

Exercise and Stress Part I—Defining Stress

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What is Stress

When you hear the term “stress” what is the first thing that comes to your mind? For many of us, words such as disease, worry, and apprehension always seem to pop up.

While stress can have deleterious effects, evidence suggests that stress plays an essential role in developing a healthy body, that is able to cope with the various demands thrown our way on a daily bases.

The topic of stress has been studied for almost a century now. Yet, there is no general consensus on the definition of stress. Therefore, the purpose of this paper was to define stress.

Simmons (2006) suggests that definitions of stress typically contain one or more of the following four elements: stressors, adaptations (responses), perceptions (cognitive/emotional), and effects (acute and chronic).

Selye (1936) suggested that a stressor was anything that causes the stress response. Stressors may consist of various stimuli in the environment, such as the climate or social conditions. The organism then responds, or adapts to the stressor. Wilson J. and Wilson G. (2005) suggest that an adaptation is an acute or chronic modification of an organism or parts of an organism that make it more fit for existence under the conditions of its environment.

Perceptions can be defined as stimuli that an organism decides to take into its mind, based on importance (Simmons, 2006). Perceptions can determine what stimuli in the environment act as stressors, based on the organism’s appraisal of the stimuli. And finally, the results of the stress response can manifest themselves acutely or chronically, and be beneficial or deleterious

To tie these altogether with an example, suppose a male athlete is squatting 400 pounds (the stressor), the heaviest he has ever lifted. As the athlete prepares to perform the lift, he begins to feel apprehension, because he has never lifted this much before, and as an athlete, improving his lifts are clearly important to him (this would be the perception and interpretation; notice how it is based on task importance). In response to his apprehension, his heart rate and respiration begins to rise (acute adaptations, in response to a perceived threat). The athlete then performs the lift successfully, for 4 reps. During the subsequent training session, he finds that he can perform 8 reps with the same weight (a chronic beneficial adaptation). This example typifies the stress response.

Keeping these 4 elements of stress in mind, this paper will begin its discussion on the definitions of stress with the father of stress, Hans Selye.

During his days as a Hungarian scientist, Selye observed that his patients with diseases had many similar symptoms, regardless of the infection. These included a loss of appetite, inflamed tonsils, and pain. In this context, Selye suggested that sickness could be studied in general, rather than specific to the disease itself (McEwen, 2002).

To test his hypothesis, he examined the effects of various stressors such as toxins and sudden changes in temperature on rats. He observed that every stressor caused a similar response, suggesting that the body had a general mechanism to cope with stressors. This led him to define stress as the nonspecific response of the body to any demand made upon it to adapt, whether that demand produces pleasure or pain. Based on the general nature of stress, he developed the infamous General Adaptation Theory.

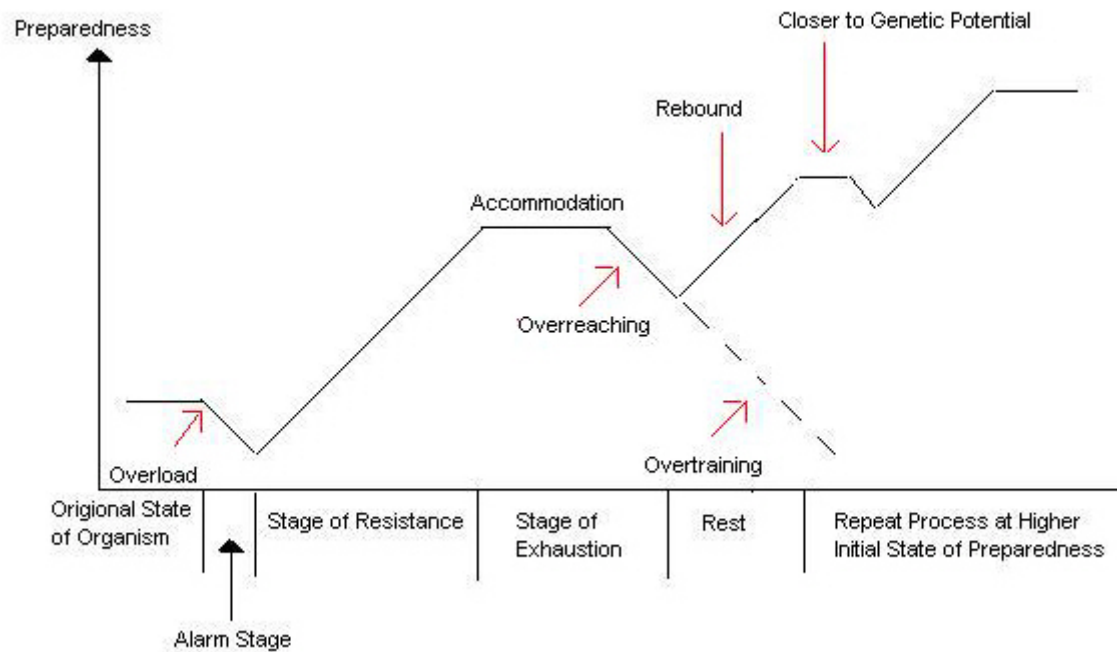


Figure 1.0

Hans Selye's General Adaptation Theory (Adapted from Wilson and Wilson, 2005, a)

Figure 1 graphically depicts Hans Selye's General Adaptation Theory. This theory suggests that stress is composed of three phases: alarm reaction, stage of resistance, and stage of exhaustion. During alarm reaction, the introduction of a stressor leads to a decrease in performance. Following this is the stage of resistance, in which the organism's defense mechanisms fight to gain resistance. This is known as adaptation and is characterized by elevated levels of homeostasis. Lastly, if the stimulus is continuous then the individual would plateau or experience

maladaptation. The maladaptation according to Seyle reflected similar symptoms to the Alarm reaction stage, and was the result of a depletion of the organisms defense mechanisms caused by chronic stress (Wilson and Wilson, 2005, a).

Seyle suggested that stress could be further broken down into two elements—distress and eustress. Distress was the damaging effects caused by stress, and could result in a decline in performance for athletes, or promote pathogenesis (diseases). Eustress was the advantageous effects of stress, and promoted growth and development.

Another popular theory is fitness fatigue model developed by Banister, Calvert, and Savage (1975).

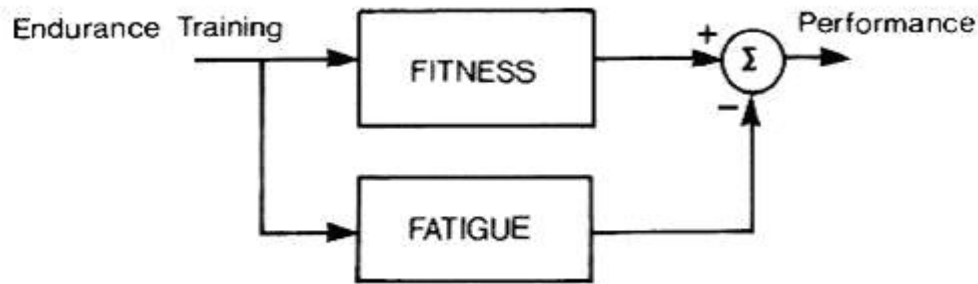


Figure 2.

Banisters Fitness Fatigue Model (Adapted from Wilson and Wilson, 2005, b)

Figure 2 graphically depicts the fitness and fatigue model. The model views adaptation as a constant flux of growth and decay and further growth of the combination of two intervening variables on performance. Banister et al. (1975) denotes these variables as fitness or positive benefits and fatigue or negative effects, while performance is seen as the difference between the two. Therefore, if fatigue is greater than the fitness gains, performance will suffer, and visa versa.

Based on these 2 models, and various other definitions of stress, athletes have used these principles to develop advanced training programs including periodization and tapering. For more information on how to manipulate exercise and stress for human performance, refer to [the science of training variables](#). And refer to [this](#) on bones by Wilson (2004) to see how stress can enhance bone growth.

Another pioneer in the study of stress was Walter Cannon (1929). Cannon discussed the body's tendency to keep itself within narrow tolerance limits necessary to sustain life (homeostasis). In the presence of a stressor that would cause an imbalance in homeostasis, Cannon suggested that the body responds in a stereotypical pattern of psycho physiological reactions to prepare to meet a survival threat (the stress response). He further posited that this response involved the famous fight or flight response, which initiated various adaptations such as shutting down digestion, tensing muscles, and piloerection (hair stands up), all of which would activate the

system so that it could handle the perceived or experienced stressor. The fight or flight response is discussed in detail in Part 2 of this series.



Figure 3.

The Balance Between demands and response capabilities (Adapted from bwilson)

Figure 3 graphically depicts McGrath's definition of stress. McGrath (1970) suggested that stress is the perceived imbalance between demands and response capabilities when failure to meet the demands is deemed important. Therefore, if the organism perceives that the demands placed on it are greater than its response capabilities, and the situation is important, stress will increase; conversely, if the situation is not important, or if the organism perceives its response capabilities exceed the situational demands, stress will decrease. This definition focused on the psychological state which triggered the stress response. Going back to the example discussed a few paragraphs ago, the athlete had a heightened stress response, because he had never lifted that much weight before, and was unsure if he had the capacity to handle the demands of a 400 pound squat.

Building on the work of McGrath, Martin (as reported by Simmons, 2006) suggested that stress could be defined as uncertainty * importance.

More recently, Inouye (2006) suggested that stress is anything that causes the body to adapt.

All of these definitions of stress are helpful in understanding the stress response; yet, by themselves, they fail to adequately define the stress response. This does not mean that any of them are invalid; what it means is that before discussing stress, it is vital that the writer defines what definition of stress they are using, because stress is such an ambiguous term that can take on numerous meanings. As has been displayed, stress can be cognitive or physical (or both); it can be beneficial or deleterious; it results in adaptation or maladaptation; and it can be acute or chronic. Perhaps a definition which combined all these factors would help clarify on this term.

In this context, the current author suggests that stress can be defined as the perceived or experienced imbalance between demands and response capabilities when failure to meet the demands is deemed important, or results in a disturbance in homeostasis. Typically, it must be inferred from acute or chronic adaptations or maladaptations.

This definition clarifies on several points. It discusses the impact of a stressor (or demand); both physiological (homeostasis and experience) and psychological (perception) responses to stress; acute and chronic adaptations of the stress response; and the positive or negative effects of stress. It also suggests that stress is a hypothetical construct that cannot be directly observed, but rather must be inferred based on acute or chronic adaptations or maladaptations.

To learn about the physiological mechanisms behind the stress response, click [Here](#).

Keep it Hardcore,

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References

1. Banister, E. W., Calvert, T. W., Savage, M. V. (1975) A systems model of training for athletic performance. *J. Sports. Med.* 7, p.57-61.
2. bwilson. <http://home.sandiego.edu/~bwilson/balance.jpg>
3. Inouye, C (2006). Exercise and Stress Lecture. California State East Bay.
4. Joseph E. McGrath, ea., Holt, Rinehart and Winston (1970). Interpersonal Stress in Isolated Groups. *Social and Psychological Factors in Stress*.
5. McEwen, Bruce (2002). *The End of Stress As We Know It*. Joseph Henry Press.
6. Selye, H., (1936) A Syndrome Produced by Diverse Nocuous Agents, *Nature* (July).
7. Simmons, J (2006). Exercise and Stress Lecture. California State East Bay.
8. Canon, Walter B. 1929. *Bodily Changes in Pain, Hunger, Fear and Rage*. New York: Appleton.
9. Wilson J., Wilson G. (2005, a). Periodization Part I – History and Physiological Basis. *Journal of HYPERplasia Research*. <http://www.abcbodybuilding.com/periodization1.php>
10. Wilson J., Wilson G. (2005, b). Tapering Part 1 - Two Factor Theory. *Journal of HYPERplasia Research*. <http://www.abcbodybuilding.com/taper1.php>
11. Wilson J. (2004). *The Mechanics of Bone Tissue Part I-III*. *Journal of HYPERplasia Research*.