

# ENDOCRINE SYSTEM

## AP Biology

Kathryn Derrick, Mina Suzuki, Kailani Ibanez



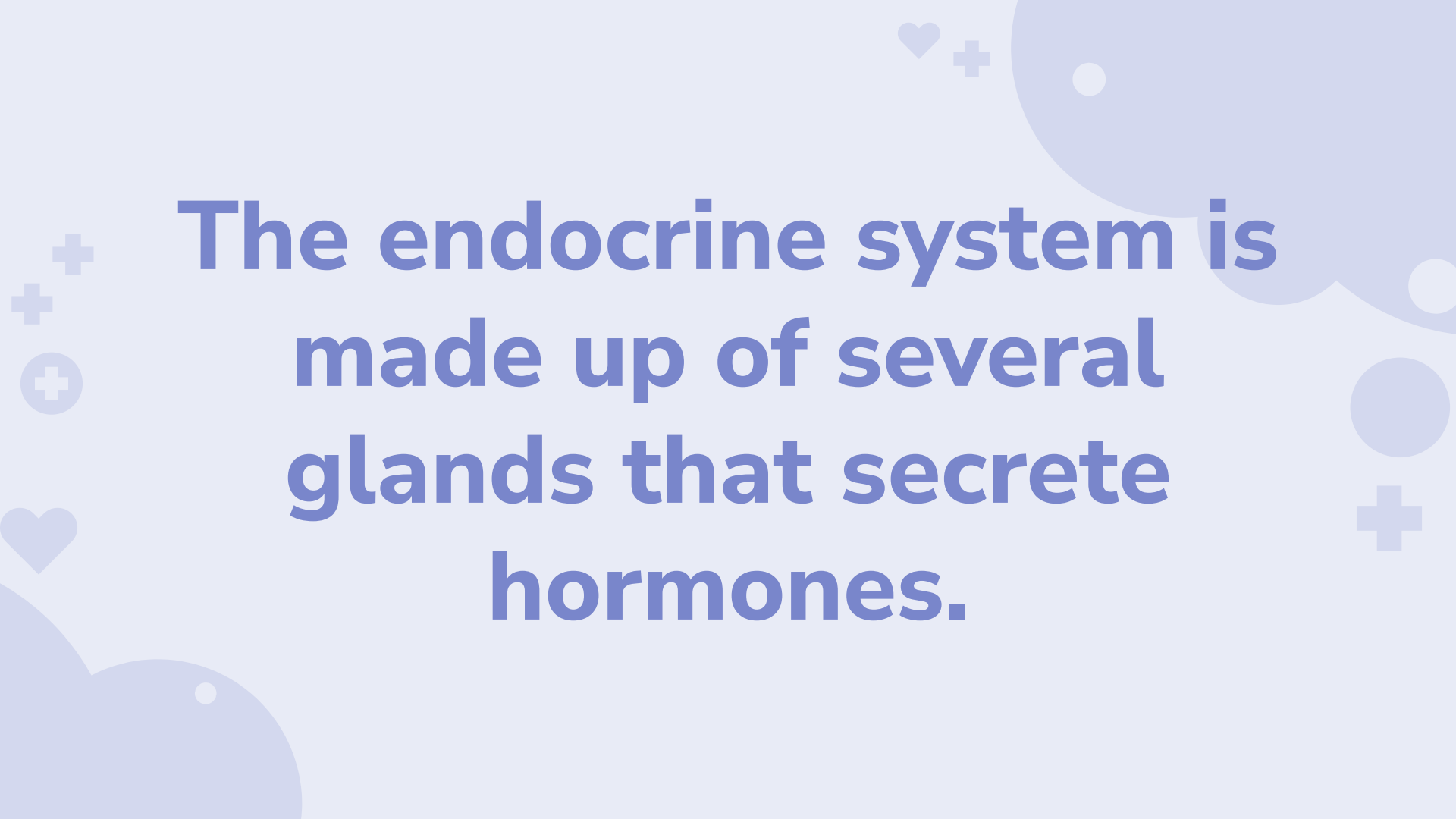
# Learning Objectives

1. Understand what the endocrine system is and why it is important
2. Describe positive and negative feedback mechanisms and explain how they help to maintain homeostasis
3. Understand difference between water and lipid soluble hormones
4. Understand individual functions of endocrine glands



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# WHAT IS THE ENDOCRINE SYSTEM?



**The endocrine system is made up of several glands that secrete hormones.**

# GLANDS OF THE ENDOCRINE SYSTEM

Hypothalamus  
and Pituitaries

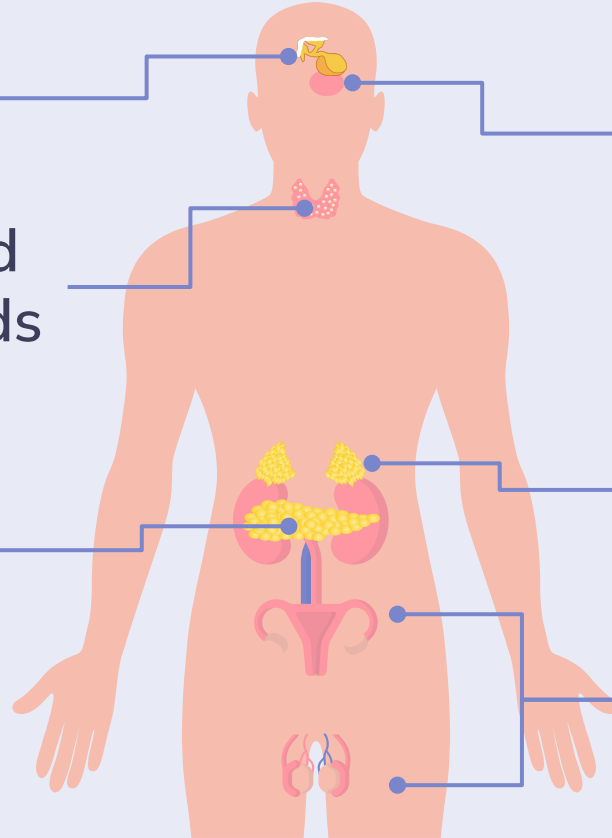
Pineal Gland

Thyroid and  
Parathyroids

Adrenal Glands

Pancreas

Gonads



# HORMONES

Hormones are chemical messengers that are carried in blood and help maintain homeostasis.

# HOMEOSTASIS

Homeostasis is the process of maintaining nearly constant internal conditions despite changing external conditions. This is important because if internal conditions vary too much, the organism may not be able to function properly.

# THE ENDOCRINE SYSTEM AFFECTS:



Metabolism



Growth



Emotions



Fertility



Sleep



Fight/Flight

**MAINTAINS HOMEOSTASIS!**





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# POSITIVE AND NEGATIVE FEEDBACK

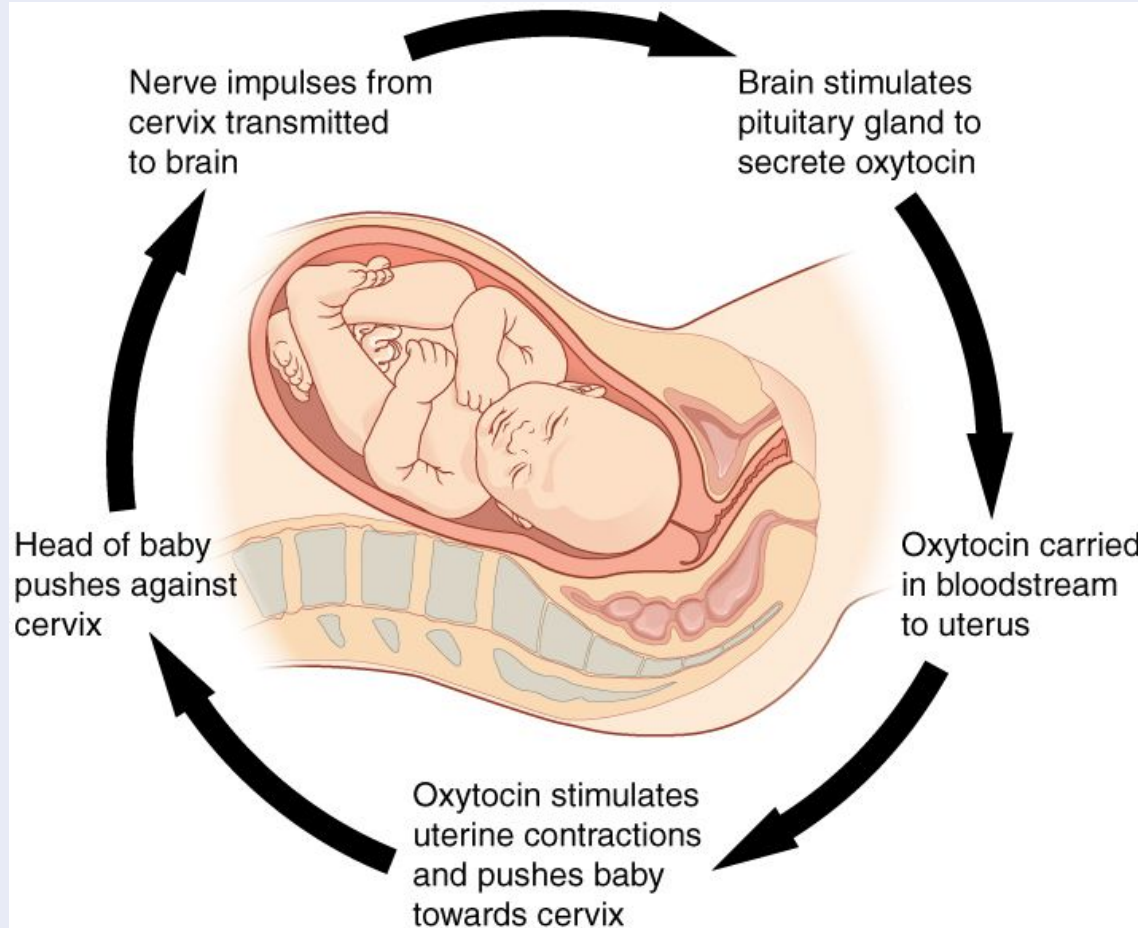
# NEGATIVE FEEDBACK

Negative feedback maintains homeostasis by **counteracting** the effects of a stimulus. It is the most common type of feedback loop in the body, and you will see many examples of it in this presentation.

# • POSITIVE FEEDBACK

Positive feedback: **amplifies** reactions that are already happening until there is no stimulus. Positive feedback helps to speed up physiological processes.

# POSITIVE FEEDBACK EXAMPLE



Process ends when baby is birthed>


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# WATER-SOLUBLE VS. LIPID SOLUBLE



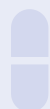
## WATER SOLUBLE HORMONES:

Amine based. May form complex polypeptides or proteins.  
Examples: oxytocin, ADH, FSH, LH, GH, TSH, ACTH, endorphins, calcitonin, PTH, insulin, glucagon, epinephrine, norepinephrine



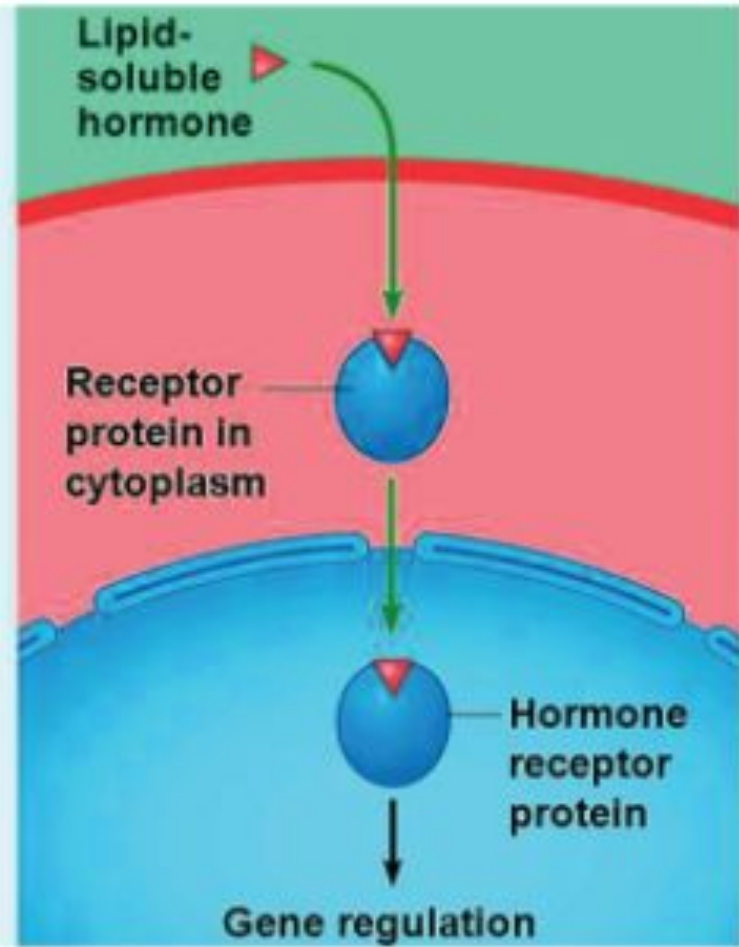
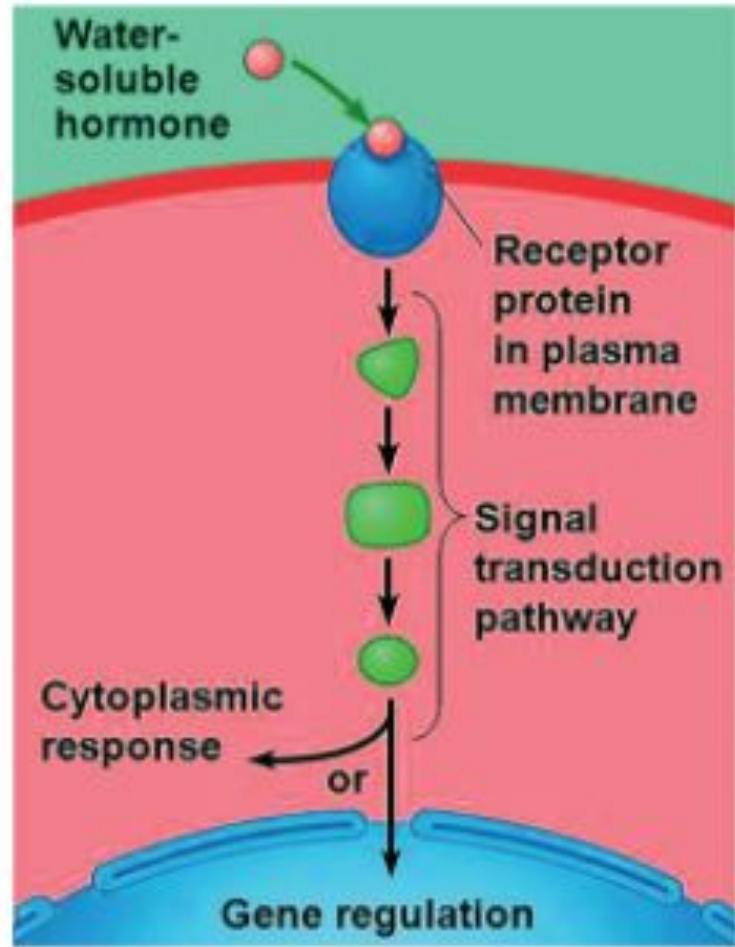
## LIPID-SOLUBLE HORMONES

Always steroids. Examples: glucocorticoids, androgens, estrogens, progesterones



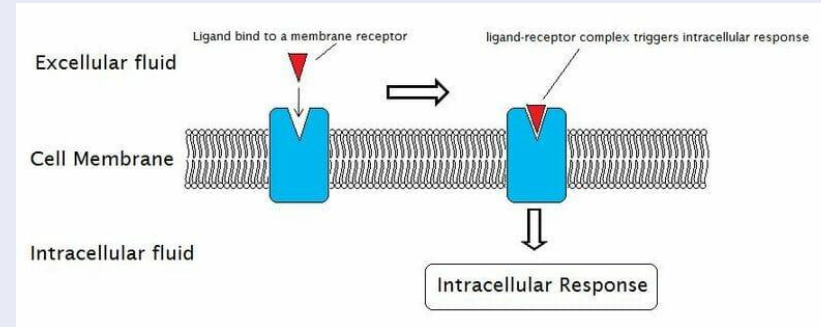
Hormone type determines how it enters the cell.





# • So what are receptor proteins?

Receptor proteins are proteins embedded into the surface of cells. In the endocrine system, they are target cells which bind to specific matching hormones (think puzzle piece). The binding causes chemical reactions within the cells, leading to feedback loop responses.







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# GLANDS & FUNCTIONS



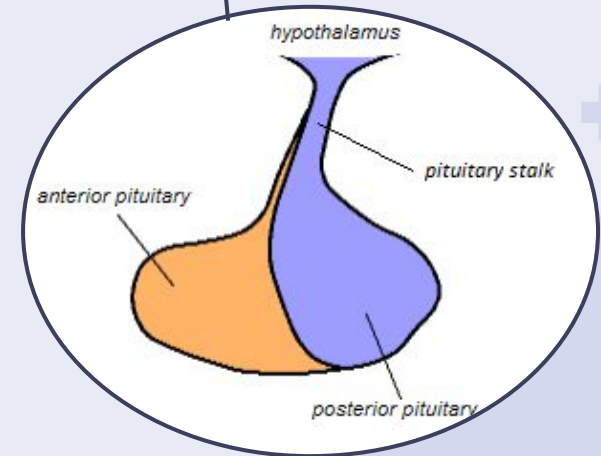
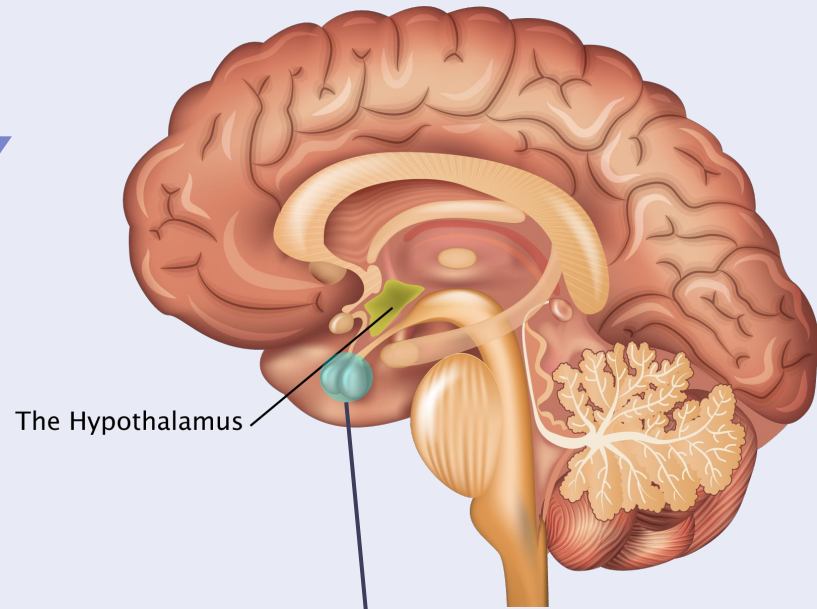
# HYPOTHALAMUS AND POSTERIOR PITUITARY

## Hypothalamus

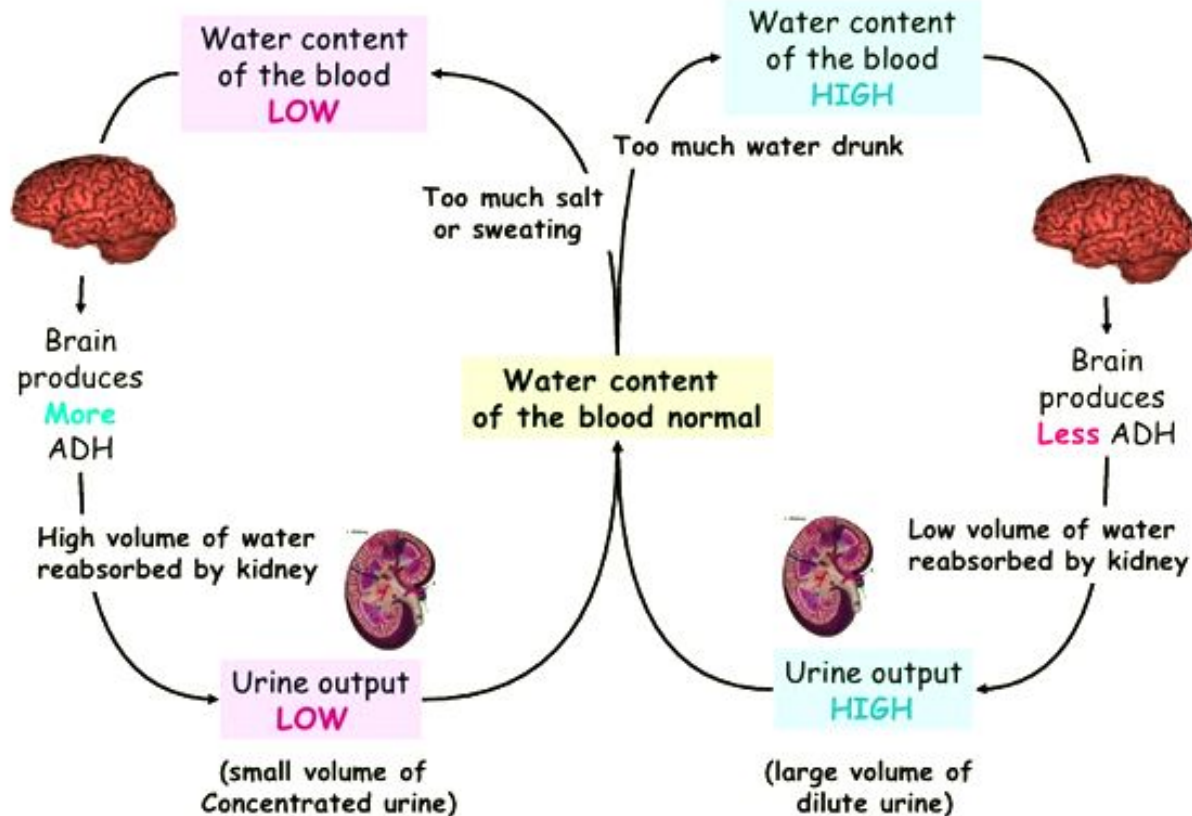
- Connects endocrine & nervous system
- Located in the brain
- Responds to information from the nerves by sending out endocrine signals that directly control the pituitary gland

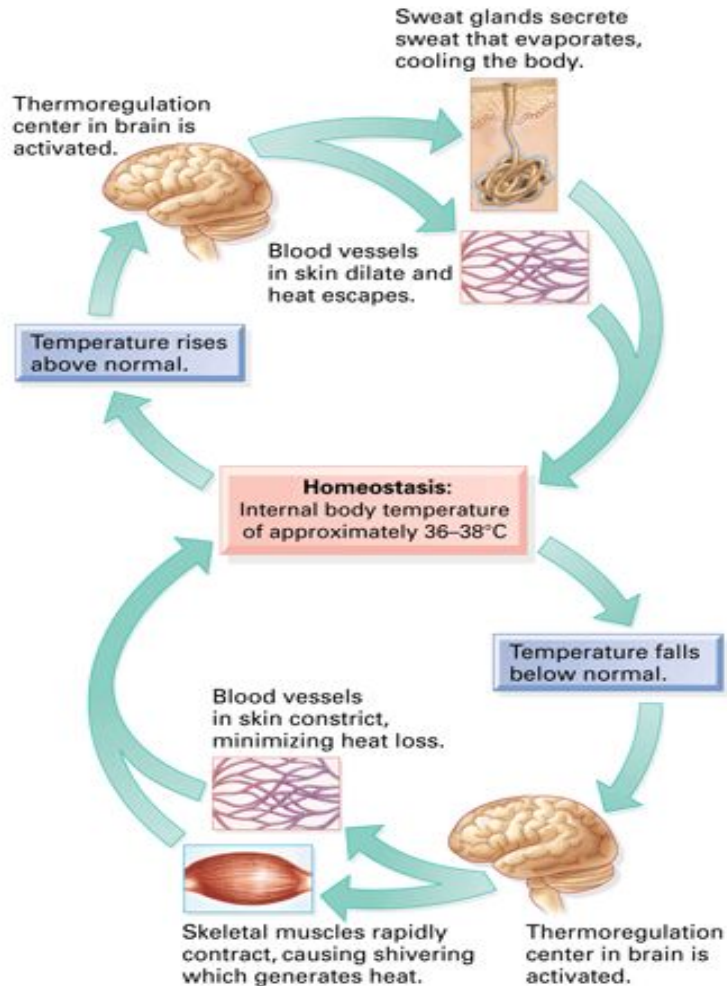
## Posterior Pituitary

- Pituitary gland: pea-sized structure that hangs down from the hypothalamus.
- Posterior pituitary: stores and secretes hormones made in the hypothalamus such as oxytocin (causes contractions) and ADH (increases water reabsorption in kidneys)



# Negative Feedback: Osmoregulation



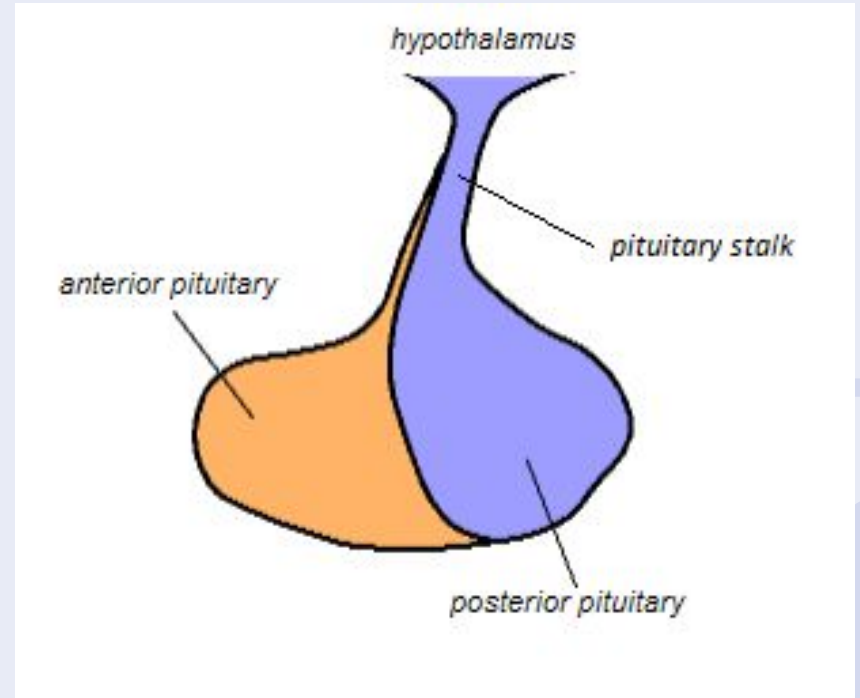


# Negative Feedback: Temperature



# ANTERIOR PITUITARY

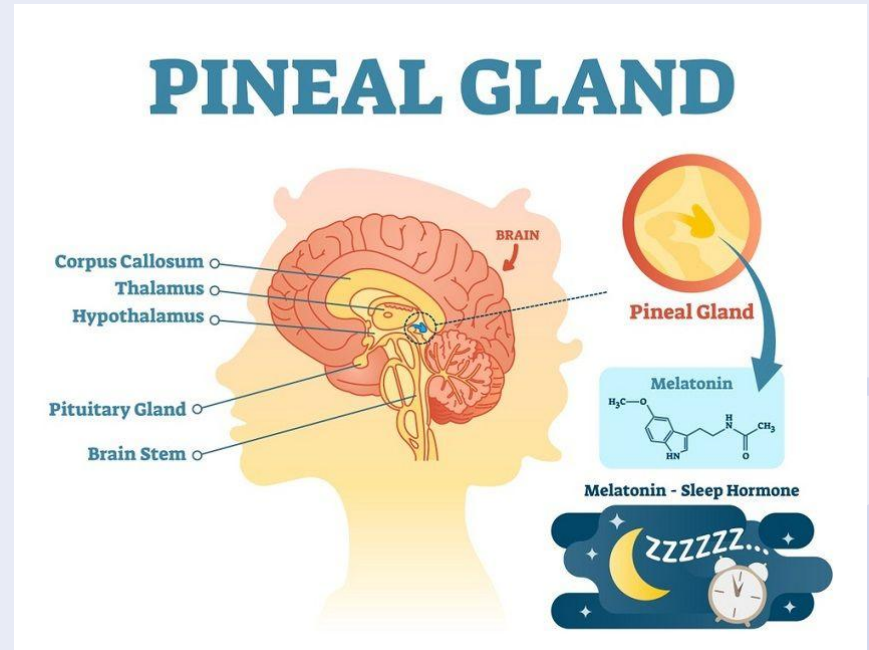
- Serves as a hormonal control center for the body
- Stimulates the thyroid and adrenal cortex with **TSH** and **ACTH** respectively
  - (HPA Axis → stress response)
- Also stimulates the gonads with **LH** and **FSH**
- Releases other hormones with diverse functions such as:
  - **GH**: stimulates growth and metabolism
  - **Endorphins**: mask pain

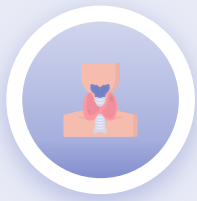




# PINEAL GLAND

- Located in the midline of the brain, shaped like a pinecone
- Detects light and dark signals from the environment, thus secreting the sleeping hormone, melatonin, to regulate the circadian rhythm
- Last part of the endocrine system to be discovered





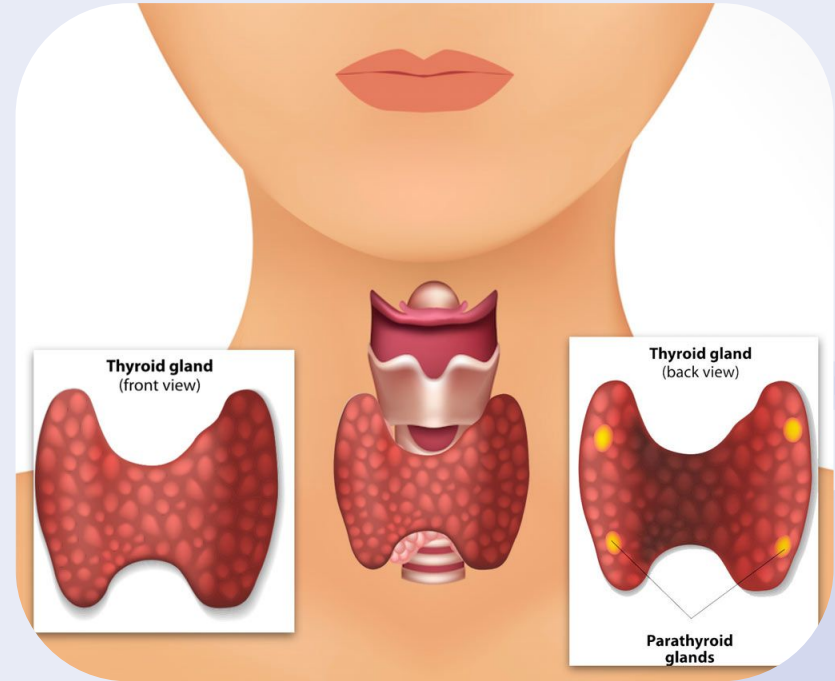
# THYROID AND PARATHYROID

## Thyroid

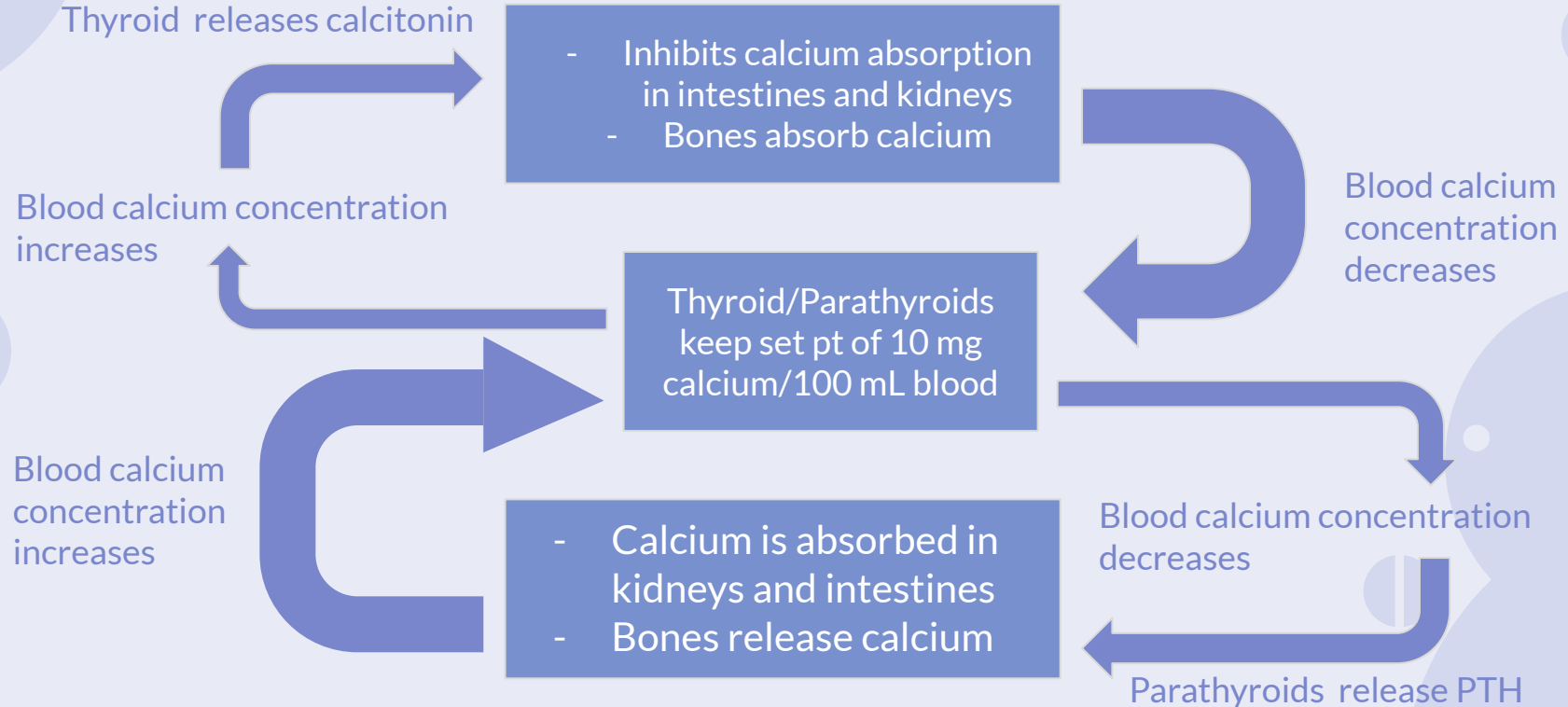
- located under the larynx and looks like a butterfly
- produces hormones that increases oxygen consumption and metabolic rate in body cells
- Produces **calcitonin**, which decreases blood calcium levels

## Parathyroid

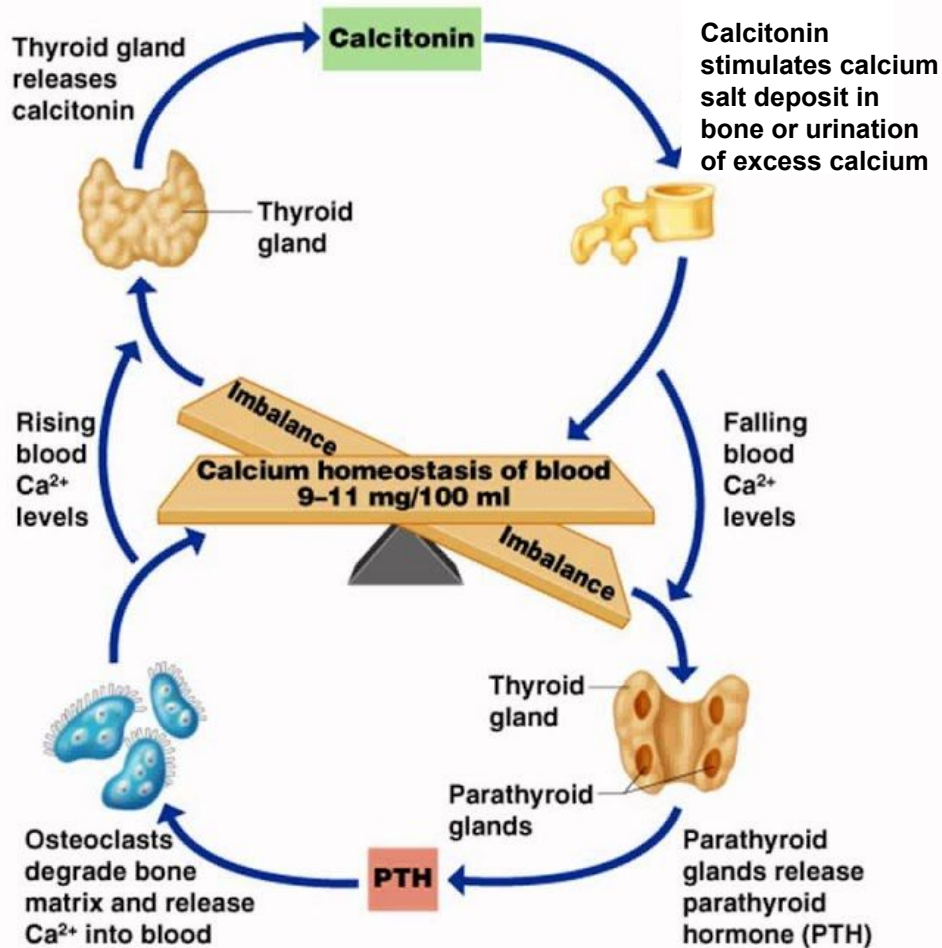
- Works with thyroid to maintain calcium homeostasis
- Produces **parathyroid hormone (PTH)**, which increases the blood calcium level
- Located in the back of the thyroid



# Negative Feedback: Blood Calcium







# Negative Feedback: Blood Calcium



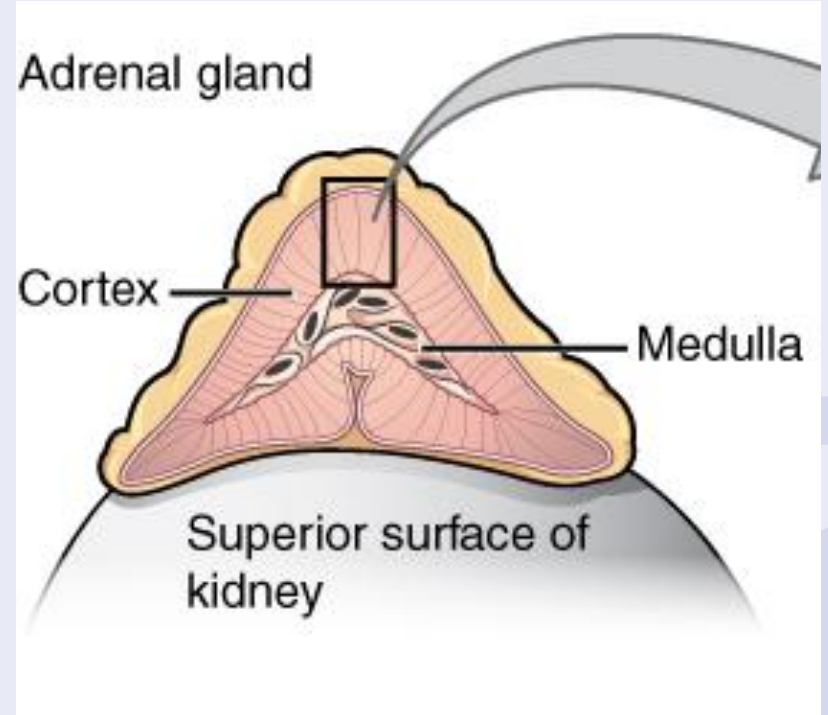
# ADRENAL GLANDS: CORTEX & MEDULLA

## Medulla

- Provokes a **quick** “fight or flight” response
- Produces **norepinephrine** and **epinephrine**, which raise blood glucose levels, increase metabolism, and constrict certain blood vessels.

## Cortex

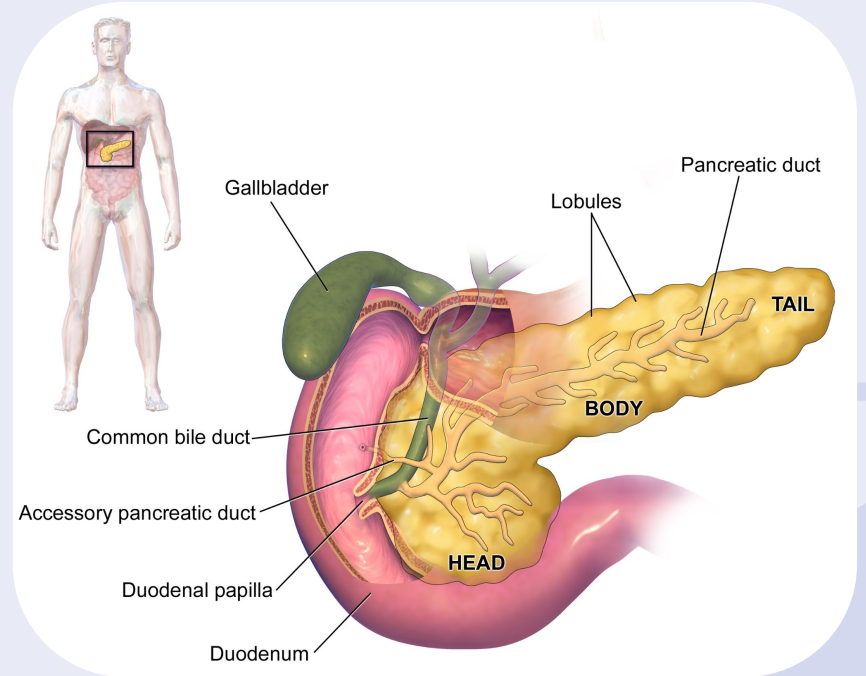
- Causes a **longer-lasting** stress response
- Produces **glucocorticoids**, which raise blood glucose level and may suppress the immune system



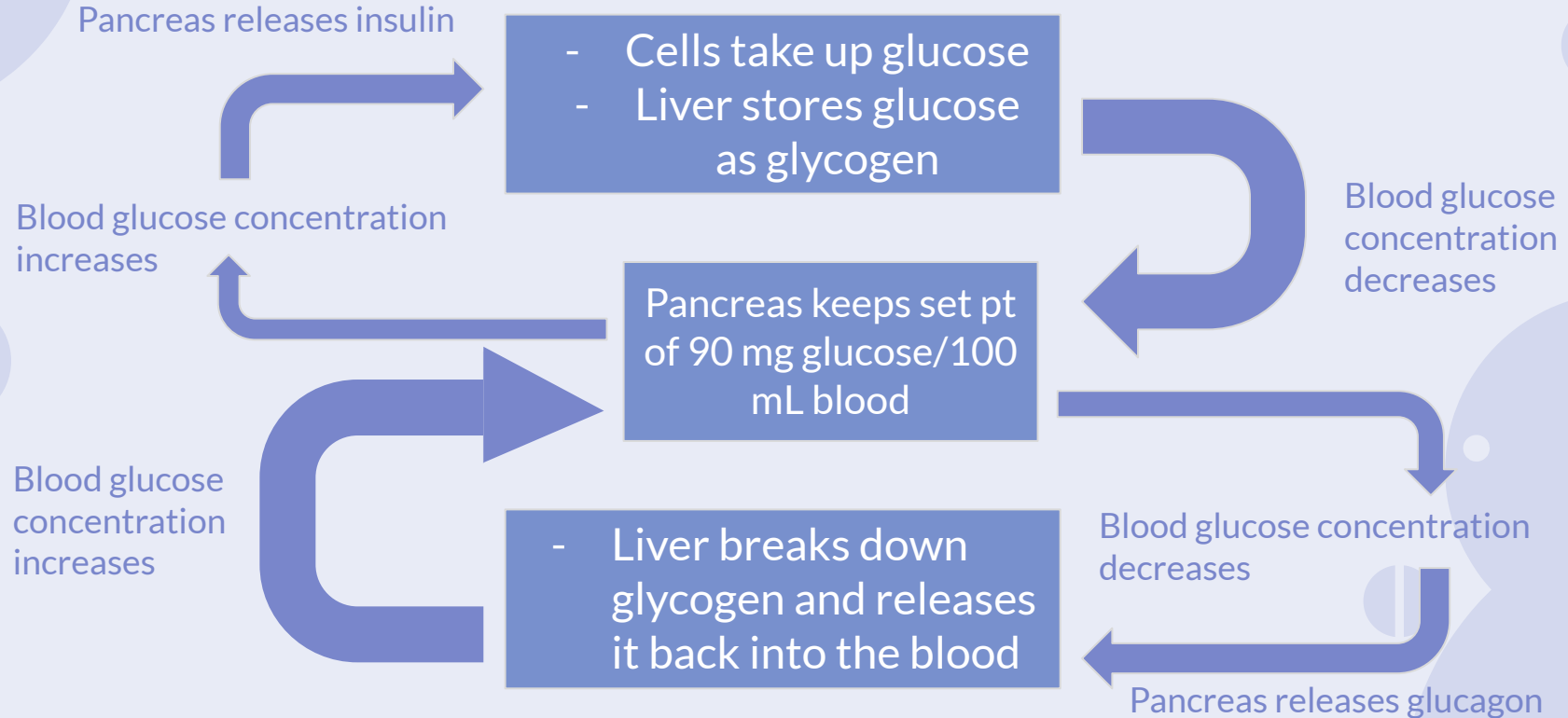


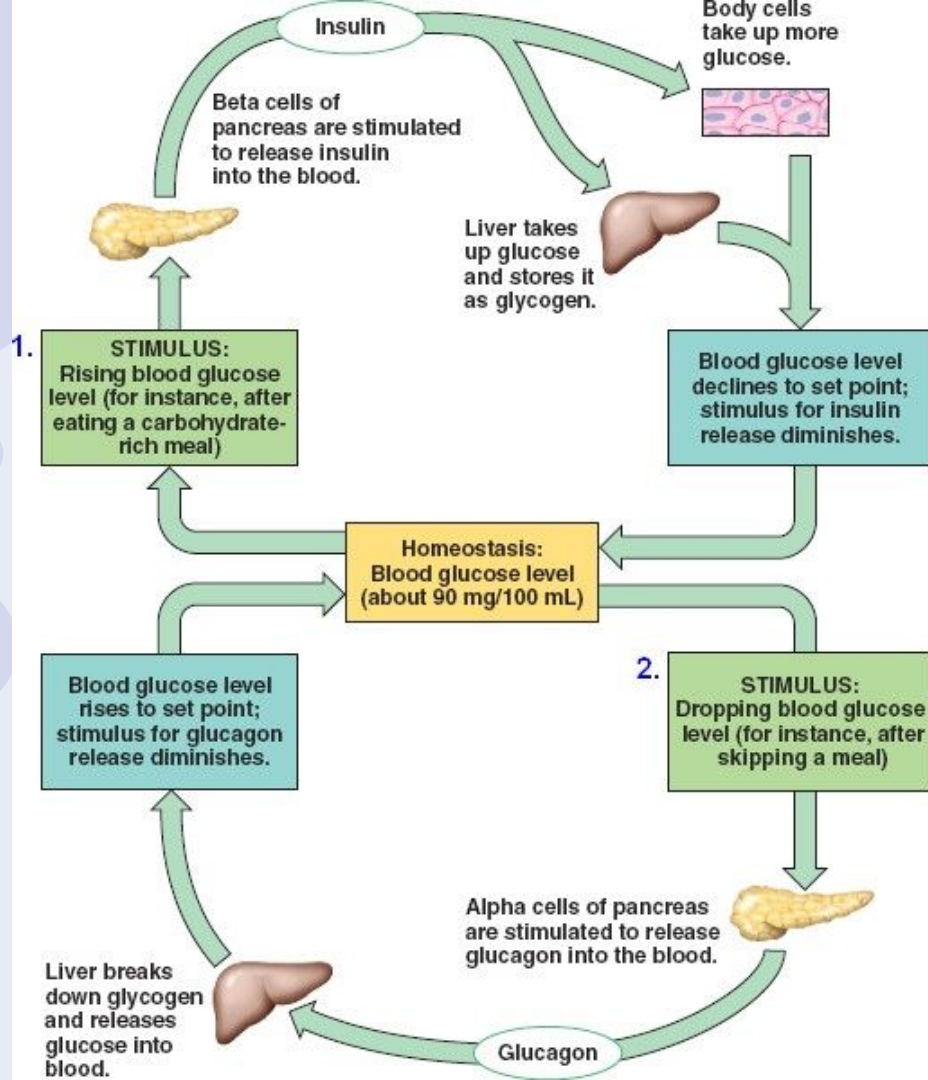
# PANCREAS

- Controls blood glucose levels by secreting **two antagonistic hormones**, insulin and glucagon, that **counter each other in a negative feedback circuit**
  - **Insulin:** lowers blood glucose levels, secreted by pancreatic beta islet cells
  - **Glucagon:** raises blood glucose levels, secreted by pancreatic alpha islet cells
- Located behind the stomach and is surrounded by the gallbladder, liver, and spleen



# Negative Feedback: Blood Glucose





# Negative Feedback: Blood Glucose



# GONADS

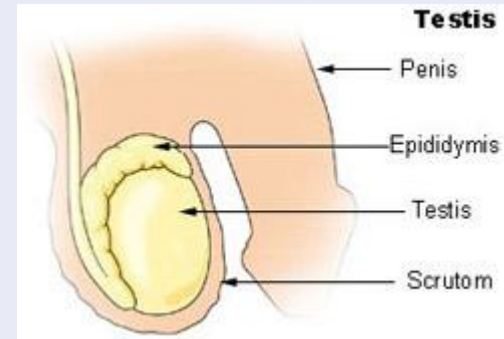
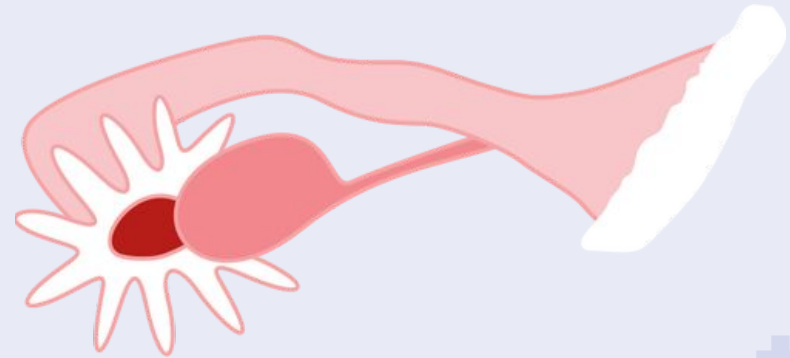


## Ovaries

- Develops and releases eggs at the signals of **follicle stimulating hormone (FSH)** and **luteinizing hormone (LH)**
  - *(Hormones released by Ant. Pituitary)*
- Produces **estrogens** that stimulate uterine lining growth and the development of female secondary sex characteristics
- Produces **progestins** that promote uterine lining growth

## Testes

- Produces **androgens** that support sperm formation and promote the development of male secondary sex characteristics.



**WHITEBOARD  
ACTIVITY  
TIME!**



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and Pituitaries

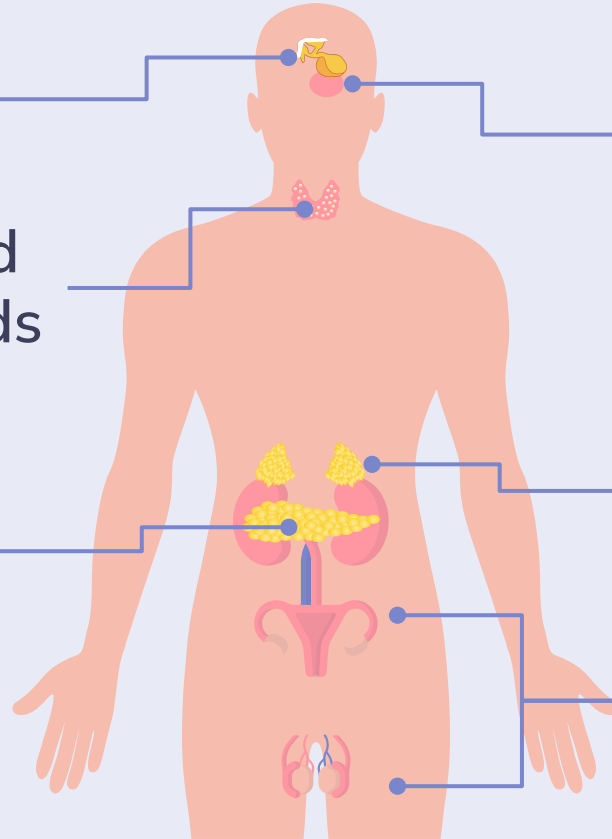
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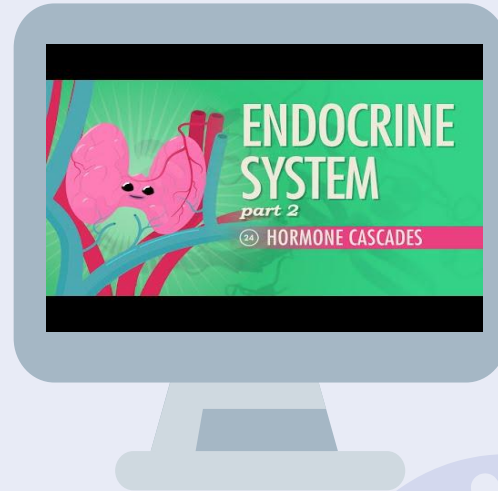
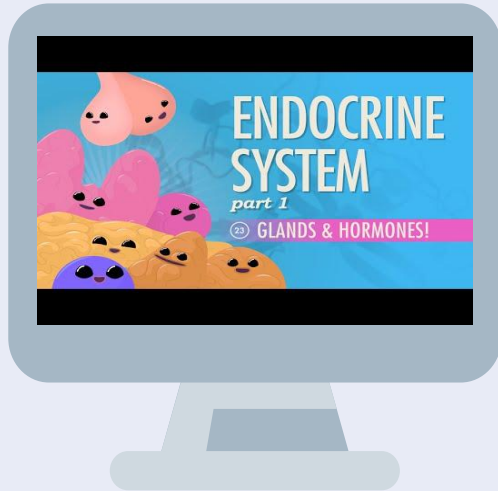


# POP QUIZ!

[https://docs.google.com/document/d/13QPFw\\_yUumk00dC784gBAyO-JtJ40c0XnnAGWwGb3yg/edit?usp=sharing](https://docs.google.com/document/d/13QPFw_yUumk00dC784gBAyO-JtJ40c0XnnAGWwGb3yg/edit?usp=sharing)

# HOMWORK

Watch these videos and take notes. Then answer the essential question:  
what is a hormone cascade and what can happen if one of its parts  
malfunction?



# WORKS CITED

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