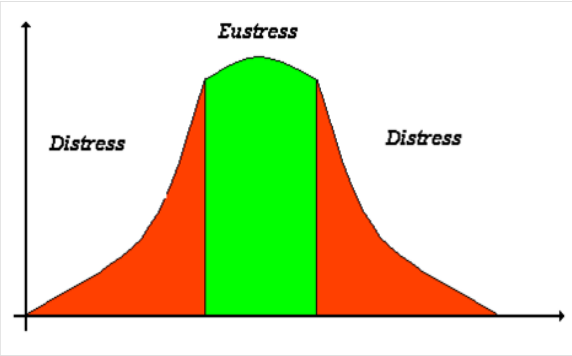
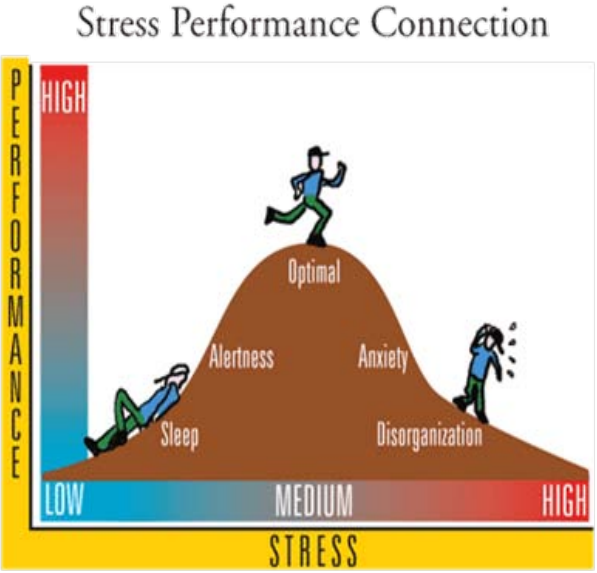
THE BODY'S RESPONSE TO STRESS

Introduction

'Stress' has been defined as **a pattern of negative physiological and psychological responses, occurring where people perceive threats to their well-being which they believe they are unable to meet**. A 'stressor' is defined as **any event that triggers the stress response**. Some degree of stress ('positive stress' or **eustress**) is good and necessary for all of us. However, too much stress ('negative stress' or **distress**) isn't.

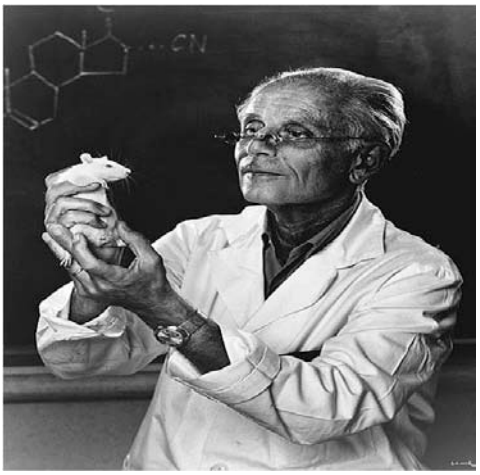




There is an 'inverted-U' relationship between stress and performance

Stress can be a 'short-term' phenomenon (whose effects are not usually harmful) or a 'long-term' phenomenon (whose effects usually are harmful). How the body responds to stress was studied extensively by **Hans Selye**,

and the processes which constitute the 'stress response' are very well understood, as is the role that stress plays in certain illnesses.



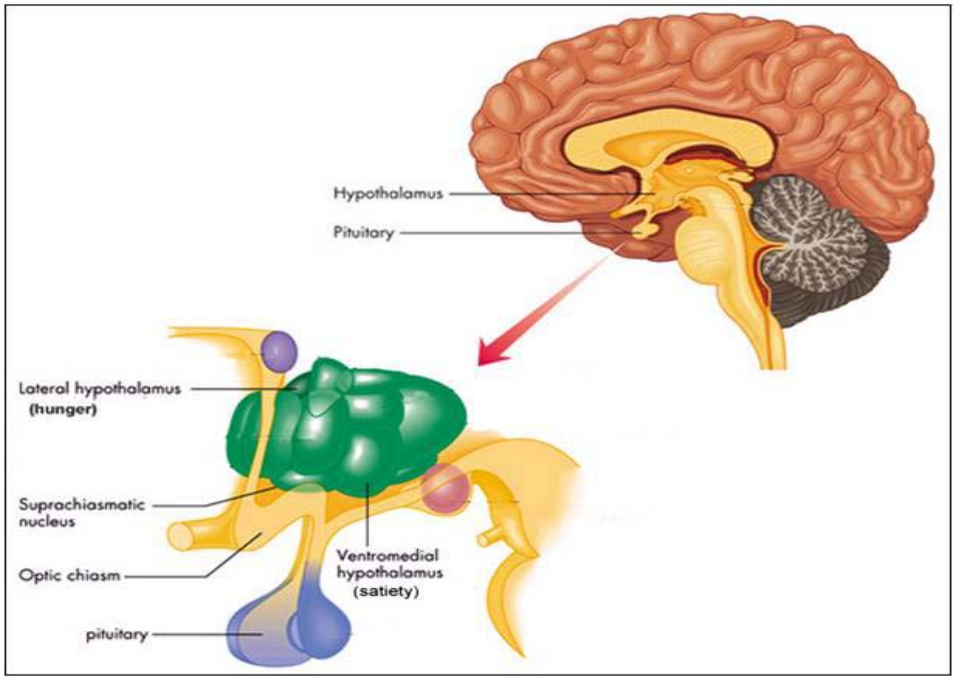
Hans Selye's findings about how the human body responds to stress were obtained from studies which involved exposing rats to extreme stressors

How does the body respond to stress?

One of Selye's first discoveries was that the body responds in exactly the same way no matter what kind of stressor we are exposed to. As a result, he called the body's response to a stressor the **General Adaptation Syndrome** (**GAS**). The GAS consists of 3 stages:

Stage 1: The alarm reaction

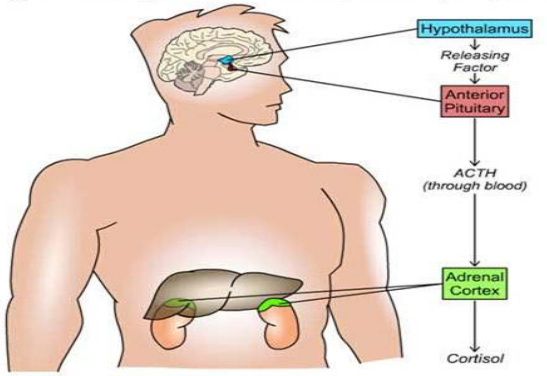
The stage consists of **two phases**. The **shock phase** is our initial reaction to a stressor, and involves a drop in physiological activity such as heart rate and muscle tension. However, within half a second the body recovers and enters the **counter shock phase**, in which it prepares to mobilise its forces to defend us against the stressor. The counter shock phase is orchestrated by a brain structure called the **hypothalamus**.



The hypothalamus is the brain structure that initiates the body's response to a stressor

Activation of the hypothalamus causes two different processes to occur simultaneously. The first process is called the **Pituitary-Adrenal System**. In this, the hypothalamus sends a message to the **pituitary gland**, which uses a hormone called **ACTH** to send a message to the **cortex** of the **adrenal glands**. This causes the adrenal cortex to release **corticosteroids**, which control and conserve the production of sugar (**glucogenesis**). This enables the body to release energy, and also helps it to fight inflammation and allergic reactions.

Figure AN-1: Hypothalamic-Pituitary-Adrenal (HPA) Axis



The Pituitary-Adrenal System (Note: It is also known as the Hypothalamic-Pituitary-Adrenal axis)

The second process is called the **Sympathomedullary Pathway**. In this, the hypothalamus also activates the **sympathetic branch of the Autonomic Nervous System** (**ANS**). This stimulates the **medulla** of the **adrenal glands**, which release the hormones **adrenalin** and **noradrenalin**. These mimic the action of the sympathetic branch of the ANS and cause heightened physiological activity in the body, which is commonly called the '**fight-or-flight response**'. The purpose of this heightened activity is to prepare us to defend ourselves against the stressor.

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SOME COMPONENTS OF THE 'FIGHT-OR-FLIGHT RESPONSE'

- **Heart rate and blood pressure increases**
- **Muscle tension increases**
- **Blood coaguability increases**
- **Perspiration occurs**
- **Some tissues are broken down**
- **Endorphins are released**

Notice that if the stressor is terminated, the Pituitary-Adrenal System is turned off immediately. However, the Sympathomedullary Pathway continues for a while even though the stressor is no longer present.

Stage 2: The resistance stage

If the stressor continues, the **parasympathetic branch of the ANS** tries to slow down our internal organs, although the body is still in a higher than normal state of physiological activity. This enables us to maintain our resistance to the stressor. If the stressor is terminated, then bodily damage is unlikely. However, if the stressor continues, **immunosuppression** occurs, and the body's **immune system** is less than

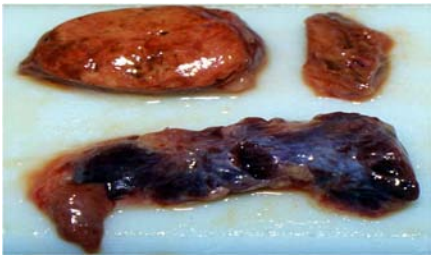
responsive because it is using up resources faster than they can be replaced. Immunosuppression is caused by the body's production of corticosteroids, which interferes with anti-body production.

Stage 3: The exhaustion stage

If the stressor continues, the body eventually reaches a point where it begins to suffer damage, because it is using up all of its resources faster than it can replace them:

EFFECTS OF CONTINUED STRESS ON THE BODY

- Adrenal glands enlarge and lose their store of hormones



- Tissues show signs of wear and tear
- Muscles become fatigued
- Blood sugar levels drop
- Other endocrine glands, kidneys, and other organs are damaged

As a result of the damage occurring above, continued stress eventually leads to what Selye called '**diseases of adaptation**', which are more commonly known as '**stress-related illnesses**'. Stress has been implicated in several types of illness, including **migraine**, **peptic ulcers**, **asthma**, **cancer**, **cardiovascular disorders**, and **illnesses caused by a malfunctioning immune system**.