



Adjustments to Stress

Nervous & Endocrine Control

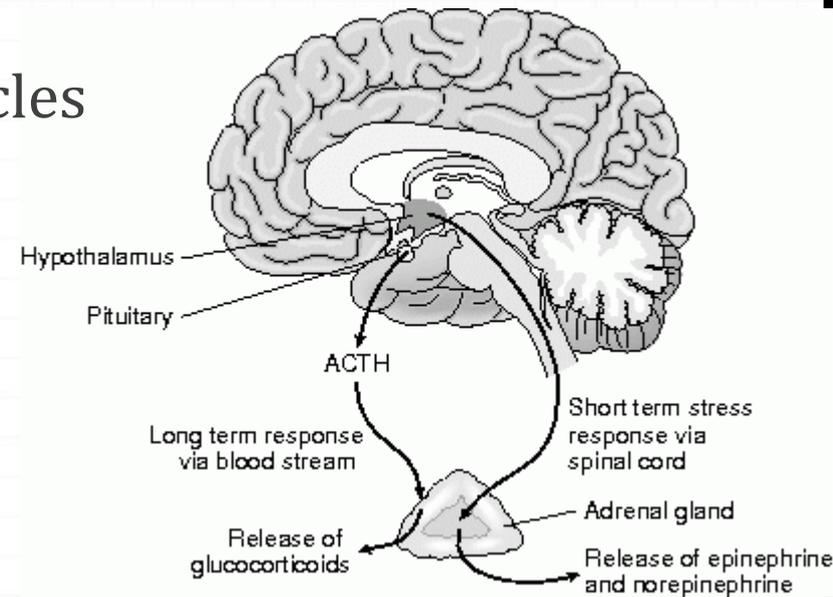
Endocrine & Nervous Systems

○ **Short term** stress response via **nervous** system

- Increased heart rate
- Diverting blood to needed muscles
- Norepinephrine, epinephrine

○ **Long term** stress response via **endocrine** system

- ACTH
- Mineralocorticoids, glucocorticoids



Short-Term Stress Response

Hypothalamus sends nerve signals via the spinal cord.

Pathway of nerve signals

Adrenal medulla

Adrenal gland
Kidney

Epinephrine and norepinephrine

Long-Term Stress Response

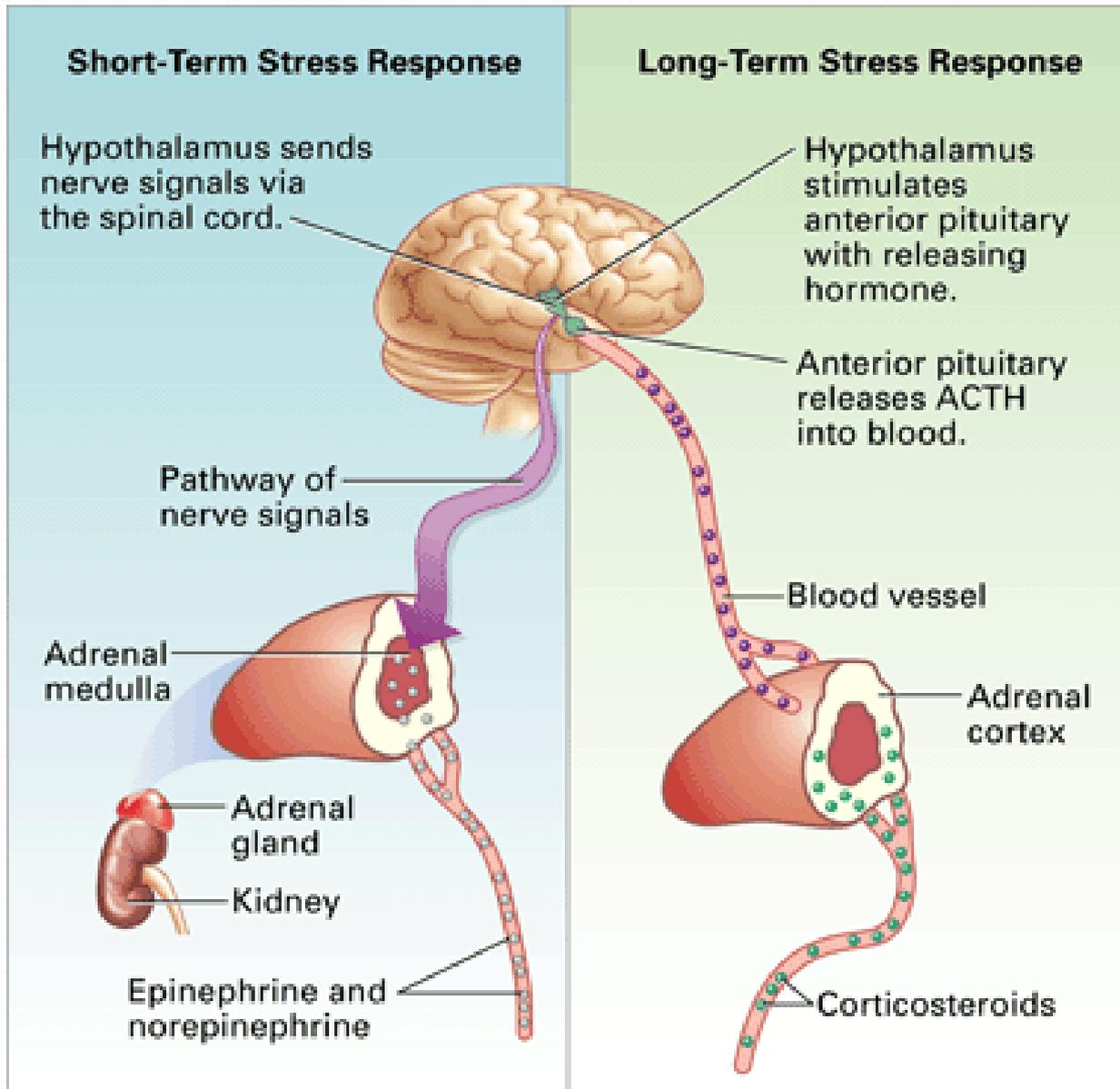
Hypothalamus stimulates anterior pituitary with releasing hormone.

Anterior pituitary releases ACTH into blood.

Blood vessel

Adrenal cortex

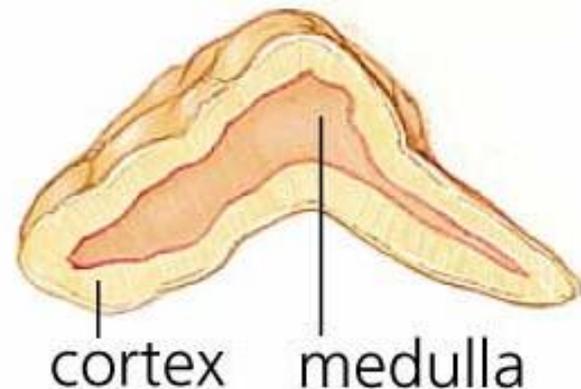
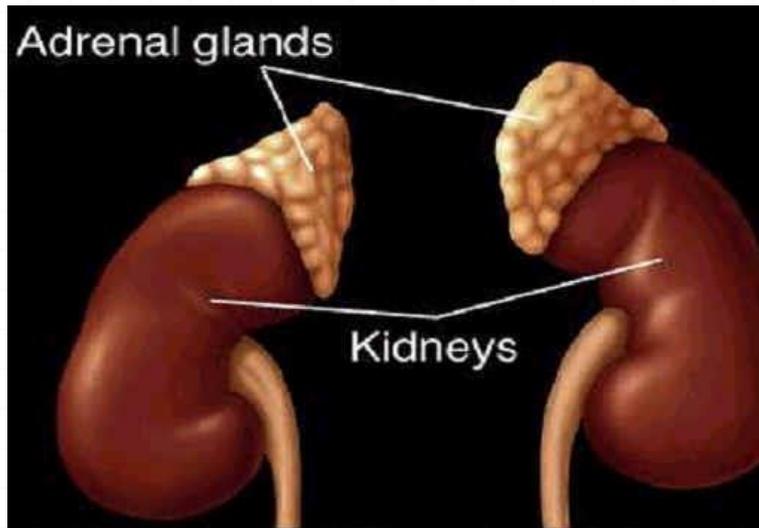
Corticosteroids



Adrenal Glands

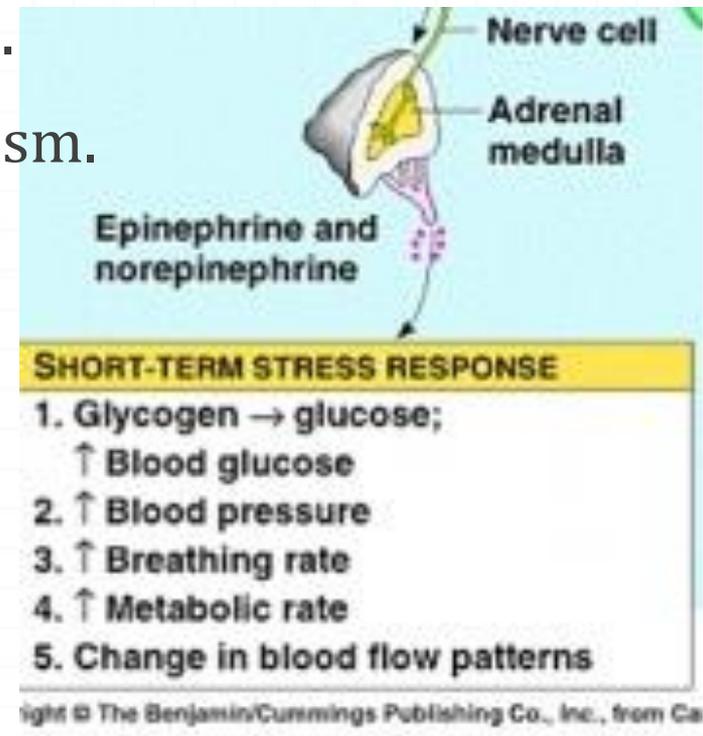
o Each composed of two glands.

1. Adrenal **medulla** → regulated by **nervous system**, **short-term** stress.
2. Adrenal **cortex** → regulated by **hormones**, **long-term** stress.



Adrenal Medulla

- Produces **epinephrine (adrenaline)** and **norepinephrine (noradrenaline)**.
- “Fight-or Flight Response”.
 - ↑ blood sugar (glycogen → glucose).
 - ↑ HR, breathing rate & cell metabolism.
 - Dilation of blood vessels.
 - Pupil dilation.



The Physiology of Fight or Flight

What we know is happening...

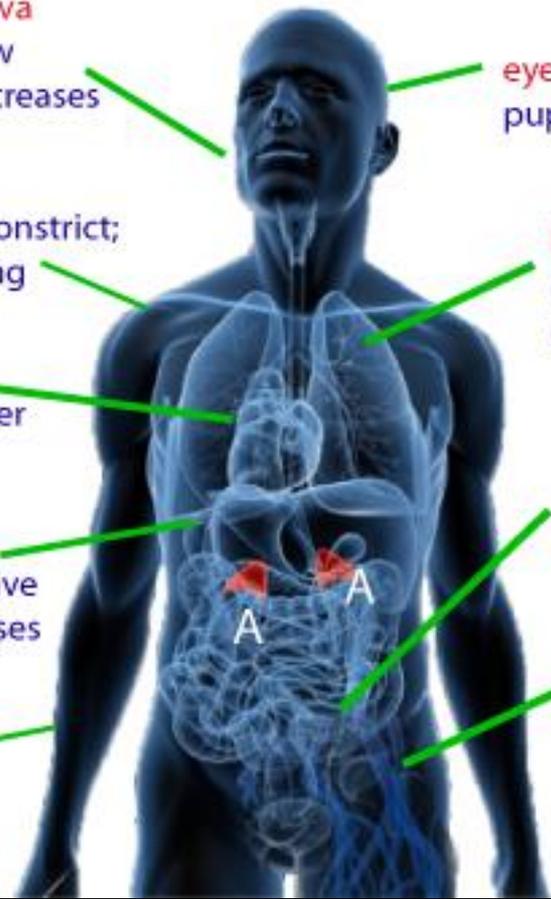


- Tunnel vision
- Dry (cotton) mouth
- Muscle tension
- Tightness in chest
- Sweating
- Nausea / diarrhea
- Need to urinate

- Dizzy or light-headed
- Can't concentrate or focus
- Blushing
- Difficulty breathing
- Difficulty swallowing
- Heart pounding
- Butterflies in the stomach
- Trembling
- Shakiness

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Why This Happens



- saliva flow decreases
- eyes pupils dilate
- lungs quick, deep breathing occurs
- skin blood vessels constrict; chills & sweating
- heart beats faster & harder
- stomach output of digestive enzymes decreases
- muscles become more tense; trembling can occur
- bowel food movement slows down
- blood vessels blood pressure increases as major vessels dilate

Adrenal Cortex

○ Produces 3 types of steroid hormones:

○ **1) Glucocorticoids** ex. **Cortisol**

○ Regulate metabolism of glucose, ↑ blood amino acids

○ Anti-inflammatories

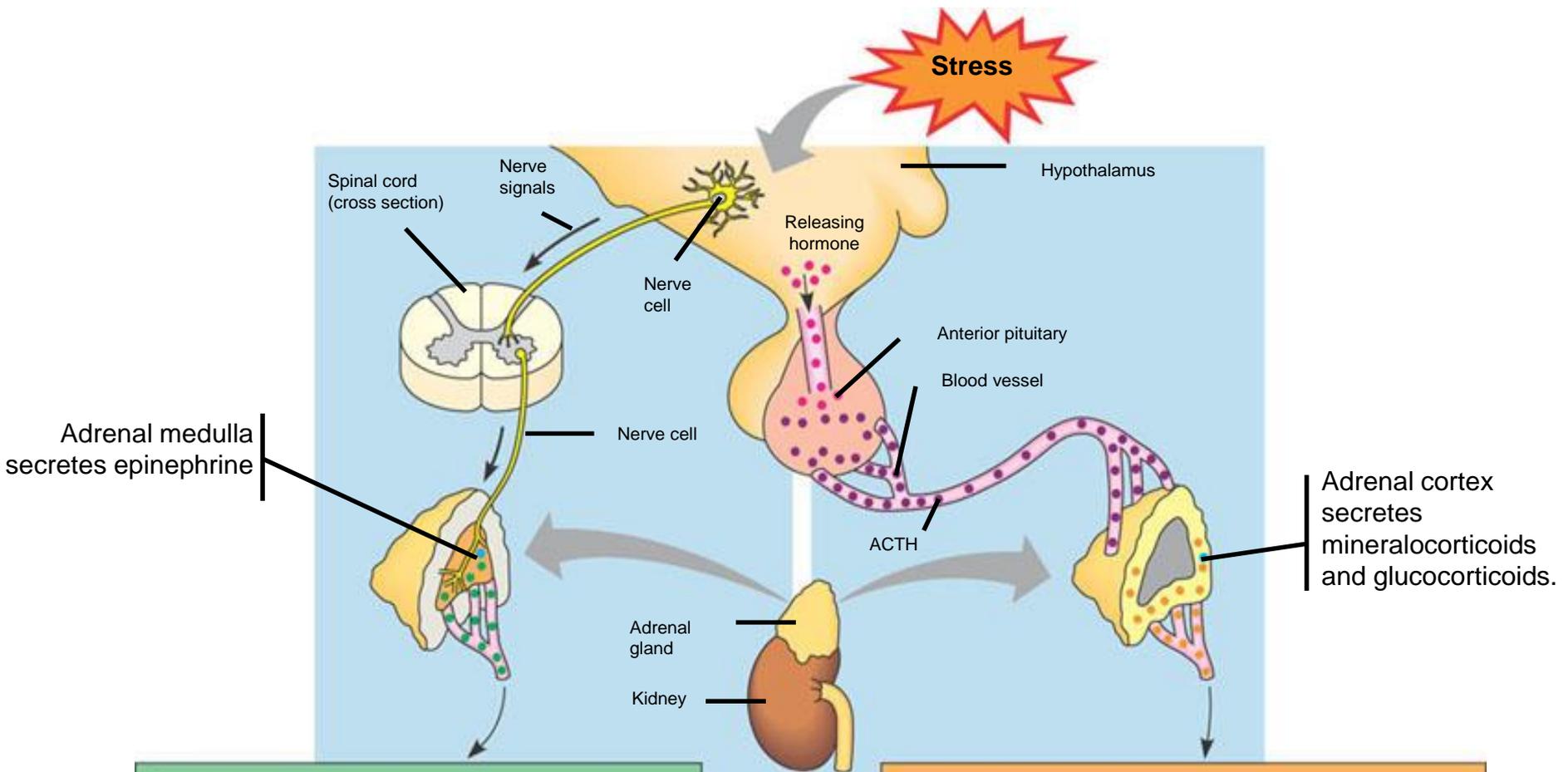
○ **2) Mineralocorticoids.** ex. **Aldosterone**

○ Influence on salt and water balances

○ **3) Androgens/Sex hormones.** ex. **Testosterone**

○ Stimulates or controls the development and maintenance of male characteristics





(a) Short-term stress response

Effects of epinephrine:

1. Glycogen broken down to glucose; increased blood glucose
2. Increased blood pressure
3. Increased breathing rate
4. Increased metabolic rate
5. Change in blood flow patterns, leading to increased alertness and decreased digestive and kidney activity

(b) Long-term stress response

Effects of mineralocorticoids:

1. Retention of sodium ions and water by kidneys
2. Increased blood volume and blood pressure

Effects of glucocorticoids:

1. Proteins and fats broken down and converted to glucose, leading to increased blood glucose
2. Immune system may be suppressed

Prolonged Exposure to Stress

- High blood glucose, BP, HR & metabolism:
 - May rupture blood vessels
 - Increase blood clotting
 - Damage to heart muscle

