Everybody knows what stress is and yet no one knows what it is.
—Hans Selye (1973, p. 692)

The effect of stress on health is one of the most-studied topics within health psychology. Stress is a ubiquitous aspect of human experience and is hypothesized to be a key driver of many psychological, biological, and behavioral processes. The study of stress, however, is complicated by a diversity of conceptualizations and methods that have emerged over the last century. A Web of Science topic search of the term “stress” returns over a million and a half publications, and even limiting the search to the psychological sciences (PsychInfo) produces over a quarter million citations. Thus, it is no surprise that the concept of stress encompasses a wide range of phenomena and subtypes. These include stress as an external event or stimulus (stressor), as a perceptual state that elicits distress and accompanying biological activity (stress response), or as a characteristic of an environment or situation likely to generate stressors or a stress response. These forms of stress also vary along a temporal dimension ranging from acute to chronic and along an intensity dimension from mild to severe. In this chapter, we review classic and contemporary conceptualizations with a focus on understanding the psychological and biological pathways through which stress impacts health, that is, how stress may “get under the skin” (Taylor, Repetti, & Seeman, 1997), for whom, and when.

Approaches to Conceptualizing and Measuring Stress

It is difficult to discuss conceptualizations of stress without describing common methods of stress measurement. Because a full description of stress measurement is outside the scope of this chapter, we describe specific measures or methodologies only to inform particular conceptualizations of stress.

Stressful Life Events

Within psychology, a classic conceptualization defines stress as an event or situation characterized by demand or challenge that requires a psychological, biological, and/or behavioral response to accommodate the demand (Monroe, 2008). Early investigations of stress focused on events that required a significant degree of “adjustment,” such as those captured in the Social Readjustment Rating Scale (Holmes & Rahe, 1967). Based on ratings of readjustment by a convenience sample of Navy
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officers, a rank ordering of stressful events was created, each requiring a specific number of life change units: loss of marital partner through death or divorce topped the list. The degree of life stress for an individual was determined by a weighted sum of life change units that had been experienced (most often measured as during the past year). This approach was designed to provide a relatively objective assessment of the degree of stress for a given individual, free of the “psychological meaning, emotion, or social desirability” of events (p. 217). However, later checklist measures of stressful life events explicitly included valuations of undesirability in the assessment of the degree of stress experienced (Sarason, Johnson, & Siegel, 1978).

A significant body of research has linked a greater number of life change units and greater level of undesirable life event experience to the greater prevalence and incidence of mental and physical health conditions (see Scully, Tosi, & Banning, 2000; Turner & Wheaton, 1995, for reviews). Although few contemporary investigations of stress apply life change units in assessing the degree of stress experienced, life event checklists remain a common strategy of stress assessment. Other approaches include the study of discrete stressors and their relation to health, including the study of bereavement (Stroebe, Schut, & Stroebe, 2007), relationship dissolution (Sbarra, 2015), and unemployment (Roelfs, Shor, Davidson, & Schwartz, 2011).

**Narrative Approaches**

Event checklist methods were also foundational in spurning the development of alternative conceptualizations and measures that emphasize that the context within which an event occurs is central to assessing the stressfulness of the experience. This is a key focus of life stressor interview approaches, including the gold standard Life Events and Difficulties Schedule (LEDS; Brown & Harris, 1978) and UCLA Life Stress Interview (LSI; Hammen, 2008; Hammen et al., 1987) (see Wethington, Brown, & Kessler, 1995, for a review). Both utilize highly trained interviewers to collect contextual information on life events occurring in various domains (e.g., work, family). This information is used to create event narratives that are coded by independent raters for various forms of threat (e.g., loss, danger, frustration) and other characteristics, a notable one being the degree to which the respondent may have brought about the occurrence of the event.

Although the explicit incorporation of individual biographic and contextual event information in interviewer-rated threat assessment is posited to address many of the shortcomings raised about life event checklists (Shields & Slavich, 2017), these interview methods require considerable time and monetary resources to implement. This has limited their use in large-scale studies of health, particularly longitudinal investigations of representative populations that are best suited for investigation of a potential etiological (causal) role of stressors in ill health over the life course. A new generation of life stressor inventories, including the Stress and Adversity Inventory (STRAIN; Slavich & Shields, 2018), combines elements of self-report life event measures with the collection of contextual information about experienced events to facilitate expedient yet comprehensive assessment of stress (e.g., severity and type of threat) in studies in which interview-based assessments are not feasible.

**Daily Hassles**

Another perspective is that it is life’s daily slings and arrows, or hassles, that have the greatest impact on our health and well-being (DeLongis, Coyne, Dakof, Folkman, & Lazarus, 1982), given their greater number and frequency. Early investigations of hassles showed stronger associations with psychological and physical symptomatology as compared to major life events (DeLongis et al., 1982; Kanner, Coyne, Schaefer, & Lazarus, 1981). However, a recent longitudinal analysis of men in the Normative Aging Study, which utilized repeated assessments of both life event and hassle experience over a 15-year period, indicated that both forms of stress (events and hassles) independently predicted
mortality risk over time (Aldwin, Jeong, Igarashi, Choun, & Spiro, 2014). Thus, both life’s minor arrows and its hammer blows may take a toll on our health.

Linkages between daily stressors and well-being are also the focus of experience sampling or daily diary methodologies (Kamarck, Shiffman, & Wethington, 2011). These methods utilize paper, telephone, or smart technology assessment of stressor experience on a more micro timescale (e.g., across a day, multiple times per day). These methods can involve recall of discrete events, or assessments can be contingent upon the occurrence of a specific event (e.g., an argument). As with life event checklist methodologies, efforts may be made to assess an event divorced from the participant’s evaluations of that event or respondent ratings of stressfulness or undesirability may be directly incorporated into assessments. Studies of nationally representative samples that use these methods indicate that the experience of daily stress is common; for example, Americans experience a stressor on almost 40% of days sampled, particularly interpersonal tensions, with events typically posing a threat of loss, danger, frustration, and disruption of routines (Almeida, Wethington, & Kessler, 2002). These studies also indicate that daily physical and affective symptoms vary alongside the level of daily stress experienced (Almeida et al., 2002), as does total daily output of the stress hormone cortisol which is greater on stressor days, particularly those that involve arguments and overloads (Stawski, Cichy, Piazza, & Almeida, 2013).

**Acute Laboratory Stressors**

Another approach to the conceptualization and measurement of stress is the use of experiments with laboratory-based stressors, which involve a short-term exposure to a challenging cognitive, social, or physical event. Oft-used approaches include engaging participants in challenging cognitive tasks (e.g., a memory or mental arithmetic task), psychosocial tasks (e.g., speech, such as the Trier Social Stress test [Kirschbaum, Pirke, & Hellhammer, 1993] or a contentious discussion with another individual), or physical tasks (e.g., cold pressor) in the laboratory (see Bali & Jaggi, 2015; Dickerson & Kemeny, 2004, for examples). Because they are often embedded within an experimental manipulation, these methods not only allow a greater understanding of the stress experience as it unfolds, but also help to clarify the characteristics of situations and individuals that shape the nature and intensity of stress responses.

**The Stress Process**

The focus of stress research that has the deepest historical roots has been the study of the cognitive-affective, physiological, and behavioral processes that are set in motion following exposure to an aversive or challenging stimulus. Over a hundred years ago, Cannon’s (1915) conceptualization of the fight or flight response initiated the study of emotional (fear and anger/rage), autonomic nervous system, and endocrine activity designed to respond to stimuli that threatened the equilibrium or homeostasis of organisms. Selye’s (1950) General Adaptation Syndrome similarly outlined how these psychobiological processes flowed from exposure to a diverse range of noxious stimuli and provided a framework for understanding how such responses were adaptive in the short term but may put organisms at risk for adverse health outcomes when prolonged (Selye, 1955). Both perspectives view stress response systems in the body as having evolved to address the demands put on organisms from environmental stimuli that disrupt equilibrium or homeostasis in the body. Each was seminal in directing empirical and theoretical attention to the emotional, physiological, and behavioral processes believed to underlie the stress response.

Both Cannon and Selye highlighted the core physiological responses of the body to stress including activation of the sympathetic nervous system, leading to downstream activation in the cardiovascular and respiratory systems and stimulating release of catecholamines (epinephrine, norepinephrine)
from the adrenal medulla, and activation of the endocrine hypothalamic–pituitary–adrenal (HPA) axis, stimulating the production and release of glucocorticoids (cortisol in humans) from the adrenal cortex. These endocrine byproducts of the stress response provide energy in the form of glucose to address the metabolic demands of a stressor and lead to other physiological stress responses (e.g., increased heart rate, blood pressure), which circulate that energy to the body’s tissues and organs. Meta-analytic and systematic reviews of the large body of acute stress investigations in the lab and in naturalistic environments over the last century confirm that stress elicits activation of the sympathetic nervous system, the HPA axis, downstream cardiovascular and respiratory systems, and some aspects of innate and inflammatory immunity (see Brindle, Ginty, Phillips, & Carroll, 2014; Dickerson & Kemeny, 2004; Marsland, Walsh, Lockwood, & John-Henderson, 2017). Although stress exposure is also reliably associated with an increase in emotional distress, a relatively recent qualitative and meta-analytic review documented that psychological and biological responses to acute stress were significantly correlated in only about a fourth of laboratory investigations (Campbell & Ehler, 2012), indicating a need for future research on the alignment of these two core components of the stress response.

A more contemporary conceptualization of stress physiology is found in the concept of allostatics, which posits that the body orchestrates the activity of primary (SNS, HPA) and secondary (cardiovascular, metabolic, immune) systems to address the varying demands of external and internal stressors (McEwen & Stellar, 1993; McEwen & Seeman, 1999). In contrast to the more regulated set points of homeostatic processes (e.g., maintaining body pH in a narrow range), allostatic processes allow greater flexibility in accommodating stressor demands (e.g., greater HPA activation to stimulate significant glucose production to meet the energy demands of a severe stressor). Although adaptive for addressing the challenge at hand, allostatic responses can increase risk of poor functioning and disease when they are too frequently or chronically engaged, are of severe magnitude, or are activated in situations with little adaptive benefit (e.g., activating physiological systems when ruminating about a past stressor).

Such conditions are hypothesized to put wear and tear on the body’s tissues and physiological systems leading to a state of allostatic load. Operationalizations of allostatic load involve a summary index of dysregulated stress biomarkers (e.g., high levels of SNS and HPA hormones, blood pressure, fasting glucose, inflammatory cytokines); this summary index is linked to greater risk of adverse health outcomes, including cognitive and physical impairment, heart disease, and mortality (Beckie, 2012; Gruenewald, 2013; Seeman, Singer, Rowe, Horwitz, & McEwen, 1997). Additional description of these biological stress processes and their associations with health can be found in Chapter 5.

**Psychological Stress Processes**

A focus on the psychobiological processes initiated in response to stressor exposure has been fruitful in elucidating the stimuli that humans and other organisms find stressful. An important advancement in the study of psychological stress processes occurred with the transactio nal model of stress and coping proposed by Lazarus, Folkman, and their colleagues in the 1980s (e.g., Folkman & Lazarus, 1980; Lazarus & Folkman, 1984). Central to this model are cognitive appraisal processes in which individuals evaluate an event or stimulus for what is at stake in the situation. Primary appraisals involve assessments of harm, loss, or challenge. Secondary appraisals involve assessment of coping resources to address the appraised threat, loss, or challenge. The resulting degree of psychological stress experienced, typically assessed with indicators of emotional distress, results from the outcomes of primary and secondary appraisal processes as well as coping efforts to manage the stressor. Some theorists have also posited that the nature of the biological response will vary as a function of primary appraisals of threat versus challenge, for example, a predominance of cardiac activation under challenge and systemic vascular resistance under threat (Blascovich & Mendes, 2000), as well as in response to
secondary appraisal processes, such as increased cortisol reactivity with appraisals of overload and reduced coping ability (Henry, 1993).

**What Makes Stressors Stressful?**

Significant effort has been expended in understanding the characteristics of events or other stimuli that tend to elicit threat, harm, or challenge appraisals—in other words, understanding what makes situations stressful. Almost a century of research points to a handful of characteristics which are potent elicitors of stress perceptions and psychobiological stress responses. Threats to our physical integrity or safety are likely the reason for the evolution of our complex stress perception and response systems. The study of physical integrity threats, including investigation of life-threatening illnesses (e.g., Falagas et al., 2007; Petticrew, Bell, & Hunter, 2002), assault/victimization experiences (e.g., Jaffee, 2017; Lee, Tsenkova, & Carr, 2014; Werner, 2012), and acute physical threat threats, (e.g., Richter et al., 1996), have been important paradigms for elucidating cognitive, affective, and biological responses to stress.

A growing body of evidence also indicates that threats to our social integrity or social self, including threats to status or social bonds that are essential for thriving and surviving in our social world, are also potent elicitors of psychobiological stress responses, particularly activation of the HPA axis (Dickerson, Gruenewald, & Kemeny, 2004; Dickerson & Kemeny, 2004; Gruenewald, Kemeny, Aziz, & Fahey, 2004). Other stress-provoking characteristics include novelty, unpredictability, and uncontrollability, as well as situations in which demands outweigh coping resources or abilities (Abramson, Seligman, & Teasdale, 1978; Dickerson & Kemeny, 2004; Miller, Chen, & Zhou, 2007). As the field has gained a greater understanding of the psychobiological stress responses linked to these dimensions of stimuli that individuals are exposed to in the lab or in their natural environments, we have begun to better understand why certain life events might show particular connections to ill health and well-being.

The characteristics such as unpredictability, uncontrollability, and demands outweighing resources are common in domain-specific measures of stress. These elements figure prominently in measures of work stress, such as Karasek’s demand-control model of job strain in which high demand in the context of low control is posited to serve as a toxic combination for health (Karasek, Baker, Marxer, Ahlbom, & Theorell, 1981; Karasek et al., 1998). A recent review by Kivimaki and Kawachi (2015) incorporating information from over 600,000 participants in 27 prospective studies from the U.S., Europe, and Japan indicates that these forms of job strain are associated with the development of heart disease, stroke, and type 2 diabetes (but not with cancer, pulmonary disease, or asthma).

Many of these characteristics also form the core dimensions that are assessed in global perceived measures of stress, such as the Perceived Stress Scale (PSS, Cohen, Kamarck, & Mermelstein, 1983). This brief, 10-item measure assesses the frequency of experience of key characteristics of situations that are likely to lead to appraisals of threat and accompanying psychobiological stress responses, and includes multiple items that assess feelings of a lack of control and poor coping ability, the experience of unexpected events, and feelings of distress and being overwhelmed. Thus, the PSS attempts to capture the intervening psychological appraisal processes and cognitive-emotional states that connect stressor experience and associated physiological and physical outcomes. Greater perceived stress as measured by the PSS has been linked to elevated endocrine and immune stress biomarkers, physical symptomatology, poor wound healing, and increased susceptibility to development of infectious disease (see Cohen & Janicki-Deverts, 2012). A recent meta-analysis (Mathur et al., 2016) concluded that greater perceptions of stress were associated with greater aging of the body’s cells as measured by shorter telomere length. (Telomeres are the caps on the ends of DNA.)

Generally speaking, a greater intensity of any characteristic believed to elicit a stress perception or stress response will lead to a greater magnitude of psychobiological response. Thus, a highly
uncontrollable situation is likely to elicit a greater stress perception and response of greater magnitude than a situation characterized by a mild degree of uncontrollability (Miller et al., 2007). Most conceptualizations of the role that life events play in poor health also rest on the assumption that a greater intensity in the form of a greater number of events, the intensity of life change required, or a greater degree of undesirability of events, should be more strongly linked to the risk of ill being.

The temporal intensity of a stressor is also key to stress experience. Chronic stressors have long been hypothesized to render individuals especially vulnerable to negative psychobiological stress responses. As previously described, repeated or persistent activation of allostatic processes in response to stress is hypothesized to lead to allostatic load and damage to multiple regulatory systems (McEwen, 2008; McEwen & Seeman, 1999; Seeman et al., 1997). Meta-analytic investigations indicate that the activity of stress-responsive systems covary with the chronicity of stress experience. For example, chronic stress is associated with greater daily output of cortisol (Miller et al., 2007) and greater overall cortisol output over more extended periods of time (Stalder et al., 2017). Likewise, a greater number of life stressors has been linked to greater cortisol activity in childhood (Evans & Kim, 2007). Meta-analytic examinations of brief versus long-lasting stress exposures indicate that chronic stressors are associated with decrements in both adaptive and cellular forms of immunity (indicating a general immune suppression), whereas short-lived stressors lead to upregulations in some forms of adaptive immunity (Segerstrom & Miller, 2004).

The Stress Experience: Who? When?

Demographic Variations

Variations in stress experience have often been invoked to explain demographic and environmental disparities in health, particularly variations by socioeconomic status and racial/minority status and sex.

Socioeconomic Status

Within the field of social epidemiology, socioeconomic status (SES) gradients in health are among the most persistently observed (Adler & Stewart, 2010). Multiple investigations have documented that those of lower SES experience a greater burden of life stressors (e.g., Evans & Kim, 2007; Steptoe & Marmot, 2003), report higher levels of perceived stress (Cohen & Janicki-Deverts, 2012; Finkelstein, Kubzansky, Capitman, & Goodman, 2007), and exhibit greater psychological and physiological reactivity to acute stress exposure (e.g., Boylan, Jennings, & Matthews, 2016; Steptoe et al., 2002). Those of lower SES are especially likely to experience chronic stressors and strains (Thoits, 2010), which may be particularly impactful for health, yet few studies directly assess the mediating, or explanatory, role of stress in the association between SES and health outcomes. A greater level of stressor burden or perceived stress has been found to partially account for SES variations in depression (Turner & Avison, 2003), heart disease (see Skodova et al., 2008), and mortality (Lantz, House, Mero, & Williams, 2005), but there are an equal number of studies for which no mediating role has been found (see Matthews, Gallo, & Taylor, 2010, for an overview).

Race/Ethnicity

Variations in stress exposure and experience also contribute to racial/ethnic disparities in health (Dressler, Oths, & Gravelle, 2005; Thoits, 2010, see Chapters 24–26), even independently of the associations between race and SES (Williams, Priest, & Anderson, 2016). A meta-analysis of almost 300 studies indicated that race-specific stress, such as racial/ethnic discrimination, was linked to poorer
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mental and physical health (Paradies et al., 2015). A recent investigation also indicated that the associations of minority status, stress, and health may vary by the health outcome studied, with racial/ethnic minorities often exhibiting better mental well-being than their non-minority counterparts, but worse physiological and physical health (Brody, Yu, & Beach, 2016).

**Sex**

Stress experience also varies by sex. A meta-analysis of over 80,000 participants indicated slightly greater levels of stress experienced by women as compared to men (Davis, Matthews, & Twamley, 1999). A relatively recent national assessment in the U.S. also documented higher levels of perceived stress among women (Cohen & Janicki-Deverts, 2012). There are also variations in frequency of experience of different forms of stress—men are more likely to report stressors in the work domain and women more likely to report stress in the home: network stress, work-home conflicts, and home-focused overloads (Almeida et al., 2002; Davis et al., 1999). Stress exposure and psychobiological stress response characteristics have been offered as one contributor to the greater prevalence of mental health conditions in women particularly greater levels of depression and anxiety (Bale & Epper, 2015), as well as greater morbidity for some diseases (Carpenter, Grecian, & Reynolds, 2017). On the other hand, both evolutionary and social pressures may have shaped psychobiological and behavioral stress responses in ways that help to mitigate the negative effects of stress on health in female animals and humans (Taylor et al., 2000), particularly females’ greater tendency to affiliate and marshal social support during times of stress (Sladek, Doane, Jewell, & Lueck, 2017).

**Life Course Characteristics of Stress-Health Associations**

*Every stress leaves an indelible scar, and the organism pays for its survival after a stressful situation by becoming a little older.*

*Attributed to Hans Selye*

Another important focus of stress research has been on understanding when in the life course stress exposure and stress response processes may have the greatest import for health and well-being. Different life course models of stress (Ben-Shlomo & Kuh, 2002; Hertzman, 1999; Kuh, Ben-Shlomo, Lynch, Hallqvist, & Power, 2003) place particular focus on different mechanisms: on sensitive or critical periods in the life course during which stressor exposure may have permanent implications for health and well-being later in development; linked chains of risk by which early life stress begets stress in later childhood, adolescence and adulthood; dispersion processes by which one form of stress leads to a different form or affects other behaviors and states detrimental to well-being; and accumulation of risk models over the life course.

Life course stress studies have typically utilized socioeconomic adversity as a stressor model given the relative ease of measuring SES and the potential for changes in SES (adversity) over the life course. The study of childhood stressors and traumas, such as physical and sexual abuse and neglect, are commonly examined in the study of critical or sensitive periods. This body of research indicates support for each of the life course mechanisms defined earlier, including sensitive periods (e.g., Danese & McEwen, 2012; Haas, 2008; Tamayo, Herder, & Rathmann, 2010), linked chains of risk (Gall, Abbott-Chapman, Patton, Dwyer, & Venn, 2010; Pudrovská & Anikputu, 2014; Singh-Manoux, Richards, & Marmot, 2005), dispersion to other forms of adversity (Matthews et al., 2010; Umberson, Williams, Thomas, Liu, & Thomeer, 2014), and cumulative adversity exposure (Pollitt, Rose, & Kaufman, 2005; Singh-Manoux, Ferrie, Chandola, & Marmot, 2004).
However, studies that have been able to compare these life course models within a given cohort study remain rare. Studies that have compared different models typically find support for multiple life course mechanisms. For example, accumulated risk models provide evidence that is consistent with the classic stress hypothesis of greater adverse health effects with greater chronicity of stressor exposures as well as evidence of critical or sensitive periods, particularly the tuning of stress response systems and well-being across the life course by early life stress exposure (Cirulli, 2017; Gruenewald et al., 2012; Gustafsson, Janlert, Theorell, Westerlund, & Hammarstrom, 2011, 2012). A growing body of evidence also indicates that the effects of stress can extend across generations, with the biological residues of stress in one generation leading to epigenetic changes (alterations in gene function but not DNA structure) that are transmitted to, and affect the stress response and health of the next generation (Cunliffe, 2016).

**Conclusion**

Over a century of stress theory and research makes clear that our mental and physical well-being are intimately connected to the stressors we experience and to our psychobiological and behavioral responses to stress. Although the diverse forms of stress and stressors studied in the scientific literature often serves to muddle rather than clarify our understanding of stress and its relation to health, taken in the aggregate, the existing research on stress concludes, overall, that stress is linked to health. However, there are variations in the consistency of associations based on the conceptualization and measurement of both stress and its health outcomes that warrant further evaluation to increase our understanding of what stress is and why it might shape our health. It is also time to unite our diverse, but rich, measurement traditions within studies, especially samples we follow over time, to enable the comparative research necessary to test theories of stress processes. Such efforts will be critical for the development of prevention and intervention strategies that have the greatest potential to dampen the negative health effects of stress experiences that are common to the human condition.

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