

Biology of Stress Introduction

Let's get something straight right from the start. The body's reaction to stress is old fashioned. In the modern world, in the vast majority of stress situations the body's response to stress causes more harm than good. However, in the olden days, like hundreds of thousands of years ago, our present day response to stress would have been a lifesaver.

But what is stress?

A stressor is defined as:

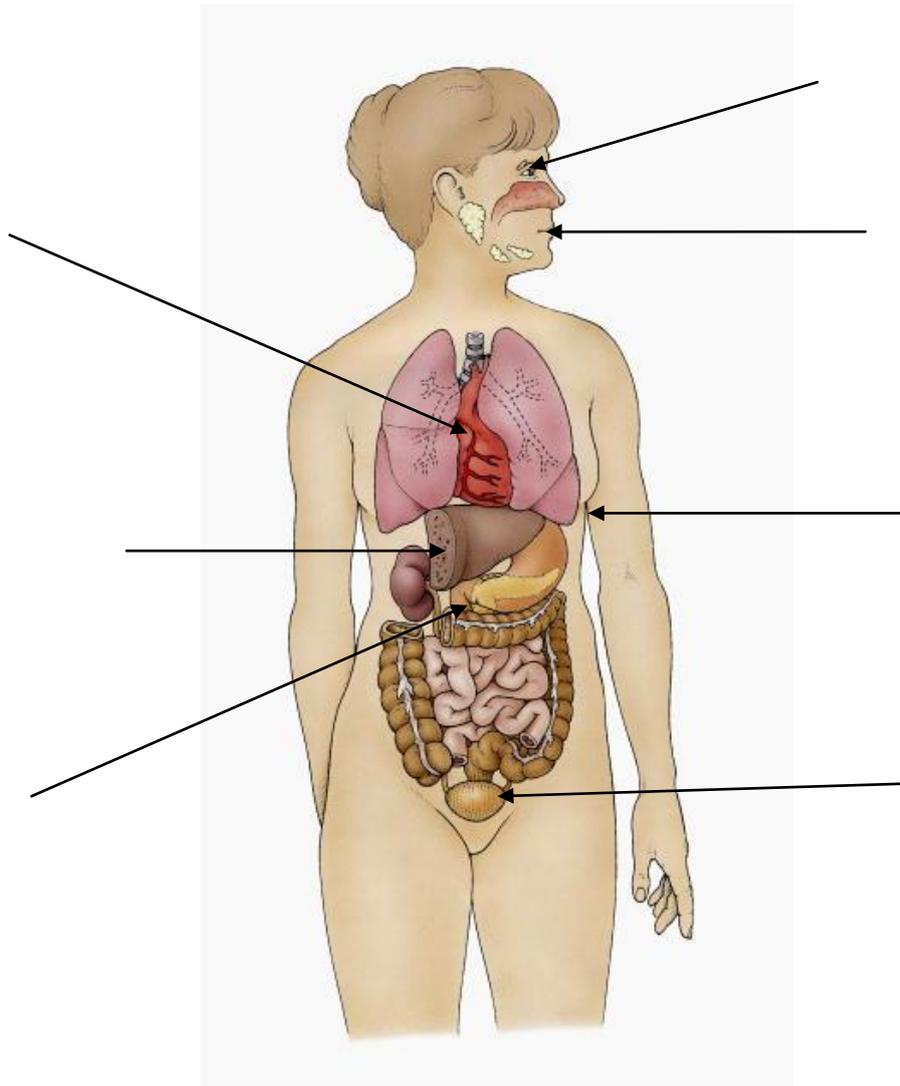
What is acute stress, give examples.



What is chronic stress, give examples.



Bodily Response to Stress



Explain why the bodily response to stress 10,000+ years ago was useful.

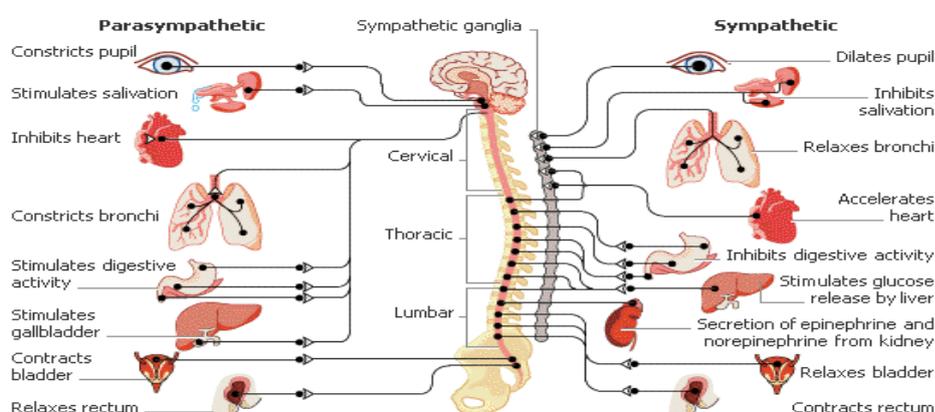
Explain why the bodily response to stress is harmful in modern 21st century society.

Autonomic Nervous System (ANS)

This controls the functions that we have no conscious control over such as digestion, temperature and heart rate. It can be split into two parts:

Sympathetic	Parasympathetic
Increases heart rate	Decreases heart rate
Releases glucose into blood	Stores glucose in the liver as glycogen
Dilates pupils	Contracts pupils
Slows digestion	Returns digestion to normal

It's obvious from this that the **sympathetic nervous system** is responsible for the stress response! The **Parasympathetic** is left to return the body to normal when the threat has passed; it recharges the batteries for the next alert if you like.



An area in the brain called the **hypothalamus** controls the body's response to stress. This is situated right next to the pituitary gland (sometimes referred to as the master gland because it controls the others) and both are located in the middle of the brain just behind the upper part of your nose!

In the stress response the **Pituitary gland** does two things.

1. It sends nerve messages to the **adrenal medulla** (part of the adrenal gland)
2. It sends a chemical **ACTH** to the **adrenal cortex** (another part of the adrenal gland).

Adrenal Medulla	Adrenal cortex
Triggers the sympathetic nervous system and releases adrenaline .	Releases corticosteroids into bloodstream
This produces the fight or flight response: <ul style="list-style-type: none"> • Increased heart rate • Slows digestion • Dilates pupils • Releases glucose into blood 	This causes: <ul style="list-style-type: none"> • Liver to release glucose • Inhibits immune response especially inflammation and production of white blood cells. • Convert fats/proteins into glucose.

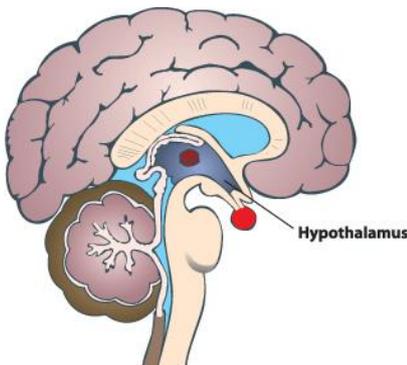
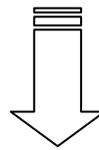
The Body's Response to Stress

Firstly, our body judges a situation and decides whether or not it is stressful. This decision is made based on sensory input and processing (i.e. the things we see and hear in the situation) and also on stored memories (i.e. what happened the last time we were in a similar situation).

If the situation is judged as being stressful, the **HYPOTHALAMUS** (at the base of the brain) is activated.



The situation is judged and is decided to be **STRESSFUL**...



The **HYPOTHALAMUS** is alerted



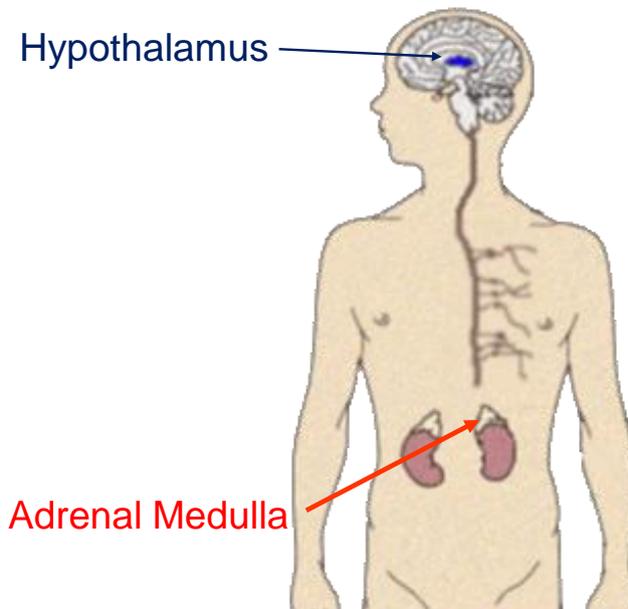
If the Hypothalamus decides the stress is **ACUTE**, it activates the **SAM** system...



If the Hypothalamus decides the stress is **CHRONIC**, it activates the **HPA**

POINT TO NOTE - In the next few pages, you will look at the HPA and SAM systems in more detail. Be prepared for some serious biological terms, but don't worry if you can't remember these straight away - it will come with practise!

The Sympathomedullary (SAM) Pathway



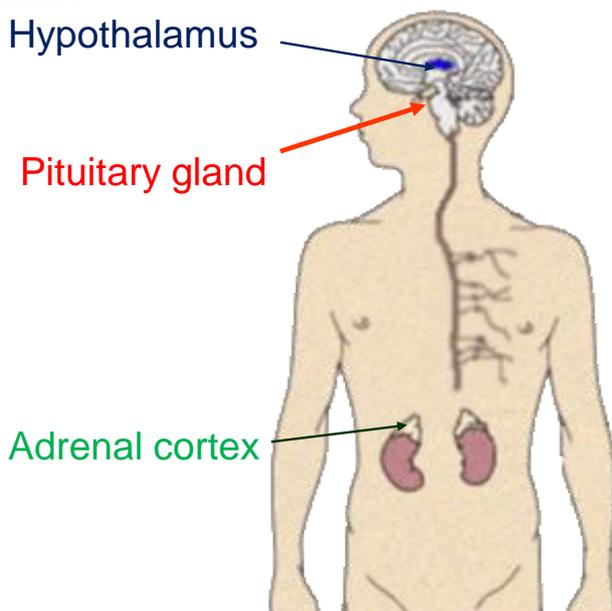
The **hypothalamus** also activates the **adrenal medulla**.

The adrenal medulla is part of the ANS which secretes **adrenaline**.

This hormone gets the body ready for a **fight or flight response**.

Physiological reaction includes increased heart rate.

The Hypothalamic Pituitary-Adrenal (HPA) System



Here, in the endocrine (hormone) system, the **hypothalamus** directs the **pituitary gland** to release a stress hormone **ACTH**. This in turn, acts on the **adrenal cortex**, which is stimulated to release the hormone such as **corticosteroid + glucose** which helps to increase the body's energy level over a longer period of time.

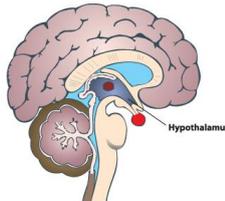
The Body's response to ACUTE stress (the body's IMMEDIATE response to stress)

⇒ **The SYMPATHOMEDULLARY (SAM) PATHWAY**

Situation is appraised and perceived as Stressful



Hypothalamus is alerted. This recognises the stress is **ACUTE** so it activates the SYMPATHOMEDULLARY Pathway

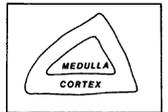


This activates the SYMPATHETIC branch of the ANS.

ANS stands for A _____

N _____ S _____

THE ADRENAL GLANDS

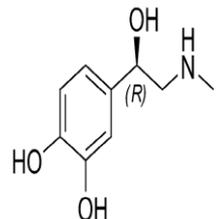
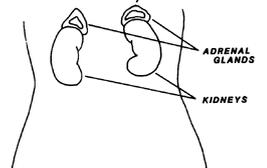


This then stimulates the A _____

M _____ This is located just above the

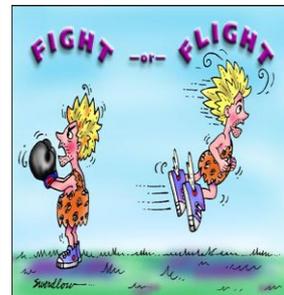
K _____ . It secretes the hormones

A _____ into the bloodstream.



This prepares the body for F _____ or

F _____ and as such causes a number of physical (bodily) changes, including increased heart and breathing rates, dilated pupils and reduction in digestive system



However, the body cannot maintain this increased level of activity for long periods of time and P _____ branch of the ANS

This is a COUNTERSHOCK response and serves to return the body back to its Natural resting state (e.g. it reduces heart rate and breathing rate, restores activity in the digestive system...)



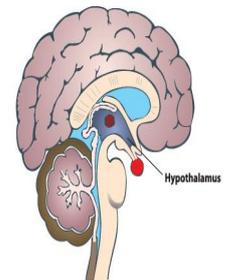
The Body's response to **CHRONIC** stress (the body's **LONG TERM** response to **ONGOING** stressors)

⇒ **The HYPOTHALAMIC PITUITARY ADRENAL System**

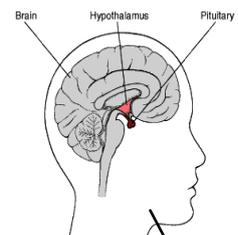
Situation is Appraised and perceived as Stressful



H_____ is alerted. This recognises the stress is **CHRONIC**.



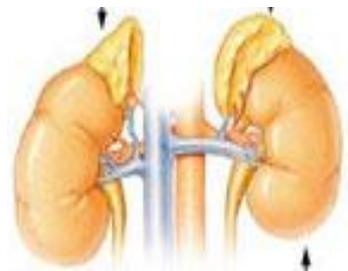
Hypothalamus activates the P_____ G_____ in the brain.



The P_____ G_____ causes the release of several hormones, including ACTH, which stands for A_____ hormone



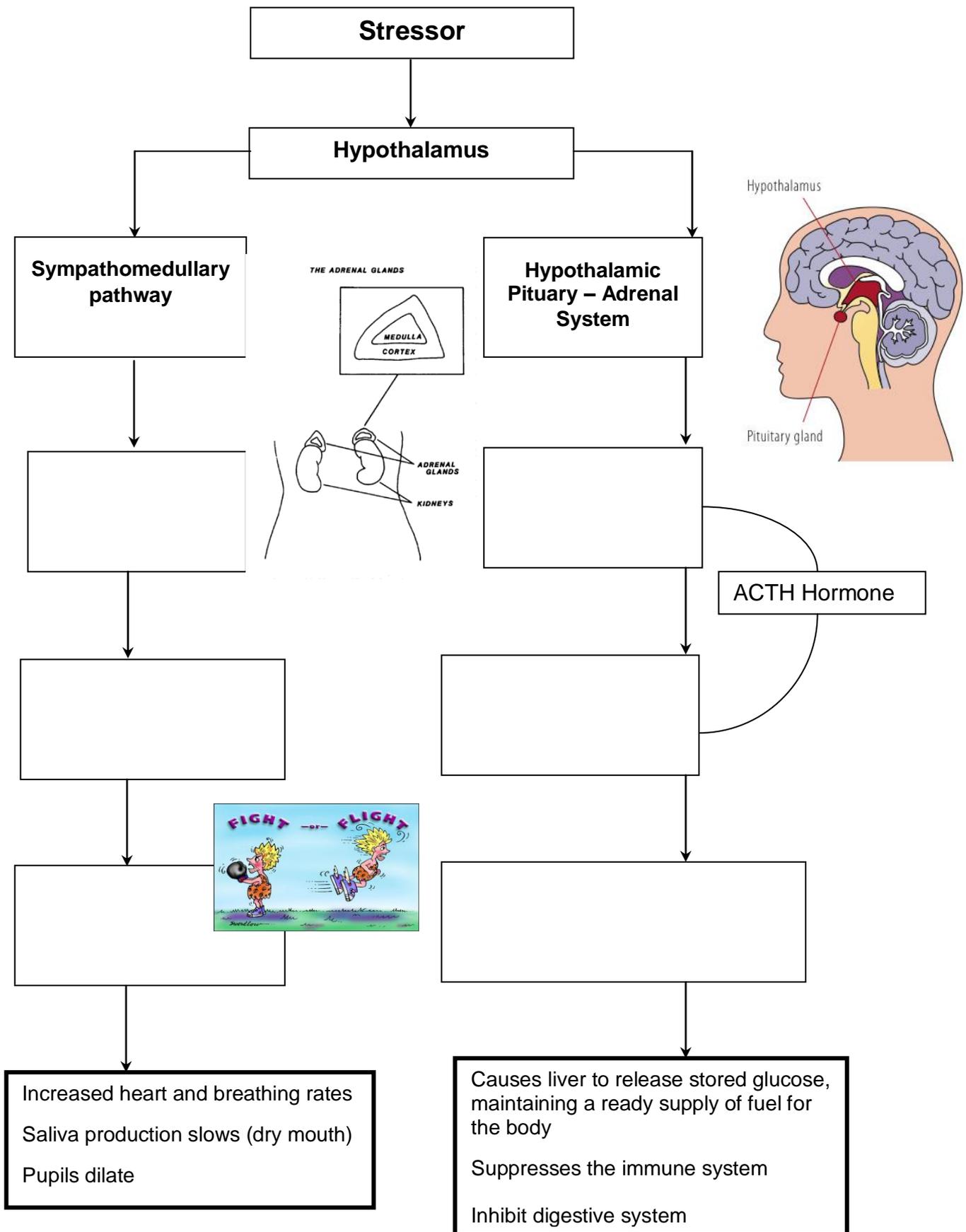
The release of ACTH stimulates the A_____ C_____ (another part of the adrenal glands) to release a range of hormones called C_____.



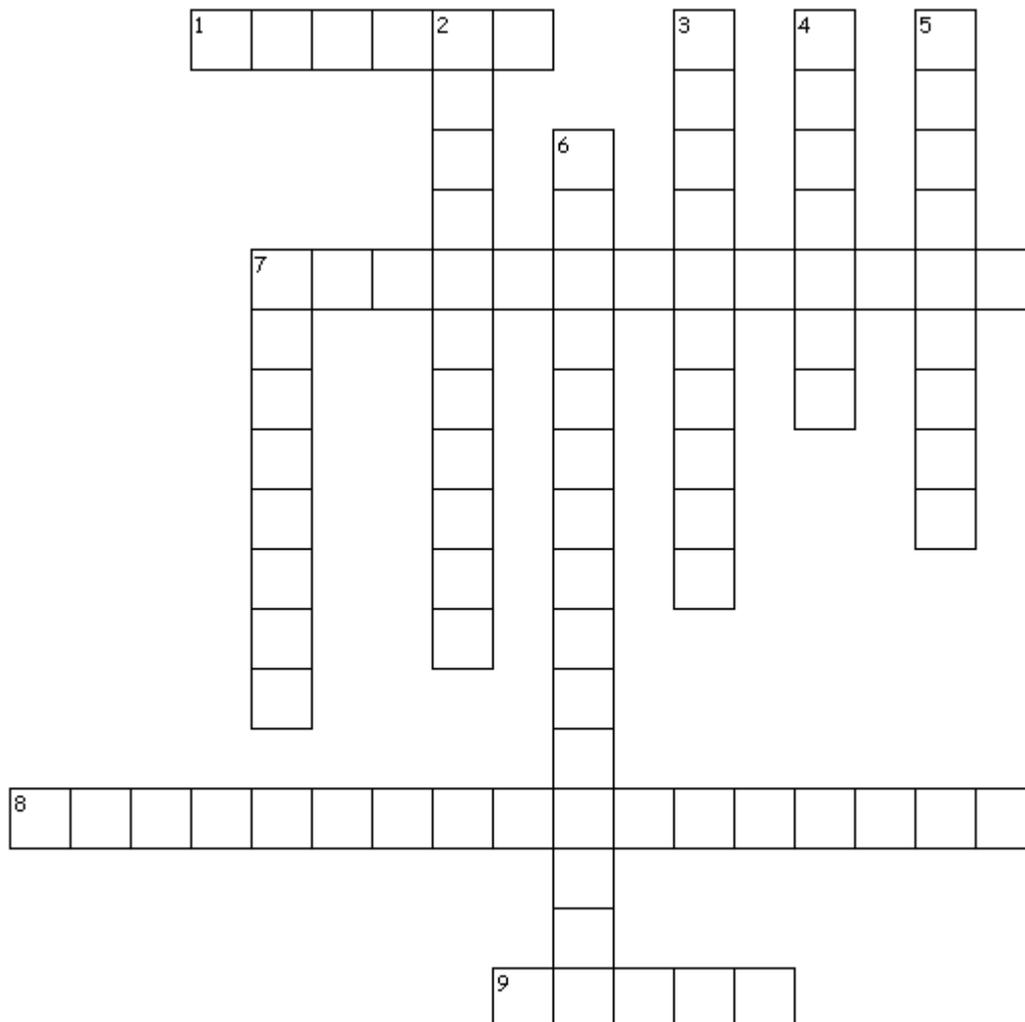
These help to control blood sugar levels and make fats available for energy. ✓

Bad effect of these hormones include suppression of the bodies I_____ S_____ ✗

Recap - Physiological Responses to Stress



Acute stress: The sympathomedullary pathway



Across

1. Experienced when a person's perceived demands exceed their perceived ability to cope
7. The neurotransmitter released by the SNS to activate internal body organs
8. A pathway that is made up of the SNS and the SAM
9. Immediate stress on the body

Down

2. A branch of the SNS that arouses an animal to ready for fight or flight
3. Released by the SAM system to alert the animal
4. Neurons of the SNS travel to this so it releases adrenaline
5. A system that controls itself
6. A branch of the SNS that returns the animal to a state of relaxation
7. These travel to every organ and gland in the body to prepare for rapid action

Bodily Responses to Stress

