coronary heart disease (Kawachi, Sparrow, Spiro, Vokonas, & Weiss, 1996), or depression among post-myocardial infarction patients (Frasure-Smith, Lesperance, & Talajic, 1993).

Regarding major depression, Fava and colleagues (Fava, 1999b; Fava, Rafanelli, Grandi, Conti, & Belluardo, 1998) have shown the power of positive factors in promoting recovery. During the residual phase of treatment, when major debilitating symptoms have subsided but well-being is not fully regained, the risk for relapse is especially high. It is during this period that Fava implements "well-being therapy" designed to increase awareness of and participation in positive aspects of daily life. Fava uses the multidimensional model of psychological well-being developed by Ryff (1989, 1995) as a framework for increasing the focus on positive experience. Those participating in such treatment showed dramatically higher remission profiles over a two-year period compared to those receiving standard clinical treatment. This work underscores the need to promote positive psychological, social, and emotional experience as a key route to sustained recovery from depression.

With regard to resilience, studies of children growing up under adverse conditions (e.g., parental psychopathology, parental alcoholism, extreme poverty) have shown that many evidence healthy development and avoid the disorders of their parents (Garmezy, 1991; Glanz & Johnson, 1999; Rutter, 1990; Werner, 1995). Numerous protective factors have been suggested to explain such resilience (e.g., having bonds with at least one nurturing and supportive parent, receiving external support in the community, having an affectionate and outgoing temperament). Emotion thus pervades the formulation of why some children are resilient in the face of difficult life circumstances.

Our studies have approached resilience from a life history perspective. At the biographical level, we have summarized Mark Mathabane's account of surviving the horrors of poverty and apartheid in South Africa (see Singer & Ryff, 1997), which speaks eloquently to the sustaining power of a committed and tenacious mother and a nurturing grandmother who saved him from a violent street life that destined him for early drug and alcohol use, sexual abuse, and high risk of mortality. In the context of longitudinal survey research, we have studied women who experienced depression at some point in their lives, but regained high well-being in their early fifties (Singer et al. 1998). The characterizations of adversity and advantage in these women's lives underscores the prominence of emotional factors, with regard to both persistent life challenges (i.e., growing up with an alcoholic parent, losing a parent to death in early life) and compensating life strengths (e.g., having close ties with a spouse in adulthood, purposeful engagement as exemplified by upward mobility in the workplace).

In later life, we have studied women who have maintained or regained positive levels of physical and mental health following a major life transition (community relocation); Ryff, Singer, Love, & Essex, 1998). Numerous protective factors constitute such resilience, including social structural influences (e.g., level of education; Ryff, Magee, Kling, & Wing, 1999) and diverse psychosocial influences (e.g., social comparison processes, coping processes, changing self-definitions, emotional adaptation; Kling, Ryff, & Essex, 1997; Kling, Seltzer, & Ryff, 1997; Smider, Essex, & Ryff, 1997). More differentiated assessment of the discrete emotions that constitute reactions to the challenges of aging are important future directions.

Across the above examples, investigations are needed to establish the neurobiological mechanisms through which health protection occurs. As noted earlier, we have probed the benefits of nurturing emotionally rewarding social relationships vis-à-vis economic adversity to reduce the likelihood of having high allostatic load, a known risk factor for subsequent morbidity and mortality. While ad-

verse outcomes, particularly under conditions of high risk, have been avoided, what is unknown is whether such avoidance represents a reversal of neurophysiological systems, or compensatory responses, or both. In animal models, those reared in emotionally impoverished environments have been shown to react to stress more radically throughout their lives than those reared in enriched environments (Caldji et al., 1998). However, these effects have been shown to be *reversible*—those exposed to inadequate nurturing in early life can, if subsequently reared by a high licking and grooming foster mother, show normal functioning and healthy adult lives. What these models offer is critically needed understanding of *how* such behavioral interventions regulate the development of neural systems.

Emotion in Health Promotion and Prevention

With regard to positive health promotion, we reiterate the importance of optimism and hope as well as social and emotional support. Optimists and minimally anxious adults have been shown to have lower ambulatory blood pressure and more positive moods than pessimistic and anxious adults (Räikkönen, Matthews, Flory, Owens, & Gump, 1999). Individuals growing up with feelings of warmth and closeness with parents had, 35 years later, decreased incidence of diagnosed diseases in midlife (coronary artery disease, hypertension, duodenal ulcers, alcoholism (Russek & Schwartz, 1997). Earlier we summarized epidemiological studies that have mapped contributions of the social ties and integration to host resistance, reduced morbidity, and delayed mortality (Berkman, 1995; Cassel, 1976; Cohen, Doyle, Skoner, Rabin, & Gwaltney, 1997; House et al., 1988).

Elsewhere we have juxtaposed the extensive literatures on the health benefits of good social supports with the extensive literatures on attachment, close and personal relationships, and marital quality (Ryff & Singer, 2000, 2001). What is notable is the missing interchange between these realms. Those in the social support arena have been explicitly concerned with health outcomes and, as such, have contributed advances regarding social influences on morbidity and mortality. Extant assessments of social relationships, however, have not probed the depths of relational flourishing, particularly emotional features—what it means to have loving, intimate, fulfilling, and enjoyable ties to others (Ryff & Singer, 2000). Alternatively, social relationship researchers who probe early and later life attachments and close personal relationships, including marital and family ties, elaborate some features of deep, meaningful, loving human connection, but these agendas are rarely connected to health.

Moreover, when social relationship researchers have probed the health significance of key social ties, inquiries have been heavily weighted on the side of relational conflict and dysfunction as risk factors for behavioral, mental, and physical health problems. In the prior section on what emotions are about (see Premise I), we reviewed findings that are mapping the physiological sequelae of marital conflict, a richly expanding area of inquiry. The counterpart agenda (i.e., mapping the physiological substrates of relational flourishing) has received dramatically less attention. The emotional upside of significant social ties and how they impact health is thus a major priority for future inquiry.

It is animal models, particularly studies of positive affiliation (Carter, 1998; Panksepp, 1998a) that may lead the way with regard to the neurobiology of relational flourishing. Animal attachment can be operationalized as selective socioemotional bonds, and thus facilitate observation and experimentation connecting these bonds to physiological substrates. A review of caregiver-infant and adult-heterosexual pair bonds revealed recurrent associations between activity in the HPA axis and expression of social behaviors. Central neuropeptides, especially oxytocin and vasopressin, are implicated in social bonding and social interaction. Uvnäs-Moberg (1997, 1998; Petersson et al., 1996) suggests that oxytocin may mediate the benefits of positive social interaction on health. Oxytocin levels are raised by somatosensory stimulation (e.g., breast-feeding, suckling) as well as touch and warm temperatures. In both male and female rats, oxytocin exerts potent antistress effects, such as decreases in blood pressure, heart rate, and cortisol levels, with effects lasting from one to several weeks. Viewed over the long term, and underscoring our theme of cumulation, social bonds lead to repeated exposure to positive social stimuli and, thereby, repeated release of oxytocin. And, as we noted earlier, such positive experiences in humans may be stored in memories, which in themselves may reactivate these physiological processes.

Further innovative avenues for linking positive experience, particularly of the relational variety, to health pertain to interest in nerve growth factors (Panksepp, 1998b) and the anabolic growth-promoting hormones that embody thriving (Epel, McEwen, & Ickovics, 1998) and help maintain or repair the body. At the behavioral level, there is also much room for expanding the positive focus. Laughter and humor—significant social and emotional experiences—may have important health-promoting substrates, as Norman Cousins (1979/1995) advocated some time ago. We would also underscore the need for expanded emphasis on what Solomon (1993) referred to as the "passions"—those central, defining goals and pursuits of our lives. "Our passions are not the animal intrusions and physiologically based disruptions that they have always been thought to be" (p. xiv). Rather, our passions are the very sources of our interests, meaning, and purposes—

"they are the high court of consciousness to which all else, even reason, must pay tribute" (p. xvii). Advances in affective neuroscience, especially interest in "approach-related affect" (Davidson et al., 1990), add further importance to bringing human passions, purposes, and pursuits into the phenomenology and neurophysiology of positive human health. These constitute an especially promising, and possibly health-promoting, realm of what emotions are about (see Premise I).

Salutogenesis and the Intermingling of Positive and Negative Emotion

At first glance, it appears that optimal health, the process of which Antonovsky (1987) referred to as salutogenesis, would be nurtured by an abundance of positive emotional experiences and a dearth of negative. Numerous lines of inquiry challenge the simplistic notion that positive emotions heal and negative emotions are pathogenic (Dafter, 1996). We briefly highlight multiple realms of study that focused instead on how positive and negative emotions work fruitfully together.

Gottman (2001) argues that negative emotions are a fundamental part of "healthy" social relationships. He distinguishes between "emotion-coaching" versus "emotion-dismissing" parents, which characterizes the emotional styles they bring to the task of rearing children (Gottman, Katz, & Hooven, 1996). A major difference between the two parenting types is their distinctive modes of responding to children's negative emotions, such as anger, sadness, or fear. Emotion-coaching parents help children understand and label their own negative affect, which contributes, in Gottman's view, to the child's developing sense of control and optimism, and more generally, to effective emotion regulation. Emotion-dismissing parents, in contrast, equate such emotions with selfishness, loss of control, passivity, cowardice, and failure. From the health angle, Gottman suggests that children with emotion-coaching parents have higher vagal tone that conveys greater capacity for self-calming after emotional upset. Such children were reported to have fewer infectious illnesses compared to children with emotion-dismissing parents. Thus, the emotion-coaching parent sees negative affect as sometimes legitimate and even valuable, because it provides an opportunity for intimacy and/or teaching, which in turn can strengthen the bond between parent and child.

Further emphasis on the interface of positive and negative emotion comes from studies of naturally occurring, day-to-day social interactions within frameworks of attachment and intimacy (Berscheid & Reis, 1998; Reis & Patrick, 1996; Sheldon, Ryan, & Reis, 1996). The guiding assumption is that emotional well-being follows from the nourishment one obtains from daily social contact with others. Reis (2001) argues that intimacy interactions are those in which self-disclosure occurs *and* there is a partner responsiveness to such disclosure. This can be, and frequently is, in the context of difficult, negative, painful topics, including relational conflict. While conflict may be affectively unpleasant, Reis underscores that it does not necessarily undermine satisfaction of relatedness needs. It is *meaningful*, not uniformly positive, social ties that promote emotional well-being. These are nurtured by how individuals cope constructively with negative emotion and relationship conflict. Indeed, as Gottman emphasized above, difficult or conflictual interactions may, paradoxically, be instrumental in generating enhanced closeness. Reis's work is valuable for illuminating, at the microanalytic level, the nature of social interactions that accomplish these ends.

Another example pertains to group psychotherapy with cancer patients (Spiegel, 1998). These interventions promote social support and emotional expression. Patients are encouraged to access, express, and work through their emotional reactions to the stresses of cancer. Suppression of emotion reduces intimacy in families and social networks, limiting opportunities for direct expression of affection and concern (Spiegel & Kimerling, 2001). Importantly, emotional expression decreases psychiatric and physical symptoms, reduces medical visits, and is linked with enhanced immune response and decreased viral replication. Much of this expression is about negative or traumatic events, and the prospect of dying. It is the intermingling of tears and laughter in dealing with trauma of the disease, in families that have adopted an atmosphere of open and shared problem solving, that helps reduce anxiety and depression, and thereby possibly influencing behavioral and biological pathways of survival.

Fredrickson (1998) also emphasizes how positive emotions may undo the aftereffects of negative emotions. That is, positive emotions are efficient antidotes that may restore autonomic quiescence following negative emotional arousal. Eliciting positive emotions by films or marked smiles, Fredrickson and Levenson (1998) show that positive emotions speed recovery from the cardiovascular aftereffects of fear, anxiety, and sadness. Further, Folkman (1997) underscores the importance of positive meanings and emotion in coping with severe stress (e.g., caregiving, bereavement). Coping theory, she underscores, has been overly focused management of distress and thus overlooked the consequential roles of positive psychological states in dealing with life challenges. Finally, an extensive literature is emerging on possible health benefits of emotional disclosure—that is, expressing (typically via writing) feelings about past traumatic experiences (Cameron & Nicholls, 1998; Kelley, Leisen, & Lumley, 1997; Pennebaker & Beall, 1986; Pennebaker, 1995).

Taken as a whole, the above findings converge on the important message that negative emotion is not singularly bad for health, but rather it is *how* negative emotion is

expressed and responded to that arbitrates its deleterious or beneficial effects. Positive emotion is deeply entangled in such processes, both as an antidote to negative feelings and as a consequence of working through (frequently with significant others) difficult emotions. Thus, it is the nature of how positive and negative emotion are entwined that is critical for future health research.

Conclusion

How emotion makes its way to health outcomes is, we believe, well conceptualized via the metaphor of a *pathway*. The reason is that numerous kinds of information must be put together to understand how human feelings come to be consequential for mental and physical illness, or well-being. We have emphasized that a critical ingredient of what goes on this pathway is what emotions are about—that is, the fundamental life challenges that give rise to affective experience. With regard to the feelings themselves, we call for greater emphasis on co-occurring discrete emotions as a route to sharpening understanding of what life tasks prompt within us. Capturing the emotional experience itself is, we argue, unavoidably about the need to blend phenomenology and neurophysiology. Although emotion has largely been construed as a short-term phenomenon, we proposed that building linkages to health requires focus on recurring, cumulative emotional experience. Finally, because far more is known about how emotion undermines health and well-being, we advocate for a counterpoint agenda that clarifies the protective and health-promoting features of salubrious affective experience.

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