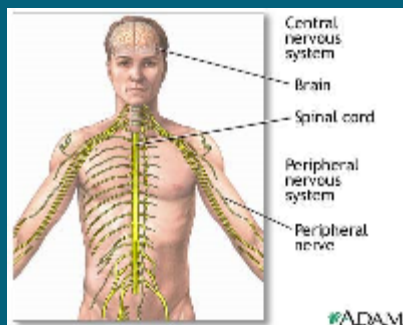


Nervous System

Dr. Wendy Smith
Chiropractor, Kinesiologist, Acupuncturist



CENTRAL NERVOUS SYSTEM

SPINAL CORD

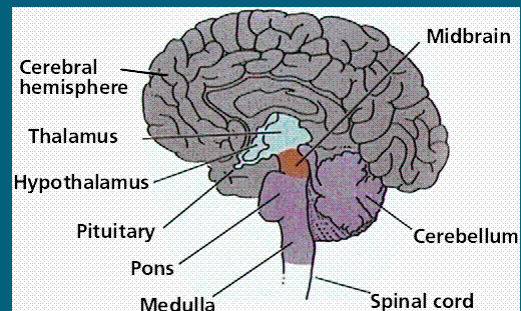
- conducts **sensory information** from the peripheral nervous system (both somatic and autonomic) to the brain
- conducts **motor information** from the brain to our various effectors
 - Skeletal muscle
 - Cardiac muscle
 - Smooth muscle
 - glands
- serves as a minor reflex center

The spinal cord is about 43 cm long in adult women and 45 cm long in adult men and weighs about 35-40 grams.

BRAIN

- receives sensory input from the spinal cord as well as from its own nerves
- devotes most of its volume (and computational power) to processing its various sensory inputs and initiating appropriate — and coordinated — motor outputs.

The average adult human brain weighs 1.3 to 1.4 kg (approximately 3 pounds). The brain contains about 100 billion nerve cells and trillions of "support cells" called glia.



BRAIN & SPINAL CORD

The brain went through stages developmentally. It is based on a hierarchy of function.

OLD BRAIN

- Hardwired and determines most of your automatic unconscious reaction. Its main function is self-preservation. It examines every new stimulus to answer the question, "Is it safe?"
- Vague awareness of the outside world. It seems only able to recognize six basic categories, is this particular person (thing) someone to attack, submit to, run away from, have sex with, be nurtured by, or nurture.

NEW BRAIN

- Malleable. Conscious and alert.
- Sends and receives information with the old brain.
- Very aware of the outside world. Logical and tries to find a reason or cause for everything.

OLD BRAIN

Brain Stem (reptilian brain: all vertebrates from reptiles to mammals have one)

- Location: Inner and most primitive layer of the old brain. It sits on top of the spinal cord in the base of the skull and upper neck.
- Purpose: To oversee such functions as reproduction, self-preservation, circulation of the blood, breathing, sleeping, and the contractions of muscles in response to external stimulation.
- Divided into:
 - Medulla Oblongata
 - Pons
 - Midbrain
 - Cerebellum

Limbic System

- Location: Middle layer that surrounds the brain stem.
- Purpose: To generate emotions--especially fear and aggression.

NEW BRAIN

- **CEREBRAL CORTEX**
 - The large mass of grey matter that we think of when we think of the human brain. It surrounds the old brain (third layer) but does not completely control it although it can moderate some of its instinctual reactions.
 - Hemispheres communicate with each other as well.

CENTRAL NERVOUS SYSTEM

- **Hindbrain**
 - Medulla Sensory and motor nerves crossover
 - Pons Regulation of sleep-wake cycle
 - Cerebellum Reflexes (e.g., balance), Coordinates movement
- **Midbrain**
 - Hearing, vision relay point
 - Pain registered

CENTRAL NERVOUS SYSTEM

- **Forebrain**

- **Thalamus**

Major message relay center
Regulates higher brain centers and peripheral nervous system

- **Hypothalamus**

Motivation
Emotion
Stress reactions

- **Cerebral Cortex**

- Occipital lobe
 - Temporal lobe

Receives and processes visual information

Complex vision
Smell
Hearing

Balance and equilibrium
Emotions and motivations
Some language comprehension

- Parietal lobe

Sensory projection and association areas
Visual/spatial abilities

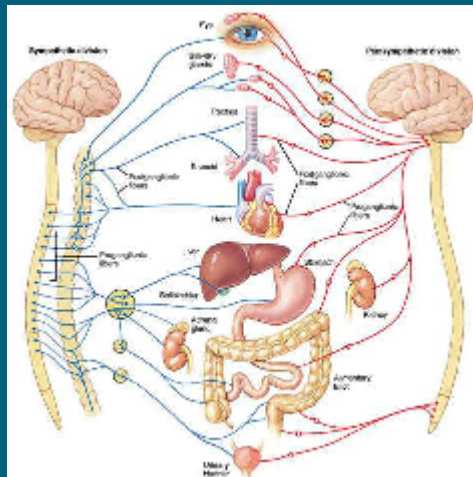
- Frontal lobe

Goal-directed behavior, concentration
Emotional control and temperament
Motor projection and association areas
Coordinate messages from other lobes

PERIPHERAL NERVOUS SYSTEM

PERIPHERAL NERVOUS SYSTEM

- Somatic Nervous System
 - Intentional or voluntary control of our body.
 - Can be influenced by automatic primitive reflexes.
- Autonomic Nervous System
 - Occurs without our intentional control.
 - Can be influenced by our intentions.
 - Further subdivided but both divisions complement and work together to create homeostasis.



Autonomic Nervous System

Sympathetic N. S.

- Fight or flight
- Catabolic (breaking down, using,)
- It dilates the bronchi and the pupils, accelerates heart rate and respiration, and increases perspiration and arterial blood pressure, but reduces digestive activity.
- Two neurotransmitters are primarily associated with this system: epinephrine and norepinephrine

Parasympathetic N. S.

- Rest and digest
- Anabolic (building up, repairing, replenishing)
- Whatever was dilated, accelerated, or increased by the sympathetic nervous system is contracted, decelerated, or decreased by the parasympathetic nervous system.
- The only things that the parasympathetic nervous system augments are digestive functions and sexual appetite. One neurotransmitter is primarily associated with this system: acetylcholine

BREAK

Stress

"Stress is life and life is stress." The words of Hans Selye from the 1940s

- Stress is important (individual perception)
- Adaptation
- Our Autonomic NS is what enables us to adapt appropriately

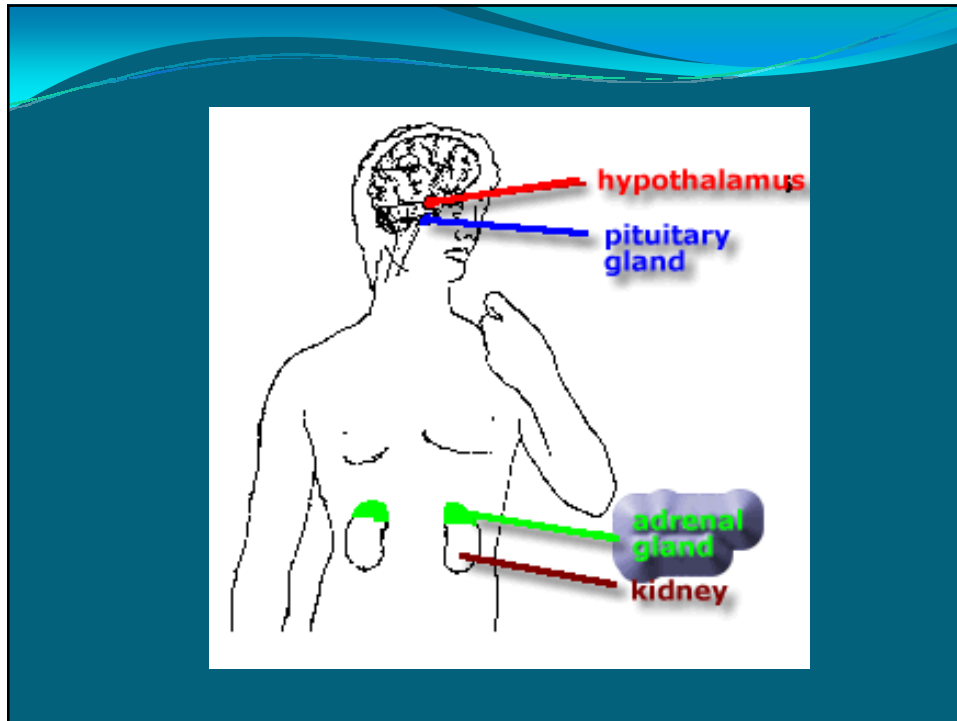
Selye recognized that physical, emotional, and environmental challenges (stressors) elicit a variety of physiological responses and that our ability to respond and adapt to these stressors is critical to our survival.

In the 50 years since these initial observations, we have learned a great deal about the complex system that allows us to maintain homeostasis in the resting state and to respond appropriately to stressors, yet much remains to be learned about the regulation of this system.

Stress Axis

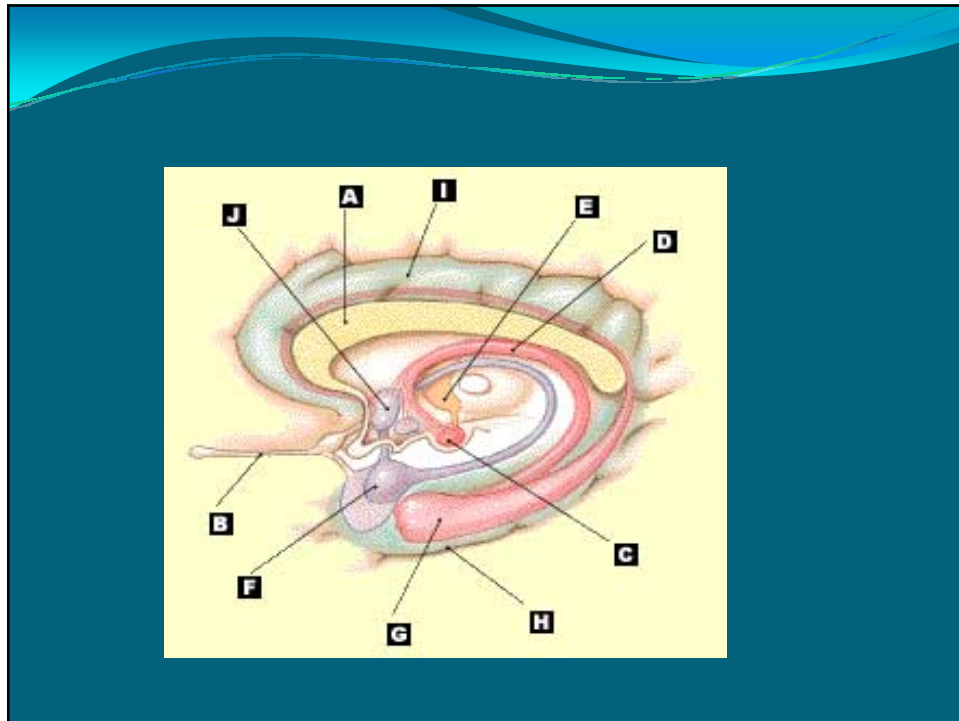
Limbic-Hypothalamo-Pituitary-Adrenal Axis

Exposure to extreme cold, starvation, loss of blood pressure, hemorrhage, undergoing surgery, infection, serious pain, a broken bone, strenuous exercise, and emotional trauma are among the many "stressors" that can energize the stress axis to help the body cope.



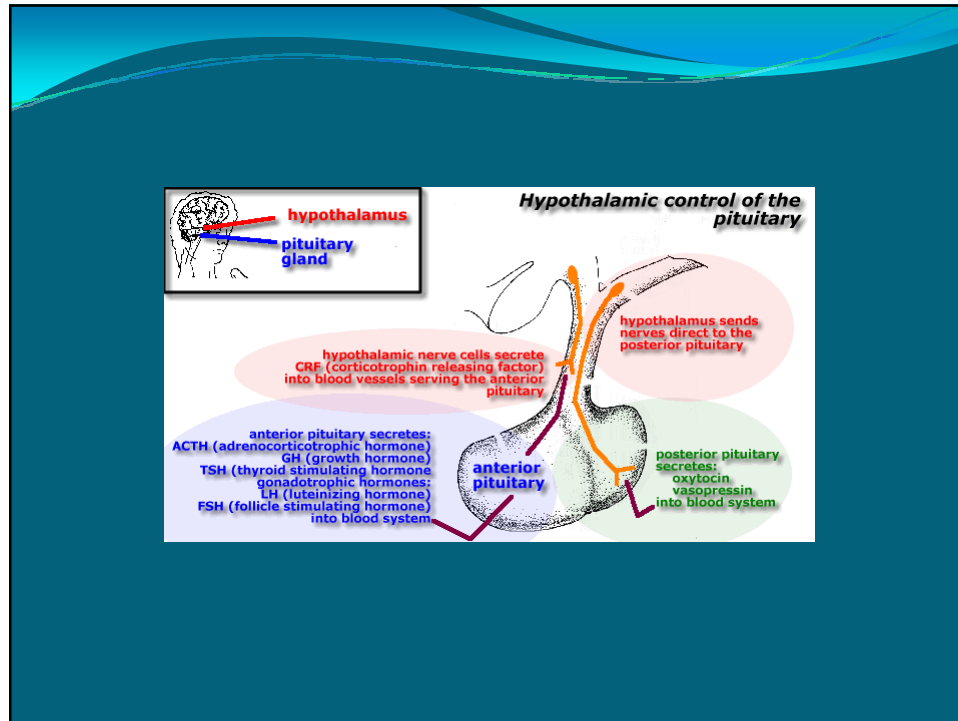
LIMBIC SYSTEM

- This system is involved in olfaction, emotions, learning and memory.
- The *limbic region* of the brain is the best candidate as the site where this understanding occurs, but the details of this awareness still elude scientists.
- A- Corpus callosum
- B- Olfactory tract
- C- Mammillary bodies
- D- Fornix
- E- Anterior thalamic nuclei
- F- Amygdala
- G- Hippocampus
- H- Parahippocampal gyrus
- I- Cingulate gyrus
- J- Hypothalamic nuclei



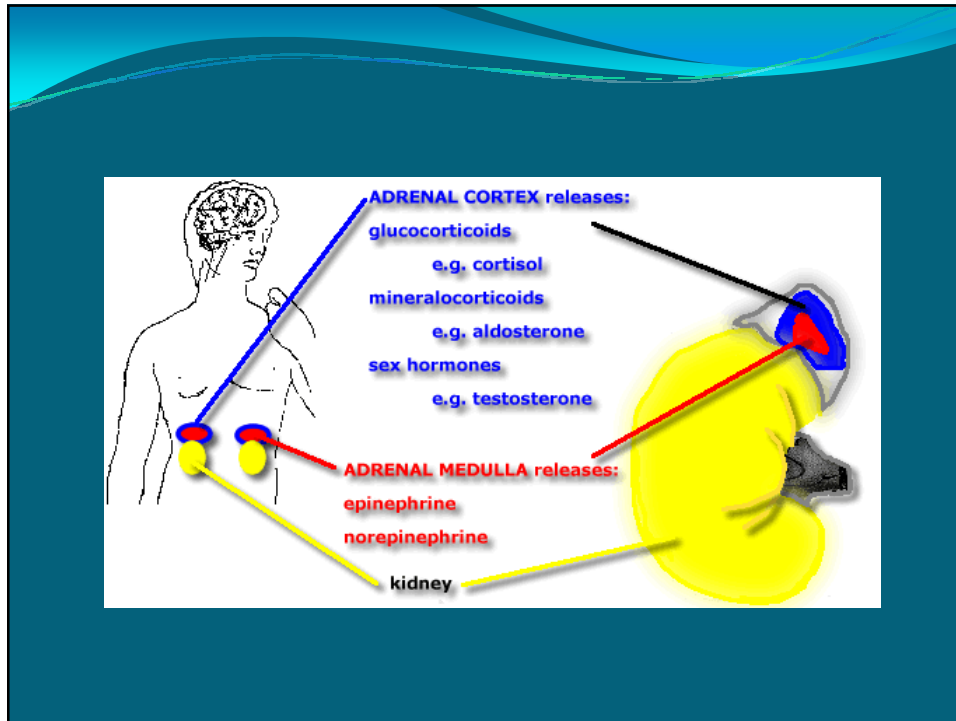
Hypothalamus

- Information from the limbic region is passed to an adjacent part of the brain, the hypothalamus, probably by direct nerve links. The hypothalamus also receives input from the senses and major organs. Once alerted, the hypothalamus sends nerve messages to a cell group within itself and secretes a hormone, *CRH* (corticotrophin releasing hormone).



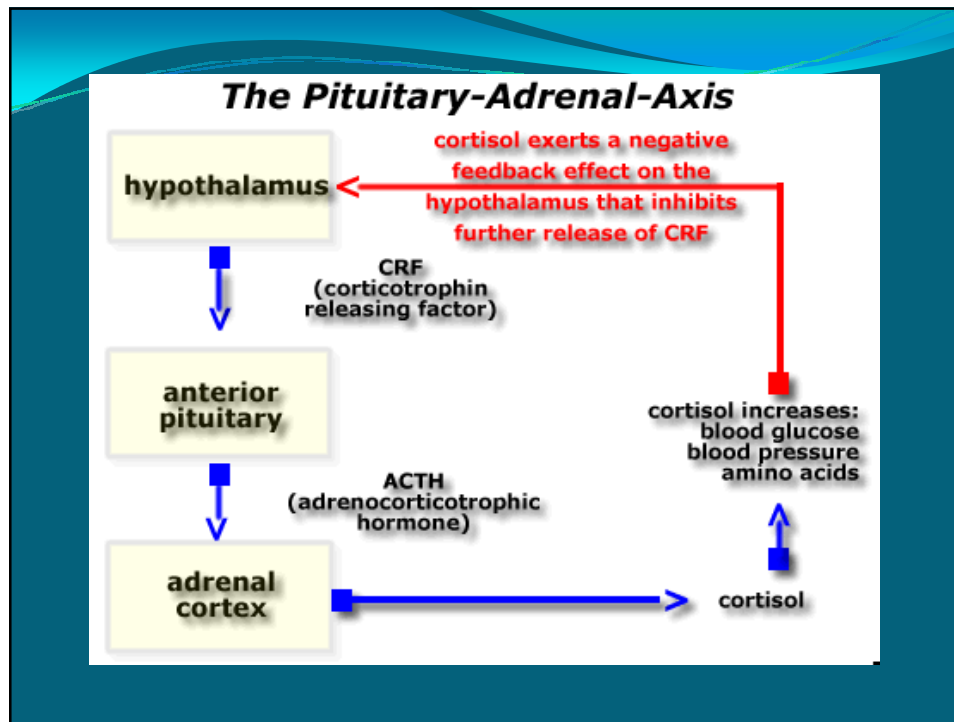
Pituitary Gland

- CRH enters the bloodstream for a short trip to the nearby *pituitary gland*. CRH stimulates the pituitary to release another hormone, *ACTH* (adrenocorticotrophin hormone), into the blood.



Adrenals

- ACTH travels through the bloodstream to the adrenal glands, where it stimulates the production and release of the "stress hormone," *cortisol*.
- Cortisol travels via the blood to several sites around the body - including back to the brain, promoting some functions and inhibiting others.



Cortisol

- One of cortisol's most important inhibitory functions is to "turn off" the stress response. The brain and pituitary quickly respond to the presence of cortisol by shutting off CRH and ACTH secretion.
- Shutting off the stress axis is important because cortisol, a steroid hormone with many physiological effects, is a potent substance. The body can't afford to have too much around. It spends considerable effort keeping cortisol under control.

Cortisol

- Rapid responses to stress call on cortisol and two other adrenal gland hormones: *epinephrine* (sometimes called adrenalin) and *norepinephrine*. They are also given credit for the "fight or flight" responses of quickening heart rate, rising blood pressure, rapid release of stored fuel for the body, and several other functions.
- How cortisol aids epinephrine and norepinephrine is not fully understood. However, experiments have shown that if cortisol is absent, the activity of these other two adrenal hormones is reduced.

Cortisol

- If the source of stress persists for a few hours, one of cortisol's major functions is to increase the supply of glucose to the brain and heart. Cortisol also makes sure that the needs of these two organs take precedence over other needs.
- The stress hormone accomplishes this by promoting metabolic breakdown of proteins from muscle, bones, and a few other tissues. The amino acids produced by this breakdown go to the liver where enzymes convert them to glucose, a process called *gluconeogenesis*. Cortisol even stimulates the synthesis of the liver enzymes that convert amino acids to glucose.

Cortisol

- Cortisol has powerful effects, under normal circumstances its presence signals the hypothalamus in the brain to stop production of CRH.
- If the source of stress persists, the brain can override cortisol's message to shut off stress axis activity. Under these circumstances, cortisol begins making long-lasting, and occasionally, permanent changes to the body.

