

## High Performance West series – Understanding the Stress Response

### PART 2 – The (Scientific) Origins of Stress

Stress. Even the work itself evokes feelings, perhaps even emotion. Thoughts, mostly negative, enter our minds about how stress impacts our daily life; the bills we have to pay, the appointments we need to keep, the work we have to do. This is the layman's view of stress. It's a negative reaction that leaves us feeling anxious, sad, or overwhelmed. We believe it leads to sickness, depression, or any number of health issues, and often have ready made phrases like "relax, don't stress it, find stress relief" ready and at our finger tips to utilize.

If you have a scientific background, your view of the word may be slightly different. Instead of the negative view, the idea of the stress response takes center stage. Fight or flight, homeostasis, stimulus and response, cortisol and adrenaline; all phrases which describe our general understanding of the scientific concept of stress. We're familiar with the idea that if we encounter a stressor, be it a lion or a robber or even a scary movie, a cascade of events take place in our body that prepare us for the impending danger. In this context, stress is not a danger, but can save our lives. If you are familiar with athletic development, you might see stress as a way towards adaptation. Apply a stress, through a hard workout, and then recover and wait to see your muscles grow, your heart pump more blood, and your performance improve.

With all these concepts, what does stress mean? The reality is it can be all of these concepts and it can be none. It's a complicated word that keeps collecting a variety of meanings as we grow to understand the concept. The problem is these meanings get lodged in our minds as truths, regardless of whether they have validity or not. We carry around these concepts, likely because of their popularity, and we have a hard time dispensing of them. If they are overturned or changed, the original, popularized concept sticks in our mind.

The concept of stress, through its meandering journey towards understanding, is one ripe with misunderstanding. The impact is we have been left with a word, that carries an abundance of context on it's back, which has shackled us from utilizing the concept of stress as the body and mind intended. To elucidate where we went wrong, we need to go back to the start.

## Origins

In 1915, a young Harvard Physiologist named Walter Cannon described “the necessities of fighting or flight” in his now classic book, *Bodily Changes in Pain, Hunger, Fear and Rage*<sup>1</sup>. With the turn of a phrase, Cannon began the process of ingraining the now famous “fight or flight” instinct into our consciousness. As often occurs with scientific breakthroughs, the now common concept was a result not of deliberate examination but one of serendipity.

As a young medical student, Cannon used the newly discovered X-ray to investigate the mechanism of swallowing; did food reach the stomach because of muscles in the mouth or esophagus? Starting with geese and then moving to cats, Cannon X-rayed animals as they swallowed a variety of liquids and foods. The results were a success, as Cannon discovered how peristalsis helped move food through digestion. While putting the cats through his experiment, Cannon noticed a peculiarity. When the cats got scared or alarmed, the movement of the food through the gastrointestinal tract came to a halt. Even stranger, if the cats were consoled and comforted, GI tract movement resumed.<sup>2</sup>

From this simple observation of digestion, Cannon and his colleagues at the Harvard lab researched the wider impact of what occurred when animals were alarmed.

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<sup>1</sup> [https://archive.org/stream/bodilychangesinp00cannrich/bodilychangesinp00cannrich\\_djvu.txt](https://archive.org/stream/bodilychangesinp00cannrich/bodilychangesinp00cannrich_djvu.txt)

<sup>2</sup> [http://download.springer.com.ezproxy.lib.uh.edu/static/pdf/913/art%253A10.1007%252FBBF01857608.pdf?originUrl=http%3A%2F%2Flink.springer.com%2Farticle%2F10.1007%2FBBF01857608&token2=exp=1491754174~acl=%2Fstatic%2Fpdf%2F913%2Fart%25253A10.1007%25252FBBF01857608.pdf%3ForiginUrl%3Dhttp%253A%252F%252Flink.springer.com%252Farticle%252F10.1007%252FBBF01857608\\*~hmac=7f6487815633cff33cac123e9ea9c91a768bde6fa34f68bbec77448f14809a54](http://download.springer.com.ezproxy.lib.uh.edu/static/pdf/913/art%253A10.1007%252FBBF01857608.pdf?originUrl=http%3A%2F%2Flink.springer.com%2Farticle%2F10.1007%2FBBF01857608&token2=exp=1491754174~acl=%2Fstatic%2Fpdf%2F913%2Fart%25253A10.1007%25252FBBF01857608.pdf%3ForiginUrl%3Dhttp%253A%252F%252Flink.springer.com%252Farticle%252F10.1007%252FBBF01857608*~hmac=7f6487815633cff33cac123e9ea9c91a768bde6fa34f68bbec77448f14809a54)

After a series of wide-ranging experiments focusing on what happens to different organs when animals experienced alarm, Cannon centered on the sympathetic nervous system, and the hormone that it triggered, adrenaline. With the administration or uptake of adrenaline through emotional disturbance, the animal's body transformed, as if preparing for battle. He saw all of the now classic signs; increases in heart rate, breathing rate, and glucose mobilization, as well as the redistribution of blood flow. With these observations, Cannon was convinced that in response to any acute emergency, the body had a singular response, and it was all because of adrenaline; Prepare to fight or flight.

Cannon wasn't finished with stress. In 1932 in his book *The Wisdom of the Body*, he outlined the other side of the stress coin, how one returns to normal. Influenced by the ideas of Claude Bernard decades earlier, Cannon sought to discover how stability in the body was maintained. How did breathing rates, heart rate, and blood pressure return to normal after a stress-inducing disturbance in these systems? He believed that the body had a natural control system, that was based on the stability of the internal environment. Through innovative animal experiments looking at hunger, thirst, Cannon outlined the concept of *homeostasis*, or the maintenance of a relatively stable environment.

Cannon had his grand theories. In response to emergencies, adrenaline was the key. When faced with a disturbance, the body sought to prepare and then return itself to balance, regardless of what type of stressor it was. In other words, the system was reactive, the emotional or physical trigger caused a downstream reaction. With the two major concepts of stress, fight or flight and homeostasis, in place, Cannon changed our understanding of emergencies and emotional disturbance forever. But it took another scientist to bring the ideas to the mainstream.

### **Selye and the popularization of Stress**

Like his predecessor, Hans Selye didn't set out to understand stress, he was after something far different—a new sex hormone. He began his experimentation by injecting ovarian extract into rats, hoping to discover the new hormone being released as a reaction to the extract. With each reaction, he saw a distinct response, but it wasn't

his sought after hormone. Instead, there was a signature response, the adrenal cortexes enlarged and the immune system reacted. Frustrated and downtrodden by his lack of hormone discovery, Selye began to think about this standard response in a different way.

He tried injecting different substances, shocking the rats, and a whole slew of other activities, and each time, the same signature response occurred. Selye believed that in response to any noxious stimulus, the body had a generalized response. Selye termed the stimulus a stress.

In his work, Selye built upon Cannon's research and found that it wasn't only adrenaline that caused the body to be ready for battle. The Hypothalamic-Pituitary Axis (HPA) played a large role. The HPA axis results in the release of Cortisol and other hormones that we now commonly refer to as 'stress hormones.' Selye believed the body went through an alarm stage (similar to Cannon's fight or flight stage) in which it mobilized a reaction to an stimulus. Cortisol acted as the main trigger, which resulted in the signature response that Selye kept observing. Crucially, Selye believed that this was a nonspecific reaction. No matter what the stressor—be it burns, cold, infection or trauma—the body responded in the same way. And if it occurred too frequently, the body would eventually become 'exhausted.'

With the believed universality of Selye's concept he called the General Adaptation Syndrome, Selye began applying it to everything. Any environmental stressor had to cause the same reaction. He took to popular writing to explain his concept, and the harm that could potentially occur. Too much stress and your organs could be damaged or even fail. Despite calls for Selye to term this negative reaction as something other than "stress" by the journal *Nature*, Selye's choice phrase grew into an empire. Stress was negative, and it was a singular reaction.

The evolution of the concept of stress didn't occur in a physiologist vacuum. Ideas grow from the context of their times. And in many ways the evolution of the concept of stress is the result of the simultaneous growth and battle of physiology versus psychology. In the start of *Bodily Changes in Pain, Hunger, Fear and Rage*, Cannon's Darwinian influence can be seen:

*the doctrine of human development from sub-human antecedents has done much to unravel the complex nature of man. As a means of interpretation this doctrine has been directed chiefly towards the solving of puzzles in the peculiarities of anatomical structure... expressive actions and gestures— the facial appearance in anger, for example—observed in children and in widely distinct races, are found to be innate, and are best explained as the retention in human beings of responses which are similar in character in lower animals.*

Cannon saw himself as extending the explosion of Darwinian explanation in the physical sciences to the world of emotions and what we now call stress. He believed that we could best understand these reactions as a simple response coming from our ancient ancestry.

During the middle of the 20<sup>th</sup> century, with Ivan Pavlov and B.F. Skinner's influence, the concept of Behaviorism took root in the understanding of psychology. The theory posited that behaviors could best be understood as a reflex or a reaction to our environment. Whenever a stimulus was presented, we had a response that was either ingrained, or conditioned. It shouldn't come as a surprise that Cannon was a friend of Pavlov, the man who popularized the notion of conditioning, which relied on ingraining a response to a stimulus. Cannon and Pavlov exchanged correspondence over Pavlov's ideas of a conditioned reflex. As Cannon outlined his theories and Selye then built upon them, it's little doubt that the ideas that held a prominent place in the conceptual framework of psychology at the time, influenced these thinkers. Whether it was Darwin or the Behaviorist, the framework at the time, provides a glimpse of the lens that most scientist saw during their time. During this unique time, the physiology and the psychology were on the same page, reactive response driven systems dominated.