
IS STRESS PHYSIOLOGICAL OR PSYCHOLOGICAL? COMPARING AND CONTRASTING TWO MAJOR THEORIES OF STRESS

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Abstract: Stress remains an essential concept in shaping a thorough understanding of both life and evolution. In human terms, stress has been looked at from various perspectives. It may be a burdensome, threatening or uncomfortable situation causing stress. In other circumstances, it may be the pressure exercised by the work environment on the individual that may amount to the feeling of stress. Or we may find the source of stress in the organism's physical response to a stimuli. Either way, the term "stress" has different meanings and not rarely these meanings have been distorted. There are many different theories of stress so the definition of stress is closely married to theory. Therefore, to better understand the impact of stress, I will compare and contrast what I consider to be two key theories of stress, also showing how robust is the evidence supporting each of these theories.

Keywords: *stress, physiological, psychological, research, organizations*

1. Introduction

Physics talks about stress as a physical quantity that arises because of the impact generated by an environmental force on a physical object. For example, when you push a liquid inside a container under pressure, each of its particles will eventually get pushed against by the surrounding particles. The container undergoes strain and this may lead to its permanent distortion.

In human terms, stress has been looked at from various perspectives. It may be a burdensome, threatening or uncomfortable situation causing stress. In other circumstances, it may be the pressure exercised by the work environment on the individual that may amount to the feeling of stress. Or we may find the source of stress in the organism's physical response to a stimuli. Either way, the term "stress" has different meanings and not rarely these meanings have been distorted (Arthur, 2005).

Some see stress as functionally healthy. For example, when we experience mild levels of stimulation we function better like the deadline of a meeting could produce beneficial results for one's own work (Minois, 1999). On the other hand, excessive stress can be detrimental, inhibiting good performance (De Dreu & Weingart, 2003).

There are many different theories of stress so the definition of stress is closely married to theory. Therefore, to better understand the impact of stress, I will compare and contrast what I consider to be two key theories of stress, also showing how robust is the evidence supporting each of these theories.

2. Physiological reactions: the response-based theory of stress

Early stress theories or the so-called "physiological models" defined stress as an organism's response to a stressor. Though it has been suggested that no criteria is objective enough to describe a situation as stressful (Briner, 1999a; Briner & Reynolds, 1993), the individual experiencing the stressful situation can do so (Lazarus, 1966).

Murray-Bruce (1990) described the organism's reaction to stress in the following manner: "*the heart and breathing rates increase, blood pressure goes up, sweating increases, muscles get tense, the eyes widen, and there is heightened alertness. Tense muscles cause*

headaches, backaches, shoulder and back pains. Clenched hands, clenched jaws, and hunched shoulders are tell-tale signs of stress, along with frowning and fidgeting, finger tremor, and the mopping of a sweaty brow. An anxious person has <butterflies> or churning in the stomach, a dry mouth, weak legs, nausea, a thumping heart, breathlessness and a feeling of light-headedness”.

As described above, the body’s response to a stressful event can activate a pattern of physical changes. We can better understand this when we think about everyday life. Changing jobs, rejection by colleagues, feeling frustrated or depressed about the nature of our work all can have an impact to our nervous system resulting in a “fight-or-flight” response. The “fight-or-flight” response, or the acute stress response, is a physiological reaction that occurs when a person perceives a situation as harmful or a threat to survival (Cannon, 1932). The physical changes in the body are regulated by the autonomic nervous system, consisting of many nerves divided into two parts: the sympathetic and parasympathetic systems.

The sympathetic system is responsible for regulating the heart rate and blood pressure and also transporting the blood from the skin and organs to muscles (Brodal, 2004). Its counterpart, the parasympathetic system is responsible for regulating the activities when the body is at rest (McCorry, 2007). Reaction to stress, as understood in the “fight-or-flight” response is thought to counteract the parasympathetic system.

Within this theoretical approach, what we normally should we concerned with, is the number of physical changes in the body. In the face of acute stress, humans can experience a frequency of positive or negative conditions that can affect a person’s mental and physical well-being. However, pinpointing exactly which part or the body is responsible for specific aspects of a stress response has been uncanny and difficult.

“The response people may have when presented with work demands and pressures that are not matched to their knowledge and abilities and which challenge their ability to cope” may cause stress and can have many profound effects on the human body (WHO, 1996). Statistics released in the UK revealed that approximately 10% of the GNP (Gross National Product) is lost due to work-related stress (Hoel et al, 2001). Organizational changes, intensification of work, never having time to finish work, a lack of recognition or autonomy, all shaped the perception of stress at the workplace as being one major contemporary challenge.

Hans Selye - a pioneering endocrinologist, physician and scholar – was among the first ones trying to explain the process of stress-related illness. Using a medicine-like terminology, Selye explained the existence of biological stress through an endocrinological experiment that eventually led to the development of his theory of stress called “general adaptive syndrome” (GAS). According to GAS, an organism responds to stress in three stages: alarm, resistance and exhaustion (Selye, 1975).

The first stage is when a stressful event makes a body react with a “fight-or-flight” response through the activation of the sympathetic nervous system. During this phase, hormones are released in the body to cope with this state of alarm. The next stage, or the resistance stage is when the body tries to adapt to the consistency of the stressor. If the body finds the means of coping with the stress, physiological functions of the body return to normal levels. Otherwise, the systemic release of glucose, cortisol and adrenaline may deplete the

bodily resources to fight with the stressor. The third stage could be either exhaustion or recovery. Exhausting bodily resources can manifest into mechanisms that can help the body to successfully overcome the stressor effect, or to prove the body incapacitated to function properly and thus becoming susceptible to illness or death.

Over the years, response based theories have been extremely influential on portraying the distress and long-term effects that stress has on individuals. Moreover, diverse attempts were made to re-conceptualize the fight-or-flight response as an “active coping system” (McCabe & Schneiderman, 1984). Coping was seen as an attempt to re-establish *homeostasis*, an effort of physiological systems to remain in a balanced level of functioning (Lazarus & Folkman, 1984).

Nevertheless, despite their effort to characterize primary physiological responses to stress, response-based physiological research has shown that stress can also be activated in individuals by diverse psychological influences (Levi, 1972, Smith et al, 1993).

3. Psychological reactions: the person-environment fit model

Contrasting response-based physiological models of stress, a new genre of stress theories came to existence beginning the 1970s. The new theories detached from analyzing what happens to the body during a stressful situation and identified the utter importance that the psyche plays in recognizing, experiencing and responding to stress.

Unlike physiological stress-models, psychological theories of stress allowed an interaction between the individual and his or her environment for an effective human functioning (Cooper et al, 2001). In other words, perception, cognition and emotion are three dimensions given relatively equal weight in determining whether an individual is able to cope with stress. Consequently, psychological models ascribe to the individual a more active role in evaluating and understanding life events that might affect his physical, psychological and social health.

This lead to a two-type categorization of psychological models: interactional and transactional theories. If interactional models focus on the characteristics of the stress process where stress is seen as a negative emotional experience, transactional models are more cognitive, putting the emphasis on the subjective dynamic relationship between the individual and the environment.

The model which has existed for a considerable amount of time, underpinning other stress and well-being approaches is the Person-Environment Fit (P-E fit) model. Derived from the early work of Lewin (1935) and Murray (1938), the P-E fit model pledged for an anti-mechanistic view of the human behavior where causes of behavior were the sole creation of the environment and instead foreshadowed the notion that stress is likely to occur when there is a lack of fit between P and E (Edwards, 2000).

But what is fit after all? Is it a perfect match, or a congruence, or something else? In organizational terms, occupational psychology literature attributed two aspects to the concept of fit: a) the degree of match between the demands employees confront at work and their ability to meet the demands on the job (demands-ability fit) and b) the degree of match between the employees' needs and the organizational resources available to meet those needs (needs-supplies fit). An employee-organization fit can thus be understood as a compatibility between any corresponding employee and organizational dimensions. In case of a mismatch,

high strains of stress can occur. If employees do not adjust to their own specific work setting (Dawis & Lofquist, 1984), this can translate in lower levels of job satisfaction (Kristof-Brown & Guay, 2011), reduced organizational commitment (Andrews, Baker & Hunt, 2010) and the intent to quit (Edwards, 1991).

Another important consideration is what best measure can be used to assess fit. Should direct measures be used where the person-environment fit is conceptualized as a general compatibility between the person and the environment or indirect measures where the person and the environment are assessed separately? Research has shown that measuring the person-environment fit can be tricky (Edwards, Cable, Williamson, Lambert, & Shipp, 2006, French et al, 1974). The question of what constitutes a good measure can be a philosophical or a pragmatic matter. Making clear the distinction between objective and subjective notions of fit (Kasl, 1978; Jackson, 1983), mapping and measuring P-E fit remains problematic: on one hand, developing and using objective measures remains an issue for all behavioral science including P-E fit model (French & Caplan, 1972), while on the other it might be the case that subjective measures can in fact reflect objective work-conditions (Frese, 1985).

As for work conditions and stress resulting from within the organization, research has examined those in some detail. Role conflict is one of the potential psychological stressors. When there is conflict between work and home roles (Allen, Herst, Bruck & Sutton, 2000), or a clash of values between the organizational role and the family role (Kossek & Ozeki, 1998) or when there are conflicting expectations by different role senders (Arnold & Randall, 2010), different types of stress is produced and can lead to coronary heart problems (Kahn et al, 1964).

Another stressor of psychological nature is role overload. When the workload is too heavy, or when the job requires an excessive hours or speed of work, an employee can experience a number of symptoms of stress (Brown, Jones & Leigh, 2005). Attempts to overcome these symptoms in the UK were carried out by impinging on specific legislation. The Health and Safety Act 1974, The Health and Safety Regulations 1993 or the Disability Discrimination Act 1996, all obliged employers to ensure workplace practices that are safe, healthy and fair.

Drawing on other empirical studies, a number of them have found shift work and techno-stress to be a potential stress factor at work (Costa, 2003; Smith, Conway & Karsh, 1999). Shift work not only that it can affect neuro-physical rhythms (Doyle, 2003), but it was listed among the three most important sources of stress in certain contexts like the oil industry (Sutherland & Cooper, 1987). However, it is not only working in shifts contributing to the creation of stress-patterns, but also modern technology brought about techno-stress. Technological changes, subsequent changes of careers, the use of repetitive tasks without a break, the exposure the radiation, electronic performance monitoring, technology breakdowns and slowdowns all led to a deterioration of the quality of working life (Smith, Conway & Karsh, 1999).

4. Is stress physiological or psychological?

Comparing and contrasting two major theoretical perspectives on stress - physiological and psychological – is not an easy task. After all, is stress biological or psychological? That is to say is stress activated by our inner biological clock, which switches on and off in a pre-

programmed way or is stress not influenced by our genetic make-up but rather by psychological characteristics?

Viewing the phenomenon of stress within the context of a biological mechanism, physiological theories of stress have received a lot of attention and recognition in the literature (Cannon, 1929; Selye, 1956; Murray-Bruce, 1990; Briner, 1999a; Saab et al, 1993; Dhabar & McEwen 1997). Still to this present day there are numerous expansions of the stress concept in all areas of physiology and human functioning (Viner, 1999; Shalev et al, 2000; Keil, 2004).

In contrast, it should be noted that there is substantial evidence and a growing consensus around the hypotheses that cognition determines affect (Cox, 1993; Cox & Griffiths, 1994; Cox & Griffiths, 1996). That is to say it is our cognitive interpretation that ultimately determines how stressors are perceived and what biological outcomes are to follow. Individuals who are optimistic and have good coping responses may do well when dealing with stressors (Glanz & Johnson, 1999). This does not exclude biology from playing an important role in stress-emerging situations. Vulnerability in the act of perception to biological predispositions can act as a very strong stimuli to stress (Millon & Everly, 1985). However, there is a plethora of other non-biological stimuli that can be accounted for when experiencing stress like: personality patterns (Millon et al, 2004) or disorders (Polusny & Follett, 1995), learning history (Lachman, 1972), violence and abuse (McMahon et al, 2003), disturbances in attachment (Lowenthal, 1998), marriage and divorce (Cicchetti, 2005), psychosocial stressors (Girdano, Dusek & Everly, 2009), environmental events (Smith et al, 1993), lack of friends support (Short, 2002), learned helplessness (Peterson & Seligman, 1984) or anxiety disorders (Faravelli & Pallanti, 1989).

Even though all of the above factors better shape our understanding of stress and all are strong arguments in favor of psychological criteria over and above the physiological ones, explaining the concept of stress through a stimulus-response biological paradigm has its strengths though.

One strength is that measuring stress hormones provides with an objective measurement of stress. Explaining stress through physical and chemical processes involved in the human functioning provides a simple-enough conceptual formulation of stress. This formulation has become apparent with subsequent neuroscience and neuroendocrinology research. Lanfield (1981) and Sapolsky (1986) were among the first ones drawing attention on how damaging the hippocampus can enable a stress response. However, it was exactly this simplistic stimulus-response paradigm that was criticized for ignoring individual differences of psychological nature (Sutherland & Cooper, 1990) and context effects (Cox, Griffiths & Rial-Gonzalez, 2000) that might underpin the response parameters.

Another strength is that the fight-or-flight biological response to threat can be observed in all mammals. There are several reviews that focus on the positive role that adrenal glands play in stress physiology (Levi, 1972; Szabo et al, 1983; Cox & Cox, 1985). It has even been suggested that potentially all physical conditions can create stress with damaging effects on the cardiovascular system (Stansfeld et al, 1999), the immune system (Kawakami & Haratani, 1999), the endocrine system (Stone, 1975) or the gastro-intestinal system (Turkkan et al, 1982). However, there is a considerable variation in degree and type of hormones

released by different people as a response to stressors (McLeod, 2010). There are also research findings showing how conscious patients manifested different stress reactions than unconscious patients (Currie & Symington, 1955), suggesting the idea that psychological factors are in fact playing an important role.

Now going back to psychological models of stress, developed to overcome the criticisms levelled by earlier physiological models, most of these portrayed stress as inherited from a problematic person-environment interaction. Studies have demonstrated that physiological responses (like the “fight-or-flight” response) can be activated by diverse psychological influences (Levi, 1972; Mason, 1972). Sociologists attribute a psycho-social dimension to stress by seeing it as a disturbing agent that can lead to social disequilibrium (Smelser, 1963).

Research on work-related stress presented any aspect of the work environment as having the potency to be perceived as a stressor. Exposure to physical and psychosocial hazards may inhibit psychological as well as physical health (Baruch & Barnett, 1987; Repetti et al, 1989). What is important then, as Epictetus put it, is “*not so much of what happens that matters, it’s how you take it*”.

The perspective of life, or the psychology of dealing and interpreting daily life situations and giving meaning to work and to the work environment informs the contemporary definition of stress. The more excessive pressure and demands that exceed the individual’s skills, capabilities, or resources, the more stress one can experience, with detrimental consequences to both the individual and the organization.

“*In fact, psychological discord had the strongest influence on maladaptive coping behaviors and stress-related illness*” (Smith et al., 1993). Chronic stress can often lead to depression and anxiety (Schlotz et al, 2011). On the other hand, the same chronic stressors may not be enough to cause pressure and discomfort (Ogden, 2007). Showing how one can flourish in a setting that for another may create suffering was a major contribution brought by the person-environment psychological model of stress.

5. Conclusions

So, is stress more psychological than physiological? By looking at how psychological approaches dominate contemporary stress theories, the answer seems to be yes. Nevertheless, the strength of the physiological-literature of stress is continuing to develop. In addition, there is always more to this than meets the eye: “*certain stimuli, by virtue of their unique meaning to particular individuals, may prove problems only to them; other stimuli, by virtue of their commonly shared meaning, are likely to prove problems to a larger number of persons*” (Scott & Howard, 1970). This implies that context might be equally important when analyzing the psychology or the physiology of work stress.

Though I have considered the response-based physiological theory of stress and the person-environment psychological fit theory as two key theories and stress, also showing how robust is the evidence supporting each of these theories, still more research is required in relation to the overall measurement of stress. Also, evaluation data on stress management programs is scarce. In other words, there is no sufficient data to validate the effectiveness of stress reduction interventions. More to say, by looking at the evaluation literature it is also not

clear how individual-focused interventions might affect organizational health (Compier et al, 1998, Cox et al, 2000).

“Perhaps the key to the methodology and evaluation of intervention studies is a re-appraisal of the value of the value of the natural science paradigm in field research. (Griffiths, 1999b). One issue might be the inappropriateness of the evaluation paradigm itself” (Cox et al, 2000). Research and theory on emotions – as central to individual adaptation - may be beneficial to this changing epistemology (Scherer & Ekman, 1984; Frijda, 1986; Plutchik & Kellerman, 1989, Lazarus, 1991c).

“While stress at work will remain a major challenge to occupational health, our ability to understand and manage that challenge is improving. The future looks bright” (Cox et al, 2000). And it must be so, as stress remains an essential concept in shaping a thorough understanding of both life and evolution.

REFERENCES:

- Allen, T. D., Herst, D. E. L., Bruck, C. P., & Sutton, M. (2000). Consequences associated with work-to-family conflict: A review and agenda for future research. *Journal of Occupational Health and Psychology*, 5: 278-308.
- Andrews, M. C., Baker, T., & Hunt, T. G. (2011). Values and person–organization fit: Does moral intensity strengthen outcomes? *Leadership & Organization Development Journal*, 32(1): 5-19.
- Arnold, J., & Randall, R. (2010). *Work psychology: Understanding human behavior in the workplace* (5th Ed.). Harlow, UK: Financial Times / Prentice Hall (Pearson Education).
- Arthur, A. R. (2005). When stress is mental illness: A study of anxiety and depression in employees who use occupational stress counselling schemes. *Stress and Health*, 21: 273–280.
- Baruch, G. K., & Barnett, R. E. (1987). Rolequality and psychological well-being. In: F.J. Cobb (ed) *Spouse, Parent, Worker: On Gender and Multiple Roles*. Yale University Press, New Haven, Connecticut.
- Briner, R. B. (1999a). Introduction. *European Journal of Work and Organizational Psychology*, 8(3): 321-322.
- Briner, R. B., & Reynolds, S. (1999). The costs, benefits, and limitations of organizational level stress interventions. *Journal of Organizational Behavior*, 20: 647–664.
- Brodal, P. (2004). *The Central Nervous System: Structure and Function* (3rd ed.). Oxford University Press US: 369–396.
- Brown, S. P., Jones, E., & Leigh, T. W. (2005). The accentuating effect of role overload on relationships linking self-efficacy and goal level to work performance. *Journal of Applied Psychology*, 90: 972-979.
- Cannon, W. B. (1929). *Bodily Changes in Pain, Hunger, Fear and Rage*. 2nd ed. New York: Appleton.
- Cannon, W. B. (1932). *Wisdom of the Body*. United States: W. W. Norton & Company.
- Cicchetti, D. (2005). Child maltreatment. *Annual Review of Clinical Psychology*, 1:409–438.
- Cooper, C. L., Dewe, P., & O’Driscoll, M. (2001). *Organizational Stress: A review and critique of theory, research, and applications*. Thousand Oaks: Sage.
- Costa, G. (2003). Shift work and occupational medicine: An overview. *Occupational Medicine*, 53: 83-88.
- Cox, T. (1993). *Stress Research and Stress Management: Putting theory to work*. Sudbury: HSE Books.

- Cox, T., & Cox, S. (1985). The role of the adrenals in the psychophysiology of stress. In: E. Karas (Ed.) *Current Issues in Clinical Psychology*, Plenum Press, London.
- Cox, T. & Griffiths, A.J. (1994). The nature and measurement of work stress: Theory and practice. In N. Corlett & J. Wilson (Eds.) *Evaluation of Human Work: A Practical Ergonomics Methodology*. London: Taylor and Francis.
- Cox, T. & Griffiths, A.J. (1995). The assessment of psychosocial hazards at work. In M.J. Shabracq, J.A.M. Winnubst & C.L. Cooper (Eds.) *Handbook of Work and Health Psychology*. Chichester: Wiley & Sons.
- Cox, T., Griffiths, A.J., Barlow, C. A., Randall, R.J., Thomson, L.E. & Rial-Gonzalez, E. (2000). *Organisational interventions for work stress: a risk management approach*. HSE Books, Sudbury.
- Currie, A. R., & Symington, T. (1955). The pathology of the pituitary and adrenal glands in systemic disease in man. *Proceedings of the Royal Society of Medicine*, 48(11): 908.
- Dawis, R. V., & Lofquist, L. H. (1984). *A psychological theory of work adjustment*. Minneapolis: University of Minnesota Press.
- De Dreu, C. K. W., & Weingart, L. R. (2003). Task versus relationship conflict, team performance, and team member satisfaction: A meta-analysis. *Journal of Applied Psychology*, 88: 741-749.
- Dhabar, F. S., & McEwen, B. S. (1997). Acute stress enhances while chronic stress suppresses cell-mediated immunity in vivo: a potential role for leukocyte trafficking. *Brain Behavior and Immunity*, 11:286-306.
- Edwards, J. R. (1991). Person-job fit: A conceptual integration, literature review, and methodological critique. In C. L. Cooper & I. T. Robertson (Eds.), *International review of industrial and organizational psychology*, 6: 283-357.
- Edwards, J. R. (2000). Cybernetic theory of stress, coping and well-being. In C. L. Cooper (Ed.), *Theories of stress*, (p. 122-152). Oxford: Oxford University Press.
- Edwards, J. R., Cable, D. M., Williamson, I. O., Lambert, L. S., & Shipp, A. J. (2006). The phenomenology of fit: Linking the person and environment to the subjective experience of person-environment fit. *Journal of Applied Psychology*, 91: 802-827.
- Faravelli, C., & Pallanti, S. (1989). Recent life events and panic disorder. *The American Journal of Psychiatry*, 146:622-626.
- French, J. R. P., Jr, Caplan, R. D. (1972). Organizational stress and individual strain. In A. Marrow (Ed), *The failure of success*. New York: AMOCOM.
- French, J. R. P., Jr., Rodgers, W. L., & Cobb, S. (1974). Adjustment as person-environment fit. In G. Coelho, D. Hamburg, & J. Adams (Eds.), *Coping and adaptation*, 316-333.
- Frese, M. (1985). Stress at work and psychosomatic complaints: A causal interpretation. *Journal of Applied Psychology*, 70: 314-328.
- Frijda, N. H. (1986). *The Emotions*. Cambridge: Cambridge University Press.
- Girdano, D., Dusek, D., & Everly, G. (2009). *Controlling stress and tension*. San Francisco, CA: Pearson Benjamin Cummings.
- Glanz, M. D., & Johnson, J. L. (1999). *Resilience and Development: Positive Life Adaptations*. New York: Kluwer Acad./Plenum.
- Griffiths, A. J. (1999b). Organizational interventions: facing the limits of the natural science paradigm. *Scandinavian Journal of Work and Environmental Health*, 25(6): 589-596.
- Hoel, H., Sparks, K., & Cooper, C. L. (2001). The cost of violence/stress at work and the benefits of a violence/stress-free working environment, *International Labour Organization (ILO)*, Geneva.
- Jackson, S. E. (1983). Participation in decision-making as a strategy for reducing job-related strain. *Journal of Applied Psychology*, 68: 3-19.

- Kahn, R. L., Wolfe, D. M., Quinn, R. P., Snoek, J. D., & Rosenthal, R. A. (1964). *Organisational stress*. New York: Wiley.
- Kasl, S. V. (1978). Epidemiological contributions to the study of work stress. In C. L. Cooper & R. Payne, *Stress at work*, New York: Wiley.
- Kawakami, N., & Haratani T. (1999). Epidemiology of job stress and health in Japan: Review of current evidence and future direction. *Industrial Health*, 37(2): 174-186.
- Keil, R.M.K. (2004). Coping and Stress: A Conceptual Analysis. *Journal of Advanced Nursing*, 45(6): 659–665.
- Kompier, M. A. J., Guerts, S. A. E., Grundeman, R. W. M., Vink, P., & Smulders, P. G. W. (1998). Cases in stress prevention: the success of a participative and stepwise approach. *Stress Medicine*, 14: 155-168.
- Kossek, E. E., & Ozeki, C. (1998). Work-family conflict policies, and the job-life satisfaction relationship: A review and directions for organizational behaviour-human resources research. *Journal of Applied Psychology*, 83: 139-149.
- Kristof-Brown, A., & Guay, R. P. (2011). Person–environment fit. *APA handbook of industrial and organizational psychology*, 3: 3-50.
- Lachman, S. (1972). *Psychosomatic disorders: A behavioristic interpretation*. New York: Wiley.
- Landfield, P. W, Baskin, R. K, & Pitler, T. A. (1981). Brain aging correlates: Retardation by hormonal-pharmacological treatments. *Science* 214: 581–584.
- Lazarus, R. S. (1966). *Psychological Stress and the Coping Process*. New York: McGraw-Hill.
- Lazarus, R. S. (1991c). *Emotion and Adaptation*. New York: Oxford University Press.
- Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping*. New York: Springer.
- Levi, L. (1972). Stress and distress in response to psychosocial stimuli. *Acta Medica Scandinavica*, 191: 528.
- Lowenthal, B. (1998). The effects of early childhood abuse and the development of resiliency. *Early Child Development and Care*, 142-152.
- McCabe, P., & Schneiderman, N. (1984). Psychophysiological reactions to stress. In N. Schneiderman & J. Tapp (Eds.), *Behavioral medicine* (p. 3–32). Hillsdale, NJ: Erlbaum.
- McCorry, L. K. (2007). Physiology of the autonomic nervous system. *American journal of pharmaceutical education*, 71(4): 78.
- Millon, T., Grossman, S., Millon, C., Meagher, S., & Ramnath, R. (2004). *Personality disorders in modern life*. Hoboken, NJ: John Wiley & Sons, Inc.
- McMahon, S. D., Grant, K. E., Compas, B. E., Thurm, A. E., & Ey, S. (2003). Stress and psychopathology in children and adolescents: Is there evidence of specificity? *Journal of Child Psychology and Psychiatry*, 44:107–133.
- Minois, N. (1999). Longevity and aging: beneficial effects of exposure to mild stress. *Biogerontology*, 1: 15-29.
- Murray, H. (1938). *Explorations in personality*. Boston, MA: Houghton Mifflin.
- Murray-Bruce, D. J. (1990). *Promoting employee health*. Basingstoke, UK: Macmillan.
- Peterson, C., Seligman, M. E. P. (1984). Causal explanations as a risk factor for depression: theory and evidence. *Psychological Review*, 91:347–374.
- Ogden, J. (2007). *Health Psychology: a textbook (4th ed.)*, New York: McGraw-Hill, 281-282.
- Plutchik, R., & Kellerman, H. (1989). *Emotion: Theory, Research and Experience*, Vol. 4, New York: Academic.
- Polusny, M. A, Follette, V. M. (1995). Long-term correlates of childhood sexual abuse: theory and review of the empirical literature. *Applied and Preventive Psychology*, 4:143–166.

- Repetti, R. L., Matthews, R. A., & Waldron, I. (1989). Employment and women's health: effects of paid employment on women's mental and physical health. *American Psychologist*, 44: 1394-1401.
- Saab, P. G., Llabre, M. M., Hurwitz, B. E., Schneiderman, N., Wohlgenuth, W., et al. (1993). The cold pressor test: vascular and myocardial response patterns and their stability. *Psychophysiology*, 30:366-373.
- Sapolsky, R., Krey, L., & McEwen, B. S. (1986). The neuroendocrinology of stress and aging: the glucocorticoid cascade hypothesis. *Endocrinology Review* 7: 284-301.
- Scherer, K. R., & Ekman, P. (1984). *Approaches to Emotion*. Hillsdale, NJ: Erlbaum.
- Schlottz, W., Yim, I. S., Zoccola, P. M., Jansen, L., & Schulz, P. (2011). The perceived stress reactivity scale: Measurement invariance, stability, and validity in three countries. *Psychological Assessment*, 80-94.
- Scott, R., & Howard, A. (1970). Models of stress. In S. Levine and N. Scotch (eds) *Social Stress*. Aldine: Chicago.
- Selye, H. (1956). *The Stress of Life*. New York: McGraw-Hill.
- Selye, H. (1975). Confusion and controversy in the stress field. *Journal of Human Stress*, 1 (2): 37-44.
- Shalev, A. Y., Yehuda, R., & McFarlane, A. C. (2000). *International handbook of human response to trauma*. New York: Kluwer Academic/Plenum Press.
- Short, J. L. (2002). The effects of parental divorce during childhood on college students. *Journal of Divorce & Remarriage*, 38:143-156.
- Smith, K. J., Everly, G. S., & Johns, T. (1993). The role of stress arousal in the dynamics of the stressor-to-illness process among accountants. *Contemporary Accounting Research*, 9: 432-449.
- Smith, M. J., Conway, F. T., & Karsh, B. T. (1999). Occupational stress in human computer interaction. *Industrial Health*, 37: 157-173.
- Stansfeld, S.A., Fuhrer, R., Shipley, M.J. & Marmot, M.G. (1999). Work characteristics predict psychiatric disorder: prospective results from the Whitehall II study. *Occupational and Environmental Medicine*, 56: 302-307.
- Stone, E. A. (1975). Stress and catecholamines. In A. Friedhoff (Ed) *Catecholamines and Behaviour*, Vol 2. Plenum, New York.
- Sutherland, V., & Cooper, C. L. (1987). *Man and accidents offshore*. London: Lloyds.
- Szabo, S., Maull, E.A., & Pirie, J. (1983). Occupational Stress: understanding, recognition and prevention. *Experientia*, 39: 1057-1180.
- Turkkan, J.S., Brady, J.V., & Harris, A.H. (1982). Animal studies of stressful interactions: a behavioural-physiological overview. In L. Goldberger & S. Breznitz (Eds) *Handbook of Stress: Theoretical and Clinical Aspects*. Free Press, New York.
- Viner, R. (1999). Putting Stress in Life: Hans Selye and the Making of Stress Theory. *Social Studies of Science*, 29(3): 391-410.