

# SECTION 3: THE STRESS RESPONSE

## The physiology of stress

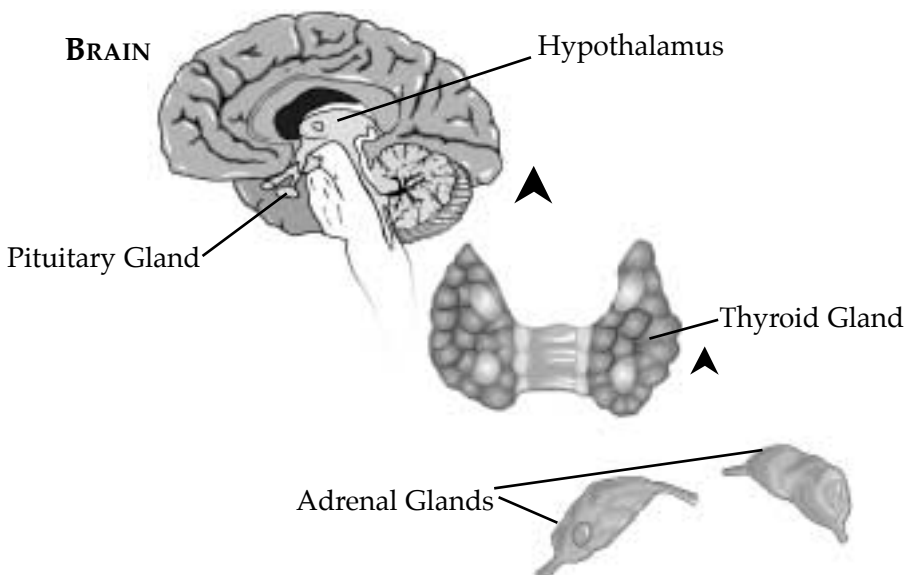
Hans Seyle and Walter Cannon, both physiologists, were the two pioneers credited with originating research on the body's response to stressors.

Walter Cannon was the first person to use the term *stress* to refer to the physiological reaction caused by the perception of aversive or threatening situations. He also introduced the phrase "*fight or flight*" to refer to the response which prepares an animal to cope with the threats posed by a predator.

Few human beings come into contact today with predators. Much more common are the pressures of deadlines, the irritation of noise, the frustrations of traffic jams and the throes of poverty.

When the brain perceives that a given situation is going to be stressful, it sends alarm messages via nerves and hormones to prepare the body for "fight-or-flight". Specialized areas in the brain which include parts of the *neocortex*, *limbic system* and *brain-stem* are important in one's response to stress.

The messages which are sent from the brain via nerves travel quickly and directly to specific parts of the body. Those which are sent by chemical messengers (hormones), such as epinephrine, travel much more slowly through the blood-stream to organ systems and their message is much more long-lasting.



**Norepinephrine (NEp)** is the main neurotransmitter in the brain responsible for the heightened arousal that follows exposure to a stressor. NEp acts by stimulating the *sympathetic branch of the autonomic nervous system (ANS)*. This includes stimulation of the *adrenal medulla* with the consequent secretion of *epinephrine (Ep)* and *norepinephrine (NEp)* into the bloodstream. Most cells in the body have *adrenergic receptors* on which these two substances act. Stimulation of this system results in increased heart rate, blood pressure, perspiration, muscle tone and cell metabolism.

Stressful situations also stimulate various areas of the *hypothalamus*, including the *paraventricular nucleus*. Stimulation of this nucleus results in the secretion of *corticotrophin releasing hormone (CRH)*. CRH in turn stimulates the *pituitary gland* to secrete *adrenocorticotrophic hormone (ACTH)* which circulates in the blood-stream and stimulates the *adrenal cortex* to secrete cortisol. *Cortisol* is a *glucocorticoid* (a naturally occurring *steroid*); almost every cell in the body has *glucocorticoid receptors*. Stimulation of this system results in increased glucose availability, increased blood flow and increased behavioral responsiveness in the face of stressful situations. Although the short-term effects of glucocorticoids are essential, the long-term effects are damaging and include damage to muscle tissue, increased blood pressure, diabetes mellitus, etc. In addition, excess cortisol inhibits inflammatory responses and the activity of macrophages, which are normally released into the blood-stream by the thymus gland to kill invading bacteria. A weakened immune system in turn makes us more vulnerable to infection and to cancer.

Stimulation of the hypothalamus also results in the release of *thyroid stimulating hormone, prolactin and beta-endorphins* from the *pituitary gland*. Beta-endorphins are naturally occurring opioids which elevate one's mood, decrease sensitivity to pain and have been linked to suppression of the immune system.

## The stress response

Through research pioneered by Hans Selye, it was discovered that the body's stress response consists of a predictable, non-specific, three-stage pattern of physiological responses: the *alarm* stage, the *adaptive/resistance* stage and the *exhaustion* stage. Not everyone experiences all three stages. The exhaustion stage is reached only when the person becomes stuck in the alarm stage or goes through the alarm and resistance stages too often.

*The alarm stage* is the fight-or-flight response that prepares a person to meet a challenge or threat. The person experiences the changes characteristic of the first exposure to a stressor which include anxiety, panic, fear, racing thoughts, increased heart rate, increased blood pressure, headaches, muscle tension, gastrointestinal distress, etc.

*The adaptive/resistance stage* is the stage during which the body may return to its pre-excited state and recovers from the physiological strains of the alarm stage once the stressor is eliminated.

If the stressor persists, the individual reaches a new level of adaptation as the internal organs mount a sustained resistance. The signs and symptoms which are characteristic of

the alarm reaction virtually disappear. If the stressor is not eliminated, the person enters into a mode of energy conservation which may be evidenced by social withdrawal, absenteeism, poor productivity, tardiness, etc.

Stress-prone or over-stressed persons, who may interpret even normal events as negative stressors, are often unable to reach the adaptive/resistance stage. They develop an extended alarm reaction until their bodies enter the exhaustion stage. In addition, persons who are able to successfully move to the adaptive stage may also reach the exhaustion stage if they experience too many stressors.

*The exhaustion stage*, often termed “*burn out*” is a reaction to the constant high metabolic demands of an extended alarm stage. With its resources severely depleted, the body is susceptible to illness, or in extreme cases, to death.

Warning signals of exhaustion include feelings of hopelessness and/or helplessness, a desire to “cop-out”, suicidal and/or homicidal ideation or marked impairment in social or occupational functioning.

Recent research suggests that the nature of the physiological response to stressors may be much more *stressor-specific* than was earlier believed. For example, exposure to stressors that are viewed as *arousing* and *challenging* tend to result in significant elevations of serum catecholamines with no change in serum prolactin or cortisol. In contrast, exposure to stressors that are viewed as overwhelming and result in *submissive behaviors* tend to result in marked elevations of serum prolactin and cortisol with no change in serum catecholamines. Hence, the “specificity” of the stressor may in fact reside in the individual’s perception of the event’s implications for them.

In conclusion, irrespective of the form which the stress response takes once we have dealt with a stressful situation and the threat is over, our physiological state returns to normal. The fact that such physiological responses can have long-term deleterious effects on our health only matters if the stressor is severe or prolonged.

## Recognizing stress

Sometimes we miss the fact that we are stressed. The first step in recognizing when you are stressed is acknowledging the possibility that you can become stressed. The second step is to be aware of the signs and symptoms of stress, which may be mild, moderate or severe.

### *Common physical signs and symptoms of stress:*

- Rapid heart rate
- Elevated blood pressure
- Nausea and/or vomiting
- Chest pain\*

\* Urgent medical evaluation indicated.

- Difficulty breathing\*
- Fainting\*
- Dizziness
- Tremor
- Increased perspiration
- Headaches
- Muscle twitching
- Thirst
- Weakness
- Fatigue
- Grinding teeth
- Visual difficulties
- Hearing difficulties
- Non-specific body complaints

*Common cognitive signs and symptoms of stress:*

- Poor concentration
- Loss of self-confidence
- Memory impairment
- Increased or decreased awareness of one's surroundings
- Difficulty making decisions
- Poor abstract thinking
- Blaming other persons
- Difficulty identifying familiar objects or people
- Loss of time, place or person orientation
- Racing thoughts
- Disturbed thinking
- Intrusive images

*Common emotional signs and symptoms of stress:*

- Apprehension
- Uncertainty
- Fear
- Agitation
- Anxiety
- Severe panic
- Anger
- Feeling overwhelmed
- Irritability
- Hopelessness
- Emotional shock
- Guilt
- Grief
- Depression

\* Urgent medical evaluation indicated.

- Denial
- Inappropriate emotional response

*Common behavioral signs and symptoms of stress:*

- Change in activity levels
- Sleep disturbances
- Erratic movements
- Change in usual style of communication
- Loss of interest in previously pleasurable activities
- Change in eating habits
- Emotional outbursts
- Antisocial behavior
- Inappropriate use of humour
- Suspiciousness
- Hyperarousal
- Substance use (e.g., caffeine, nicotine or alcohol use)
- Deterioration in performance effectiveness
- Accident proneness
- Nervous mannerisms (e.g., foot tapping, nail biting, teeth grinding, hair pulling, hand-wringing, etc.)

## **Stress reactions of children and adolescents**

Boys and girls tend to experience similar levels of stress which generally increase with age. The causative stressors are usually related to *home, school* and *relationships*. *Their reactions to such stressors are important since they can affect their development, learning and behavior.*

Like adults, children and adolescents who are exposed to stressful situations show a wide range of complex reactions which may be immediate or delayed. These reactions tend to differ from those of adults in that they are age-dependent and strongly influenced by the reactions of the adults with whom they come into contact, especially their care-givers.

The form which the stress reaction takes depends on which developmental stage has been interrupted since each stage has its own inherent tasks which must be resolved to form the basis for further change. Nonetheless, fear of an event recurring, loss of trust in adults and sleep disturbances are three of the most common responses of children and adolescents to stressful situations.

Children five years of age or younger are particularly vulnerable to changes in their day-to-day routines and disruptions of the security of their environments. They tend to respond to stress situations by becoming disobedient, aggressive, withdrawn, moving about aimlessly or by anxious attachment as evidenced by excessive crying, screaming, throwing tantrums, trembling or not letting go of care-takers or favorite objects. They may also develop sleep disorders, gastrointestinal disorders, or specific fears or exhibit regressive behaviors

such as speech difficulties, thumb-sucking, bed-wetting and fear of the dark. Their play and art work may reflect traumatic themes and issues and they may use denial to deal with overwhelming experiences and unbearable changes. Such denial may take many forms, including denial of the facts and memories regarding the traumatic events, avoidance of certain themes or issues and ignoring certain people or situations. Because they generally lack the developmental skills to effectively cope with stressful situations by themselves, they are particularly dependent on family members for comfort. For this reason, on some occasions children in this age-group may be as affected by the reactions of their care-givers as they are by the direct effects of the stressor.



Children between 5 and 11 years of age commonly exhibit regressive behaviors when they are stressed. They may also become withdrawn, disruptive and/or have difficulty concentrating. Academic and social performance may decline as a result of acting out behavior or the child's preoccupation with the events that occurred. Children in this age group may exhibit feelings or moods which are inappropriate to the circumstances in which they find themselves from day to day. They may also exhibit hyperactive, aggressive or irritable behaviors; develop irrational fears; refuse to attend school and/or have somatic complaints, e.g., gastrointestinal complaints that have no medical basis. They also tend to increasingly compete with younger siblings for the attention of their parents. Once the child feels free to talk about the incident, he or she may talk about it continually and their play and art work may also reflect themes and issues related to the stressor.

Children between 11 and 14 years of age are particularly sensitive to feedback from peers. They need to feel accepted by their peers and to believe that their feelings and fears are normal. They may experience "survival guilt" and their anxieties are frequently manifested as aggression, rebellion, withdrawal or attention-seeking behavior, or as a decline in academic and social performance. Like younger children, they also exhibit regressive behaviors, develop irrational fears, experience sleep disturbances or have various somatic complaints which have no medical basis.

Adolescents 14 years of age and over tend to develop stress reactions that are similar to those manifested by adults. However, behaviors specific to younger children can resurface in adolescents due to their tendency, not unlike younger children, to use regression as a coping mechanism. Academic and social performance may decline and psychosomatic reactions are common. *When adolescents are experiencing high levels of stress, males are more likely to externalize as evidenced by delinquent behavior, while females are more likely to inter-*

*nalize as evidenced by features of depression.* Some adolescents respond to stress by “growing up” too quickly and they may adopt lifestyles several years in advance of their age.

Perhaps because of a combination of peer pressure and a need not to have to rely on parental support, adolescents often act out their distress in ways that are ultimately misguided and self-destructive. Typical patterns include isolation, substance use, sexual indiscretion, violence, delinquency, running away and suicidal behavior. Adolescents may also displace their rage onto unsuspecting and undeserving victims, such as teachers, other school personnel, peers and/or the wider community. In addition, adolescents tend to be very self-centered and exposure to stressful situations may intensify such self-preoccupation as well as destroy their self concept of omnipotence. This coupled with their readiness to blame themselves for the course of events may result in very poor self-esteem.

## How stressed are you?

*Read each statement below carefully, then circle the best answer to each question as it relates to the preceding 12 months of your life and find the total score.*

*Please see Appendix 1 for an interpretation of the total score.*

**Note that tests like these serve only to alert us that there may be a problem.**

	Never	Sometimes	Often	Always
1. I get unexplained headaches.	1	2	3	4
2. I think about my problems over and over during the majority of my waking hours.	1	2	3	4
3. I feel more tired than is reasonable.	1	2	3	4
4. I have become irritable, impulsive and/or confrontational.	1	2	3	4
5. I feel like a failure.	1	2	3	4
6. My breathing pattern is irregular.	1	2	3	4
7. I feel overwhelmed and helpless.	1	2	3	4
8. I get gastrointestinal upset (nausea, vomiting, diarrhea, constipation, abdominal colic).	1	2	3	4

9. I have become withdrawn.	1	2	3	4
10. I have lost interest in activities that I used to find pleasurable.	1	2	3	4
11. I feel like crying for no reason.	1	2	3	4
12. I have become indifferent and uncaring.	1	2	3	4
13. I have become absent-minded and accident prone.	1	2	3	4
14. I use caffeine, nicotine, alcohol and/or other drugs to try and cope.	1	2	3	4
15. I find it hard to make decisions.	1	2	3	4
16. I indulge in negative self-talk.	1	2	3	4
17. I find it difficult to concentrate.	1	2	3	4
18. My heart races.	1	2	3	4
19. I have nervous habits e.g., biting my nails, grinding my teeth, tapping my feet, pulling my hair, wringing my hands, fidgeting, pacing, etc.	1	2	3	4
20. My muscles become tense for no reason.	1	2	3	4
21. I feel anxious and/or sweat for no obvious reason.	1	2	3	4
22. My work performance has declined and I seldom finish anything.	1	2	3	4
23. I just feel like "copping out".	1	2	3	4
24. I have sleeping problems (problems falling asleep, problems remaining asleep, nightmares, etc.)	1	2	3	4
25. I eat too much or too little.	1	2	3	4

Total Score: \_\_\_\_\_

## End of Section Quiz

*Please circle the correct answer.*

- |   |   |   |
|---|---|---|
| 1. Stress is always easily recognized.  | T | F |
| 2. Cortisol is a naturally occurring steroid.   | T | F |
| 3. The stress response is a five-stage response.  | T | F |
| 4. To be able to recognize when you are stressed you must first acknowledge the possibility that you can become stressed.               | T | F |
| 5. The stress caused by exposure to an aversive stimulus is not in anyway useful.   | T | F |
| 6. All stress reactions tend to be mild.  | T | F |
| 7. Norepinephrine is the main neurotransmitter in the brain responsible for the heightened arousal that follows exposure to a stressor. | T | F |
| 8. Severe panic is a common response to minor stressors.  | T | F |
| 9. Prompt medical evaluation is indicated if one develops difficulty breathing even if it is thought to be stress-related.              | T | F |
| 10. The term "burnout" is synonymous with the first stage of the stress response.   | T | F |

Quiz answers appear in Appendix 2.

