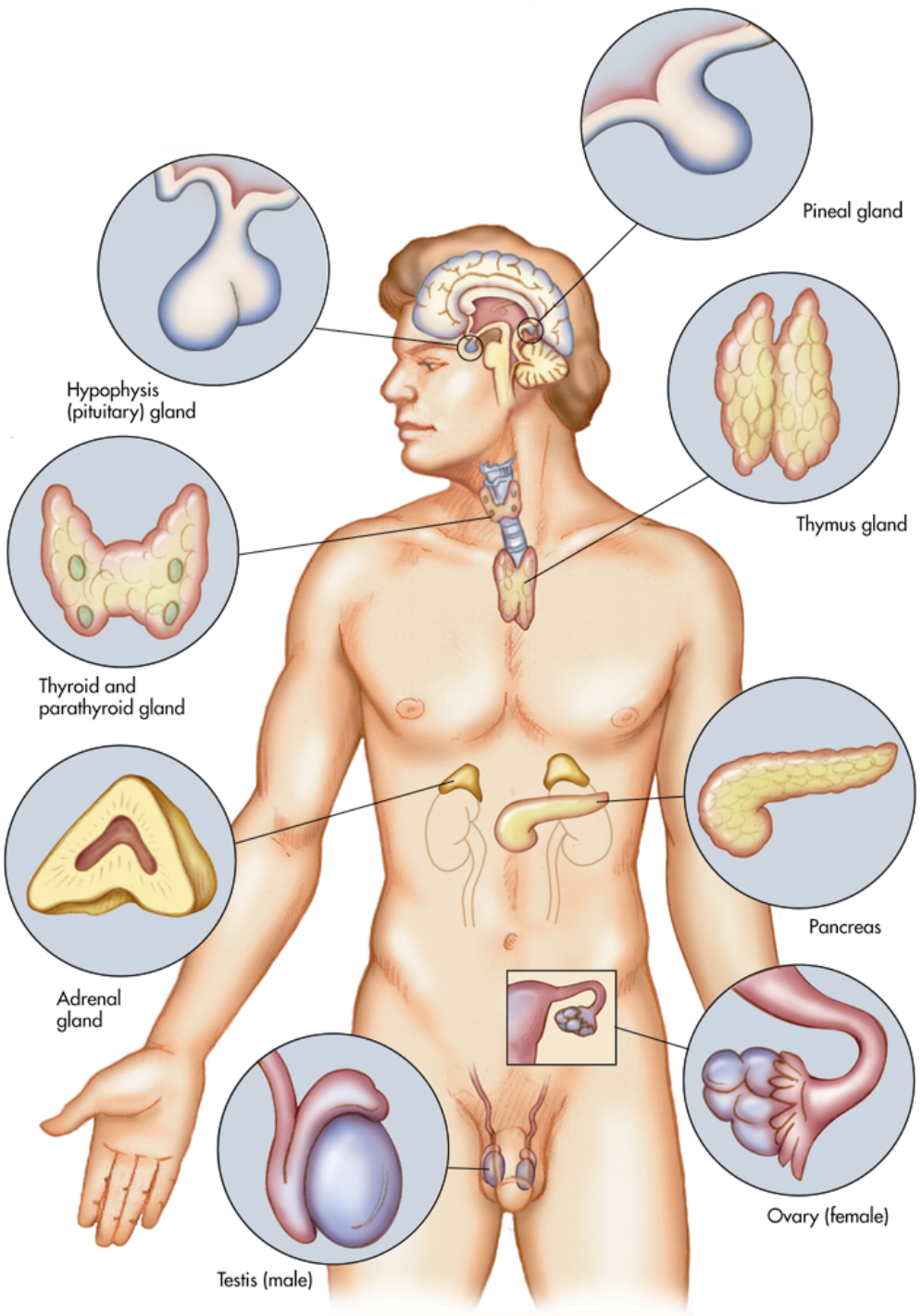


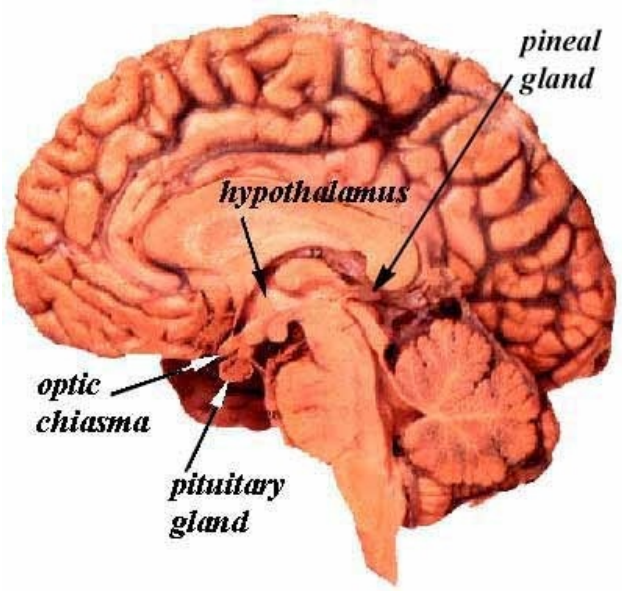
The Endocrine System

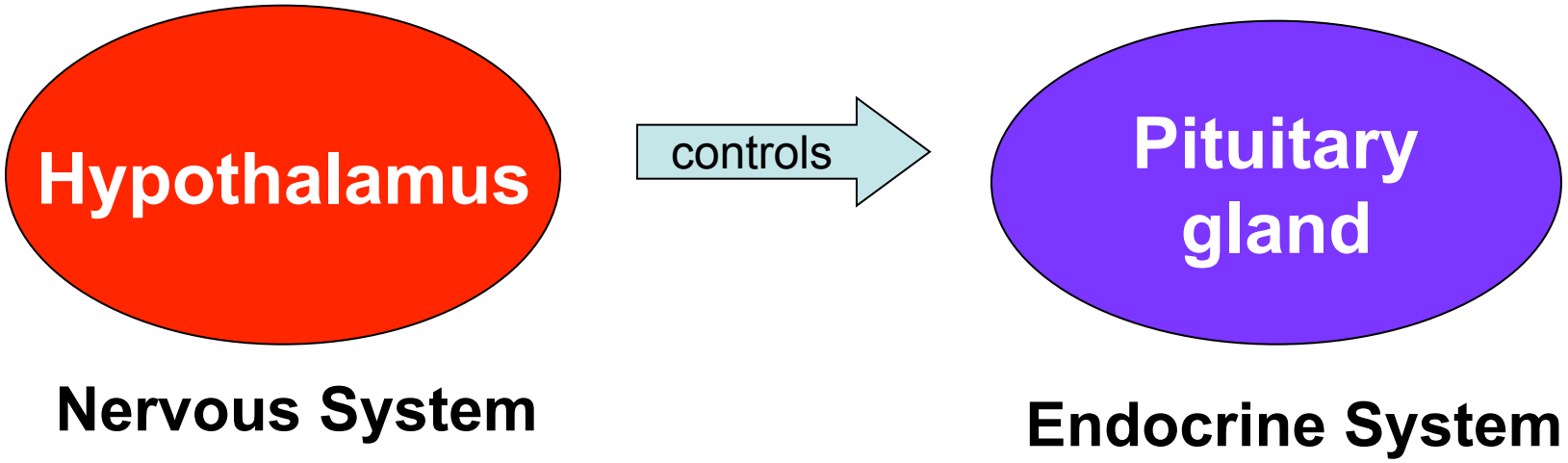
BOOKLET 1

Comparison of Nervous System and Endocrine System

Nervous System	Endocrine System
Produces neurotransmitters	Produces hormones
Direct cell to cell communication	Hormones travel through blood to their target
Fast acting	Speed varies
Short duration	Long lasting
Cause muscle contraction and glandular secretion	Influence growth, development and metabolic activities

- **The nervous system is tied into the endocrine system…**
  - **The hypothalamus (brain) controls the pituitary gland which is the master gland of the endocrine system.**

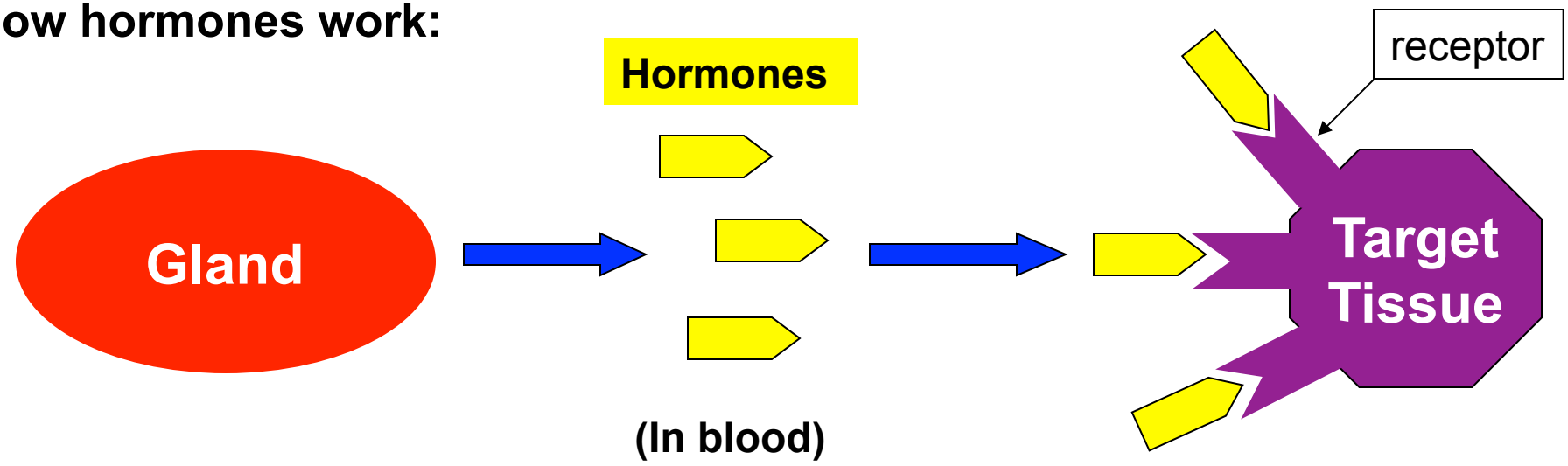




Nervous System **Endocrine System**

Endocrine System

How hormones work:



Endocrine System

- Hormones are **carried by the blood throughout the entire body, yet they affect only certain cells.**
- The specific cells that respond to a given hormone have **receptor sites for that hormone.**
- This is like a **lock and key mechanism.**

- If a hormone and a receptor site do not match, then there is no reaction.
- All the cells that have receptor sites for a given hormone make up the **target tissue** for that hormone.

Endocrine system and target tissue:

http://www.youtube.com/watch?v=HrMi4GikWwQ&safety_mode=true&safe=active

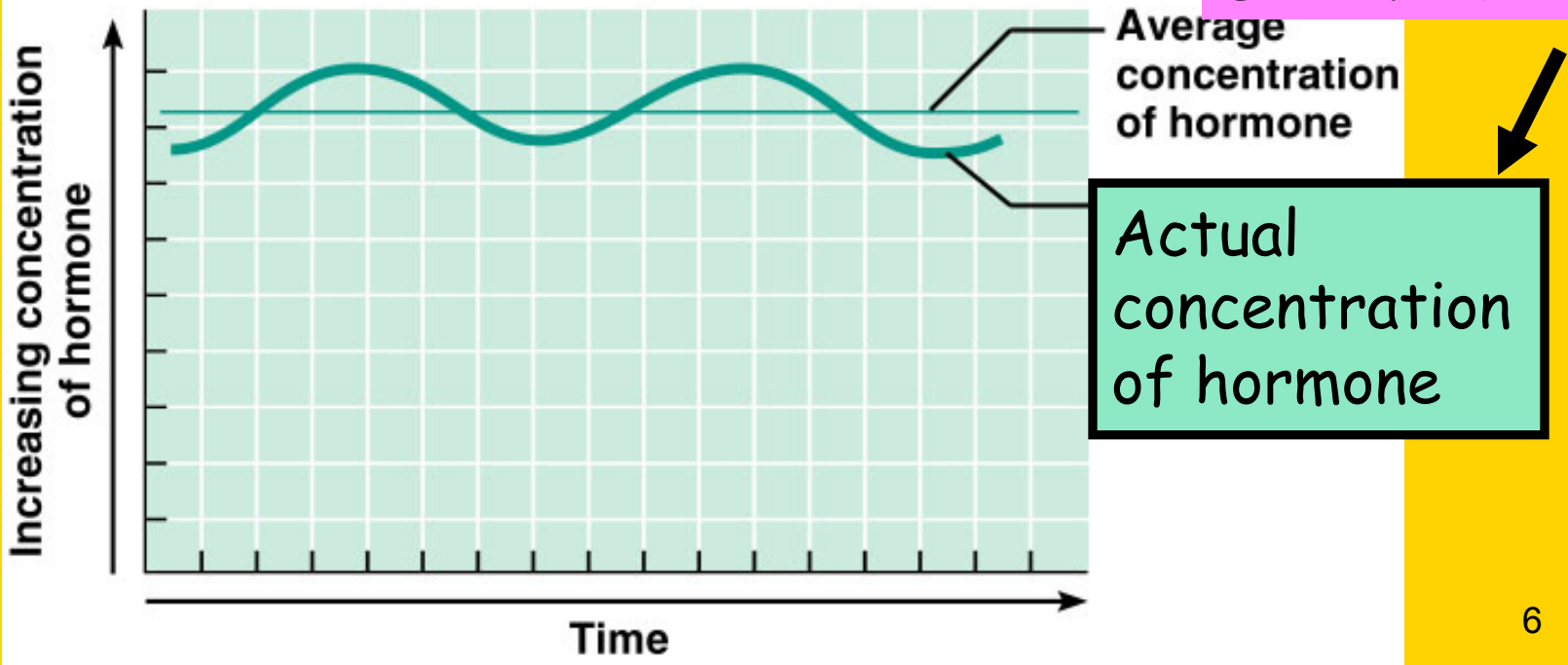
Our body has "set points" for each chemical produced that controls metabolic reactions.

Hormones levels are maintained at a certain level.

Dynamic Equilibrium = Homeostasis

Concentration of Hormones in the Body

DRAW THIS



Characteristics of Hormones

Each hormone produced by the body is unique.

Each one is different in its **chemical composition, structure, and action**, however there are some similarities as well.

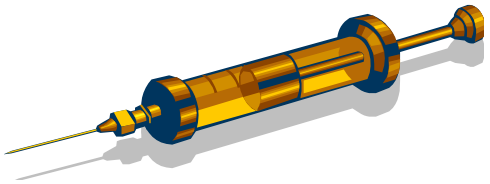
Hormones can be classified as either proteins or steroids.

Most of the hormones in the human body, are **proteins** or protein derivatives**.** This means that their building blocks are **amino acids.**

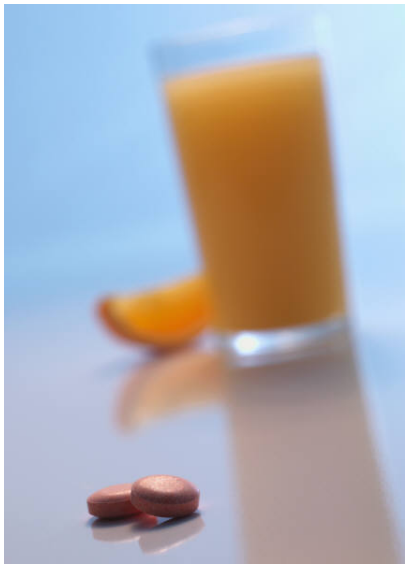
Protein and Steroid Hormones

Protein hormones cannot be taken by mouth (orally) because they are quickly **inactivated by the acid and pepsin in the stomach.**

These hormones must be administered by **injection.**



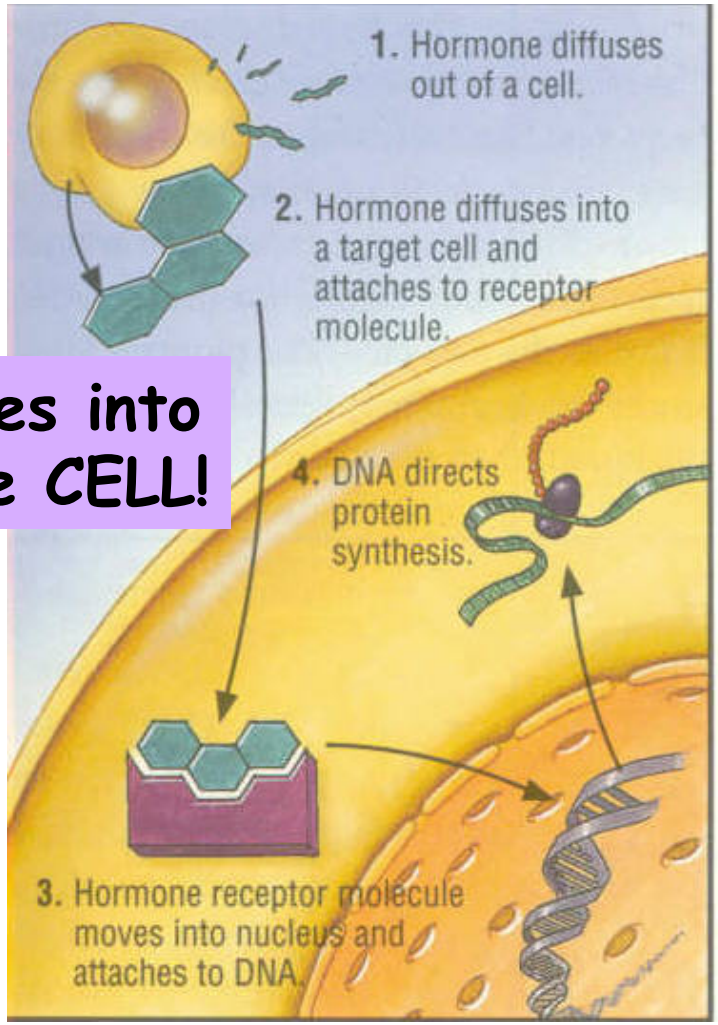
Sex hormones like testosterone may be taken orally.



Steroid Hormones

SLOW

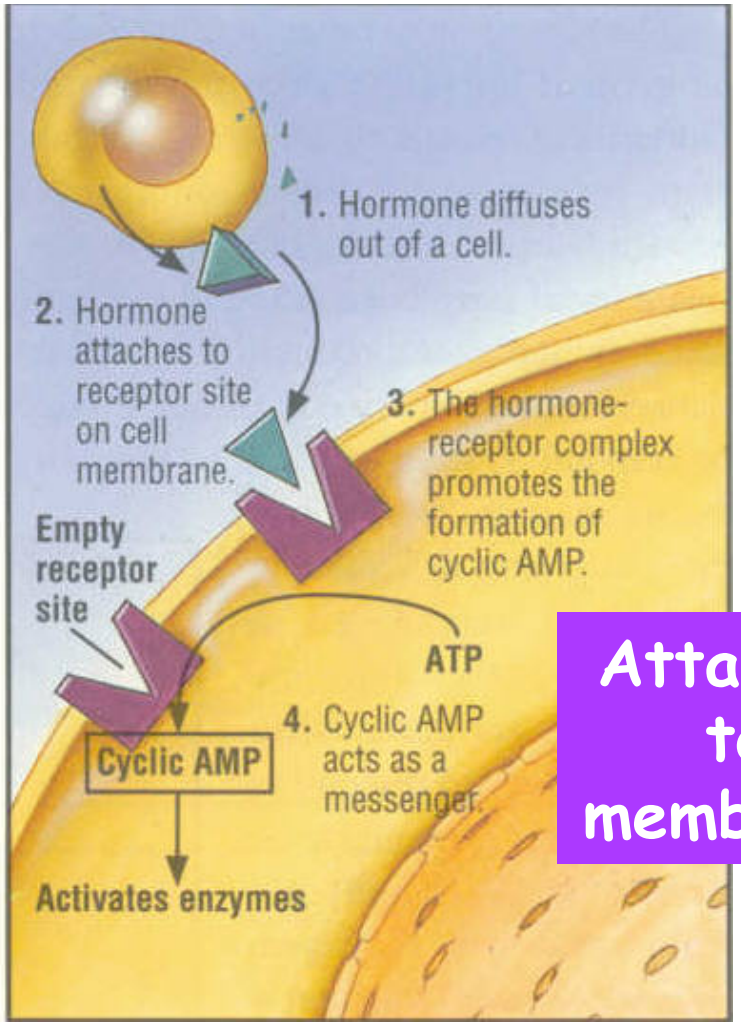
Goes into the CELL!



Protein Hormones

PROMPT (rapid)

Attaches to membrane



Tropic vs. Non-tropic Hormones

Tropic Hormones

from pituitary

Affects or targets another gland

which in turn…

causes secretion of other hormones

FSH, LH, ACTH, TSH (FLAT)

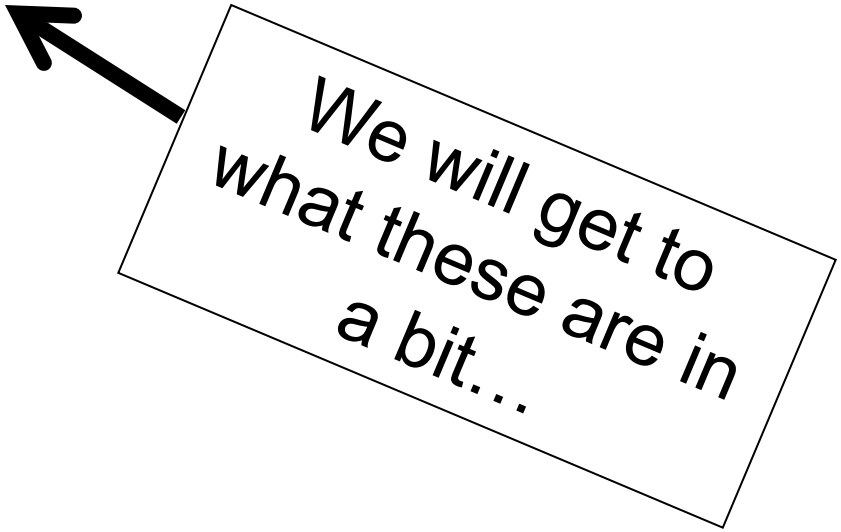
Non-Tropic Hormones

from glands

Do NOT affect other glands,

but instead…

affect specific body cells or tissues



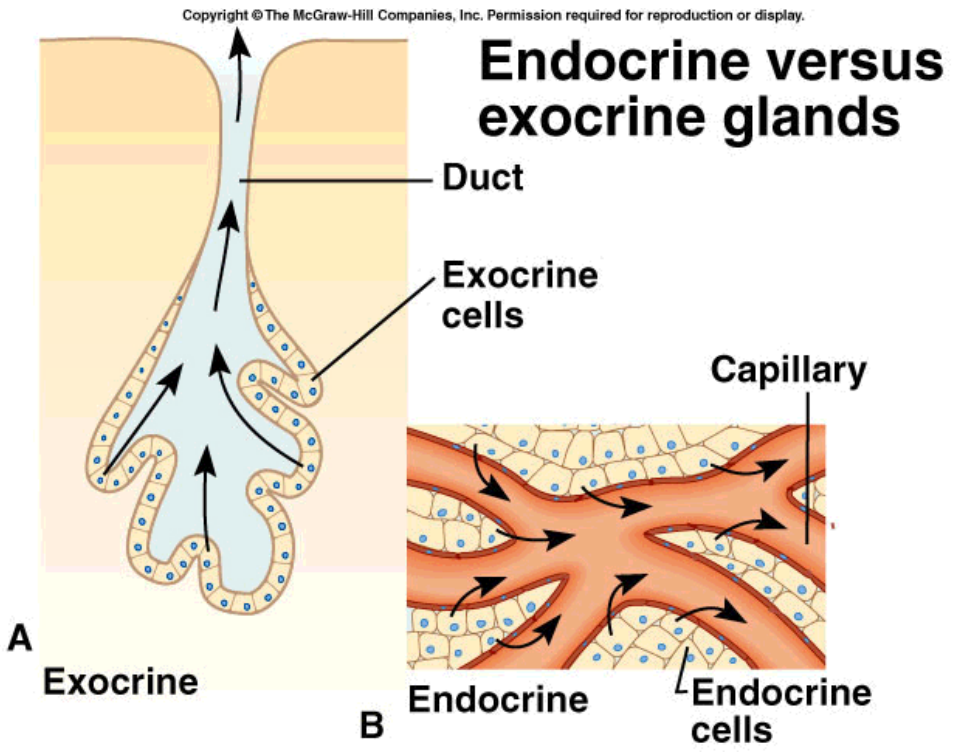
Endocrine vs. Exocrine glands

Endocrine glands

- Release substances into the blood directly
  - Ex. Pituitary gland

Exocrine glands

- Release substances into **ducts**
  - Ex. Salivary glands and sweat glands



Pancreas

The pancreas is an endocrine and an exocrine gland.

Exocrine - Secretion of digestive enzymes into small intestine

Endocrine - Secretion of hormones (eg. insulin and glucagon) directly into blood.

Feedback Loops

NEGATIVE FEEDBACK LOOP

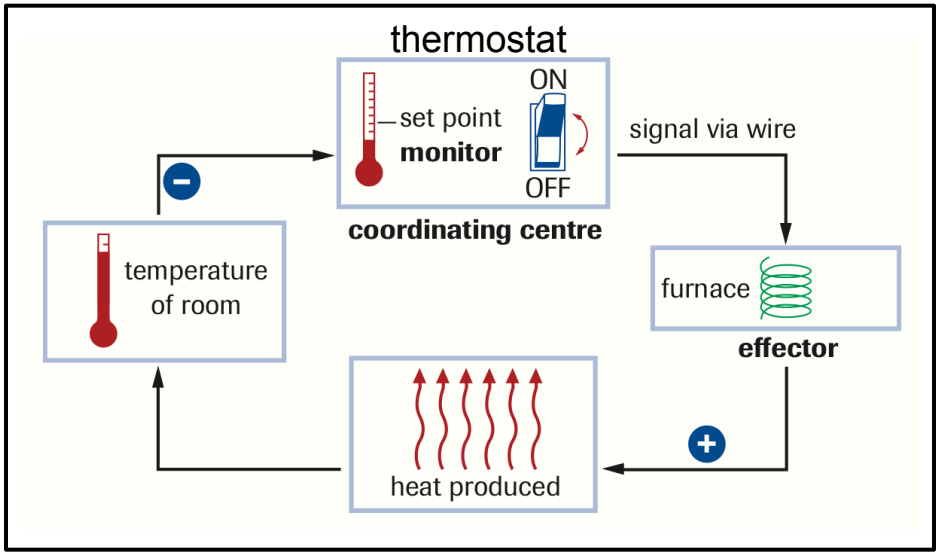
-mechanisms that make adjustments to bring the body back into an acceptable range

-a control mechanism is used to counteract further change

-our bodies mostly use this type of feedback

POSITIVE FEEDBACK LOOP

-reinforces a change (moves controlled variable away from steady state)

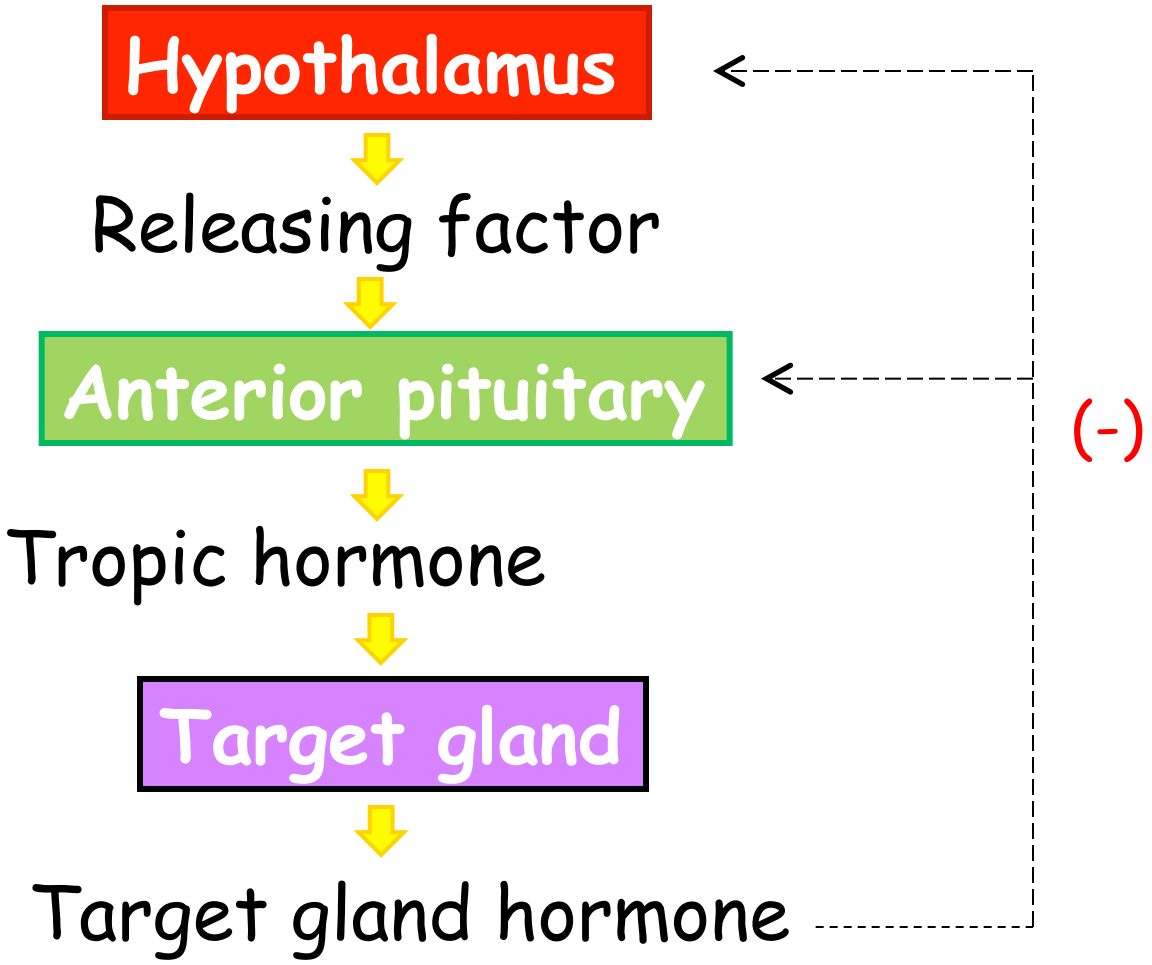


Negative Feedback Loop

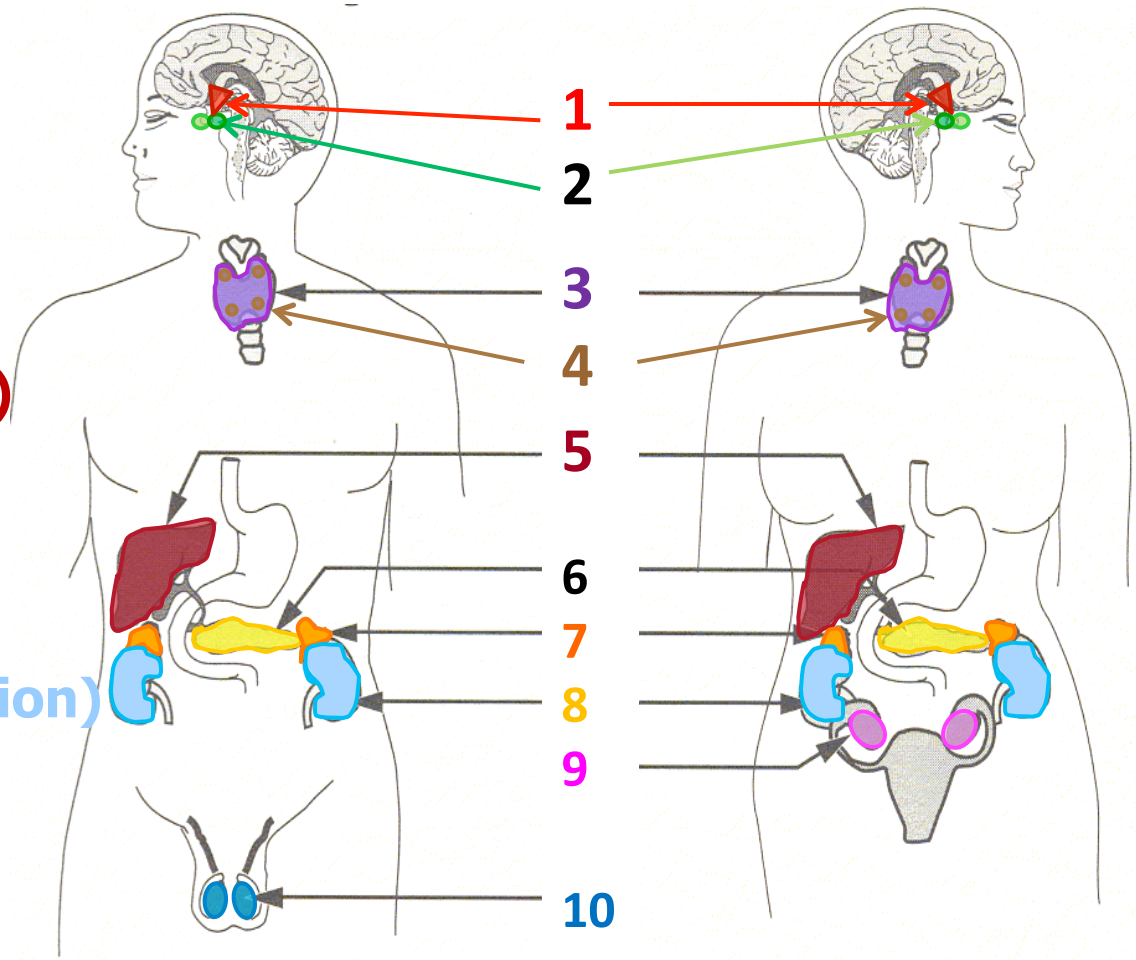
Negative feedback or feedback inhibition

- Prevents **chemical imbalances** in the body
- Once a hormone produces the desired effect, hormone production must **decrease**
- Important in maintaining **homeostasis**

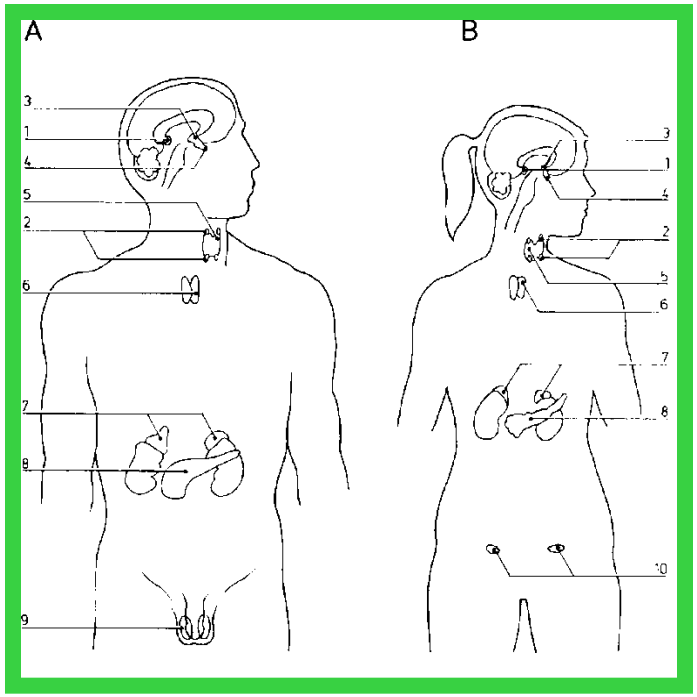
General Feedback System Loop



1. Hypothalamus
2. Pituitary Gland
3. Thyroid gland
4. Parathyroid
*5. Liver (stores glucose)
6. Pancreas
7. Adrenal Gland
*8. Kidney (water regulation)
9. Ovary
10. Testes



* Are not endocrine glands, but are target tissue for hormones.



Do the

Flash Cards Activity

in your workbook.

Endocrine System Video- bozeman

(Disregard info on Pineal gland. Do not need to know that.)

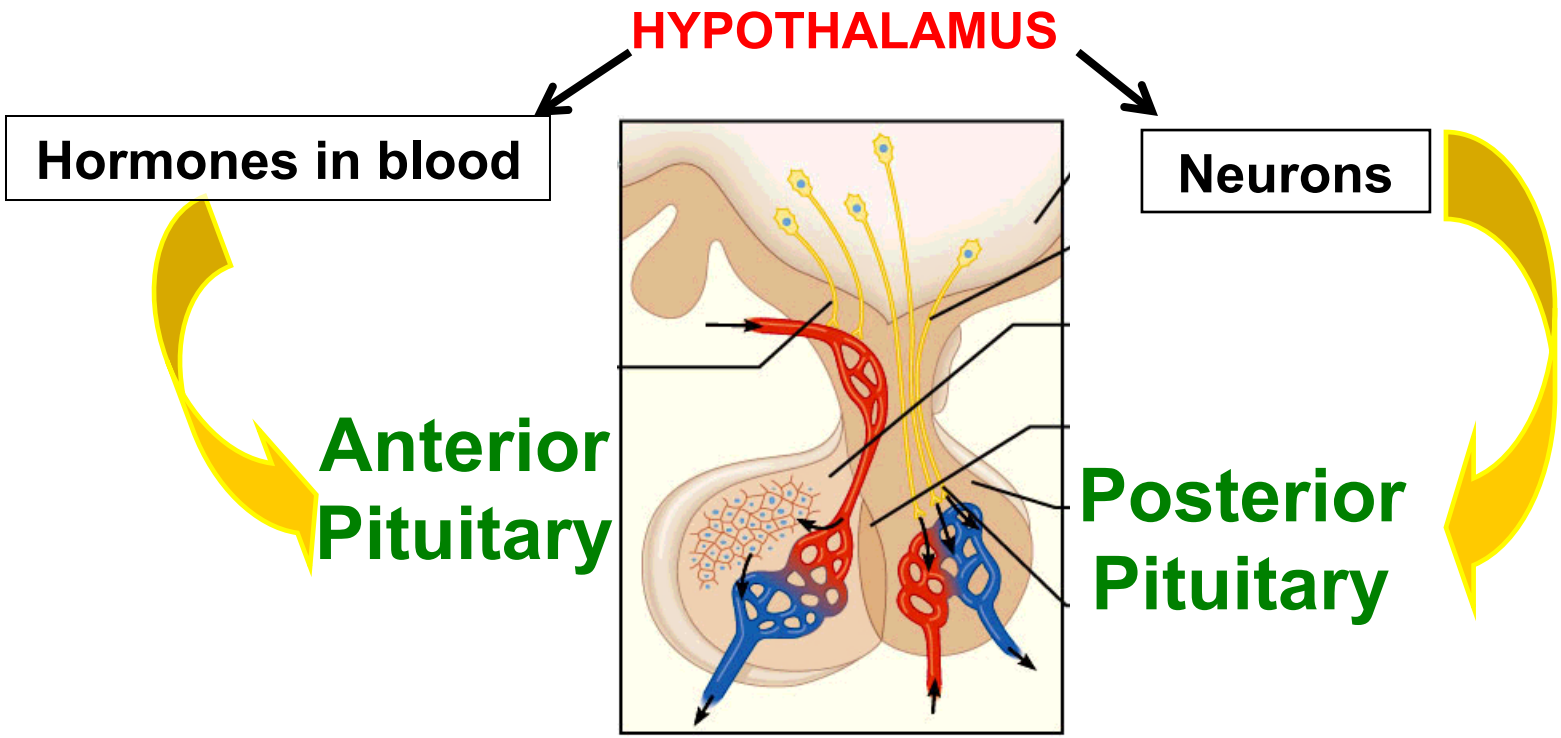
http://www.youtube.com/watch?v=-S_vQZDH9hY&safety_mode=true

The Hypothalamus and Pituitary

The hypothalamus controls the release of hormones from TWO LOBES:

a) **posterior** pituitary by **nerve impulses**

b) **anterior** pituitary by **Releasing Hormones**
also known as (releasing factors)

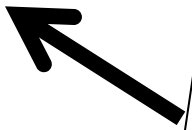


Tropic vs. Non-tropic Hormones

There are two types of hormones:

Tropic Hormones
from pituitary
Affect other glands and cause secretion of other hormones
FSH, LH, ACTH, TSH (FLAT)

Non-Tropic Hormones
from glands
Do NOT affect other glands, but instead affect specific cells or tissues

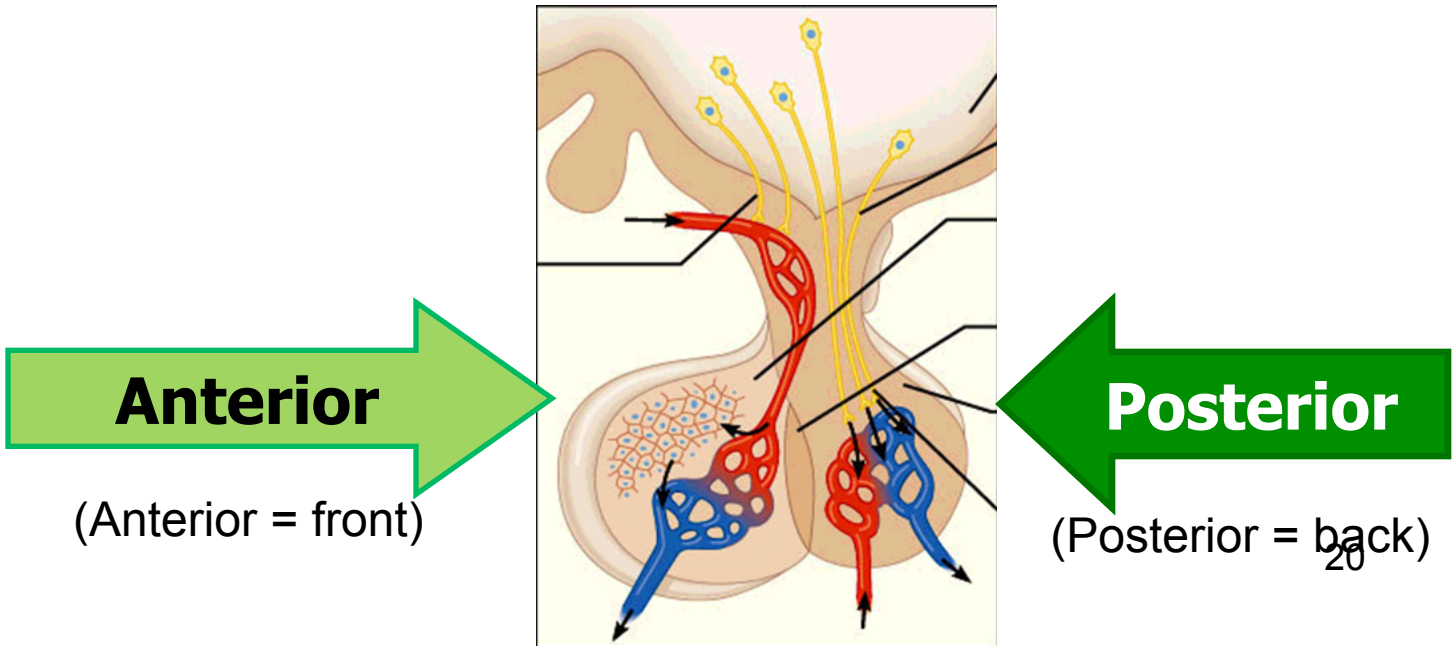


We will get to what these are in a bit…

The pituitary gland

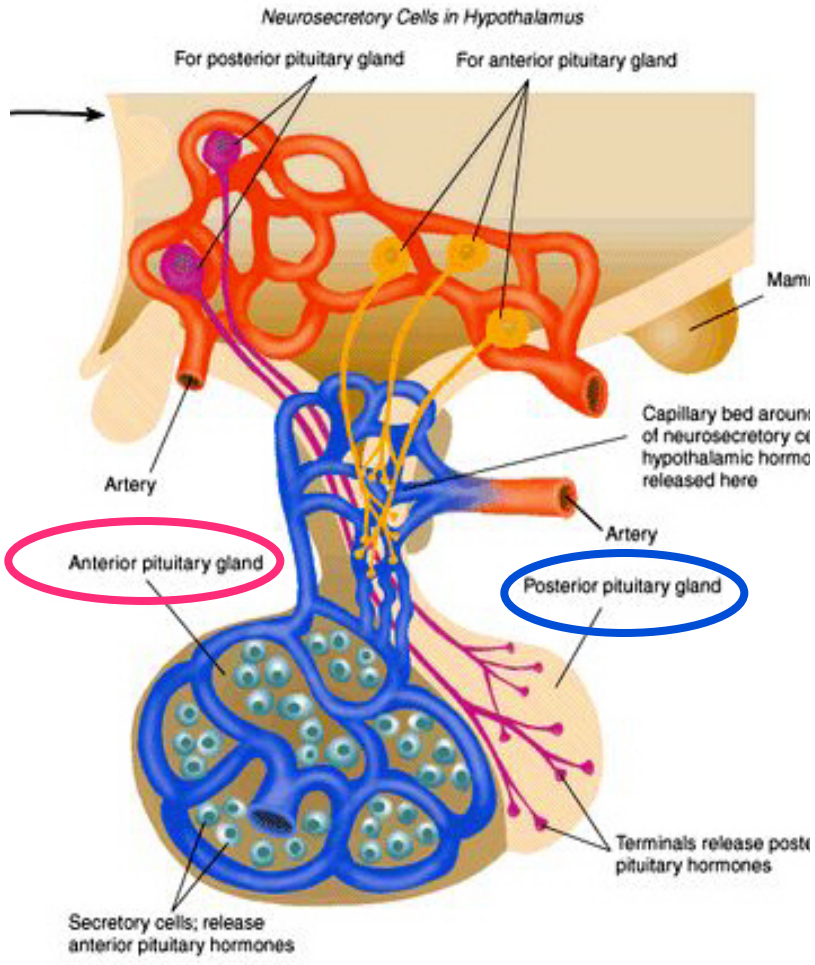
- The pituitary gland controls most of the other glands in the body
  - By sending out hormones that affect those glands, in other words it releases
    - tropic hormones!!!

Made up of two parts – anterior and posterior lobes

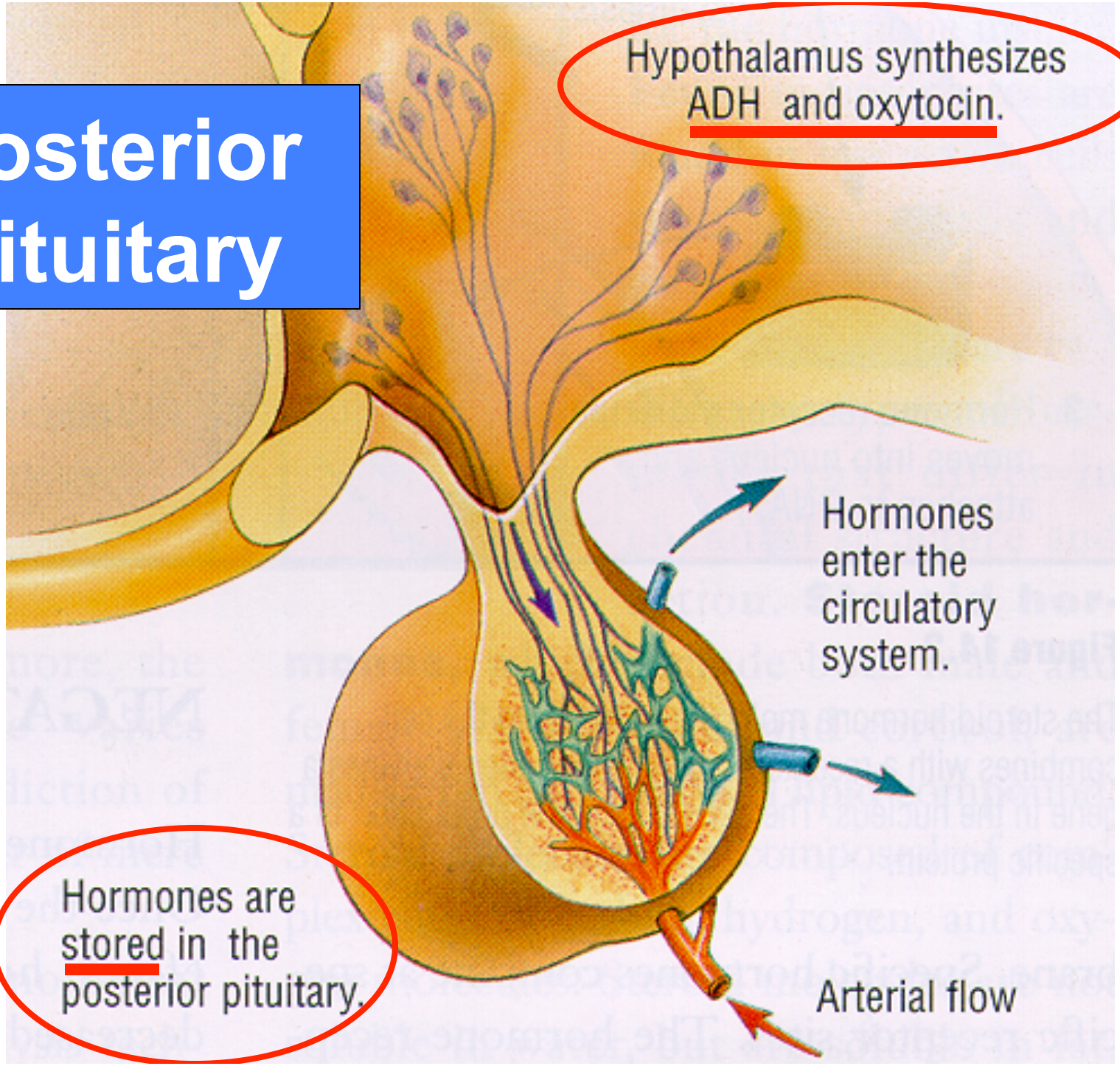


The pituitary gland

- **Anterior lobe <u>produces</u> 6 hormones,** which are released into the blood stream
- **Posterior lobe <u>stores</u> 2 hormones** (produced in hypothalamus) which are released into the blood stream
  1) **Antidiuretic hormone (ADH)**
  2) **Oxytocin**

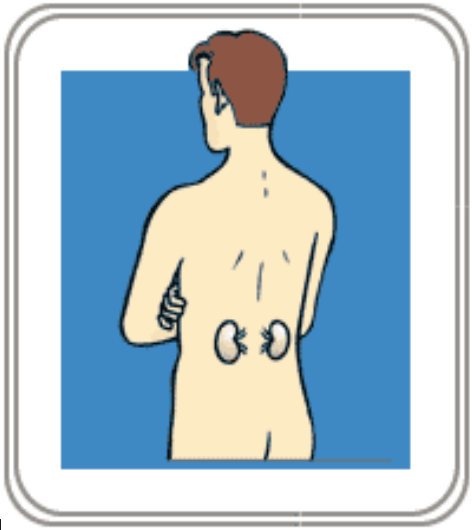


Posterior Pituitary



Posterior lobe – ADH (Antidiuretic hormone)

- **Released in <u>response</u> to dehydration (thirsty)**
- **<u>Production site</u>:** hypothalamus
  (stored in the posterior pituitary)
- **<u>Target:</u>** kidneys (and blood vessels)
- **<u>Function</u>:** increases water reabsorption by the kidneys, to increase **blood pressure**



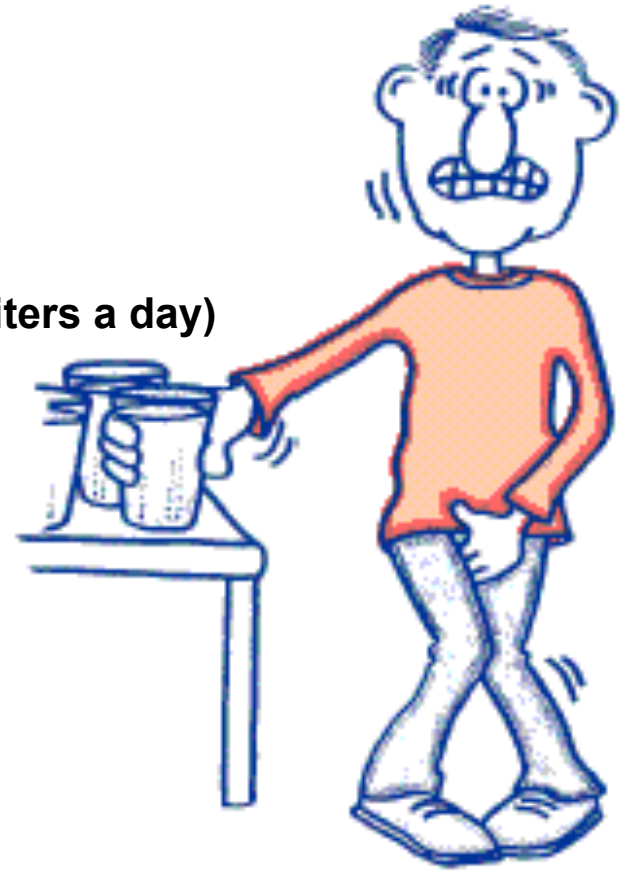
- **Hypersecretion:**(too much) abnormal water retention
- **Hyposecretion:** (too little) **diabetes insipidus** (urinate more often)

Posterior Lobe - Diabetes insipidus

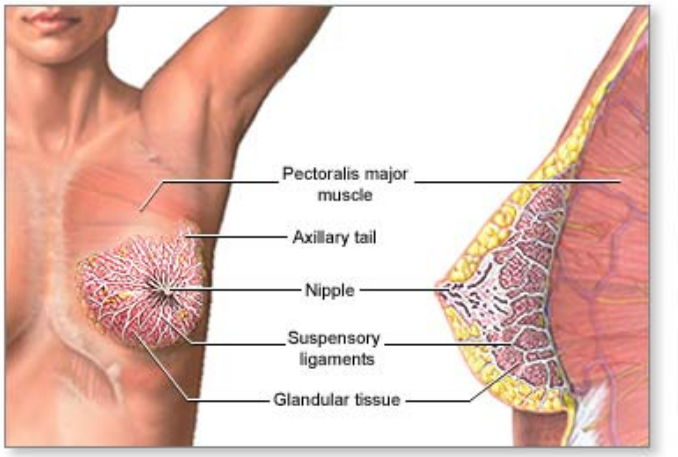
(this is not the diabetes associated with blood sugar)

- Caused by decreased secretion of ADH or incorrect receptors for ADH in kidney.

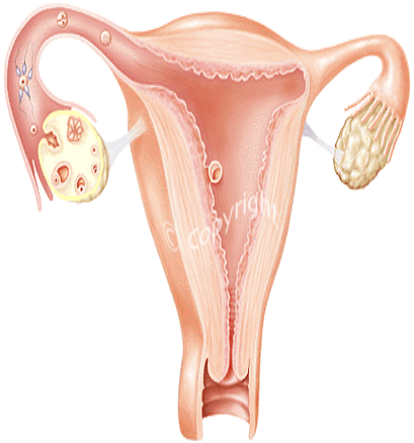
- Symptoms:
  - excessive urination (up to 16 liters a day)
  - excessive thirst



Posterior lobe - oxytocin



adam.com

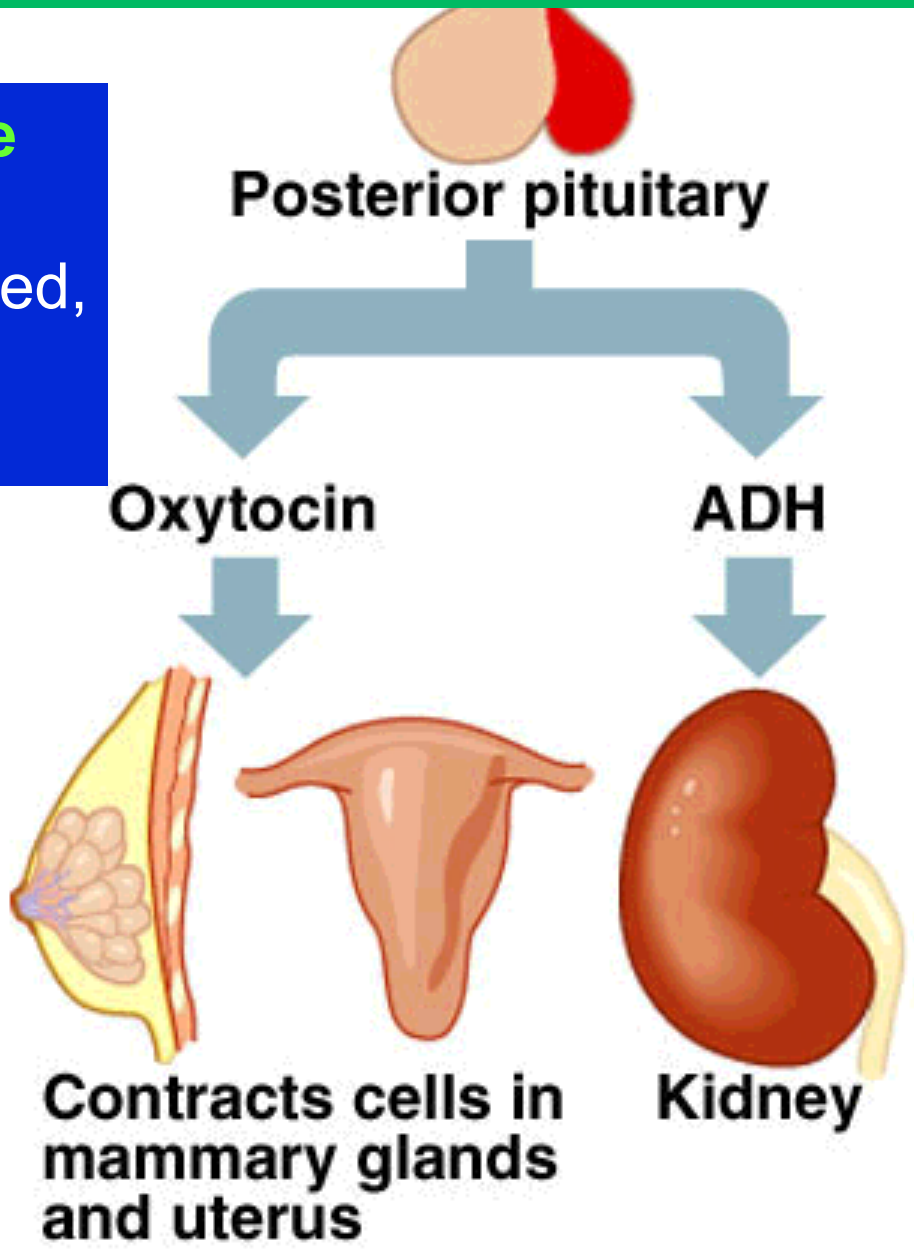


- **Production site: hypothalamus** (stored in the posterior pituitary)
- **Targets: uterus and mammary glands**
- **Functions: initiates contractions**

- **Hyposecretion:** prolonged or difficult birth
- **Hypersecretion:** inappropriate ejection of milk

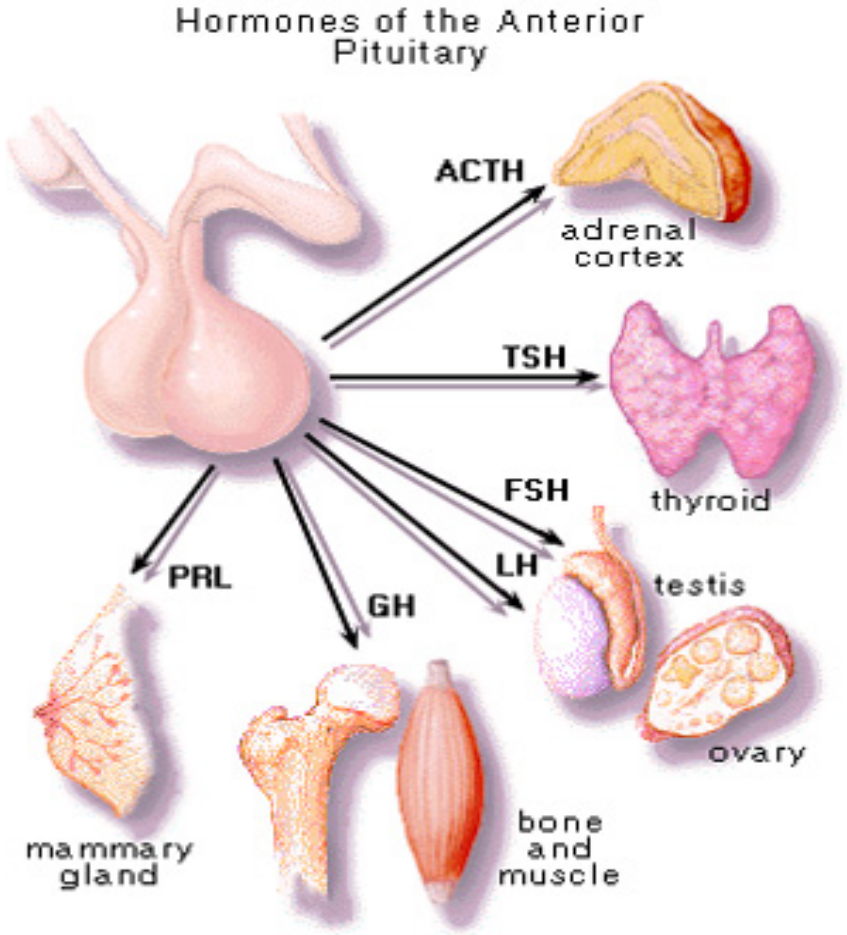
SUMMARY Posterior Pituitary

Remember **what the hormones** are,
where they are produced,
target organ,
and **function**



ANTERIOR PITUITARY

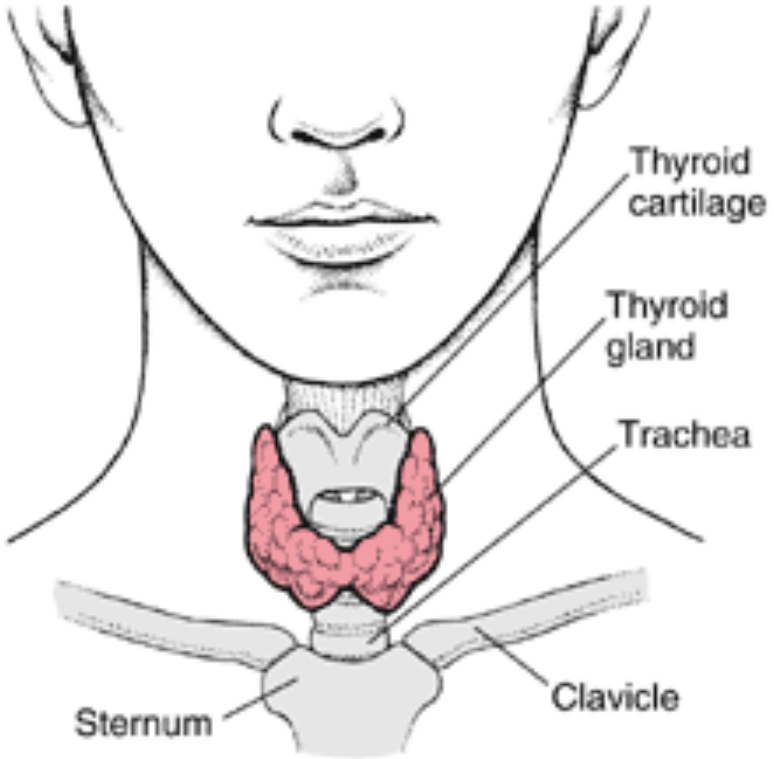
- **Produces its own hormones (6 of them)**
  - TSH
  - ACTH
  - STH or GH
  - FSH
  - LH
  - PRL
- **BUT,** regulated by the hypothalamus



ANTERIOR PITUITARY
Thyroid stimulating hormone (TSH)

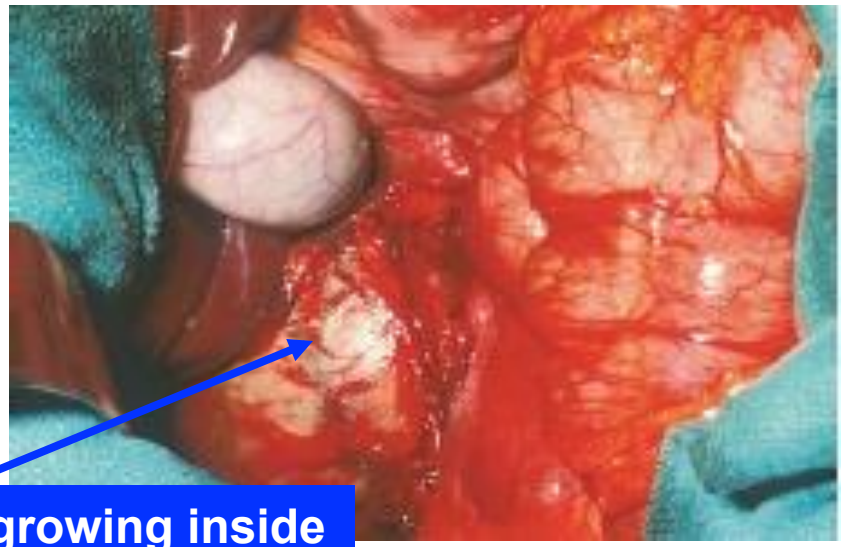
- **Production site:** **anterior pituitary**
- **Targets** **the thyroid gland**
- **stimulates** thyroid gland to produce **thyroxine**

(increases metabolism and regulates growth)

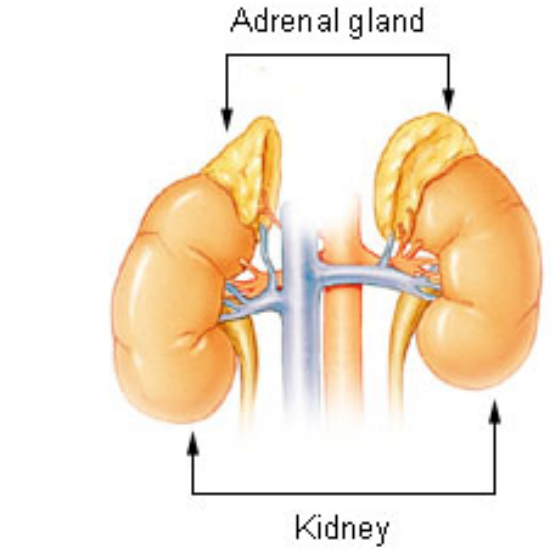


ANTERIOR PITUITARY
Adrenocorticotropic hormone (ACTH)

- **Production site: anterior pituitary**
- **Targets** the **adrenal cortex**
- **stimulates** the release of stress hormones **aldosterone**(water retention) **& cortisol** (provide blood glucose to deal with elevated energy requirements)



Tumor growing inside the adrenal cortex



ANTERIOR PITUITARY
human growth hormone (hGH) aka somatotropin

- **Production site: anterior pituitary**
- **Targets most cells**
- **(bones and muscles)**
- **Promotes growth**

- **Hyposecretion: dwarfism**
- **Hypersecretion: gigantism (child) or acromegaly (adult)**

ANTERIOR PITUITARY
Gigantism

Due to the continuous production or over production of the growth hormone

https://www.youtube.com/watch?v=5McWw03Ryrs

“General Tom Thumb”
and
Livia Warren

ANTERIOR PITUITARY
human growth hormone (hGH)

- Can affect cartilage and bone cells
- **Acromegaly is broadening of facial features, hands and feet**
  - excess hGH can no longer cause an increase in height, so the bones and soft tissues of the body widen. Thus, over time, the face widens, the ribs thicken and the feet and hands enlarge. There are also some health consequences due to acromegaly.

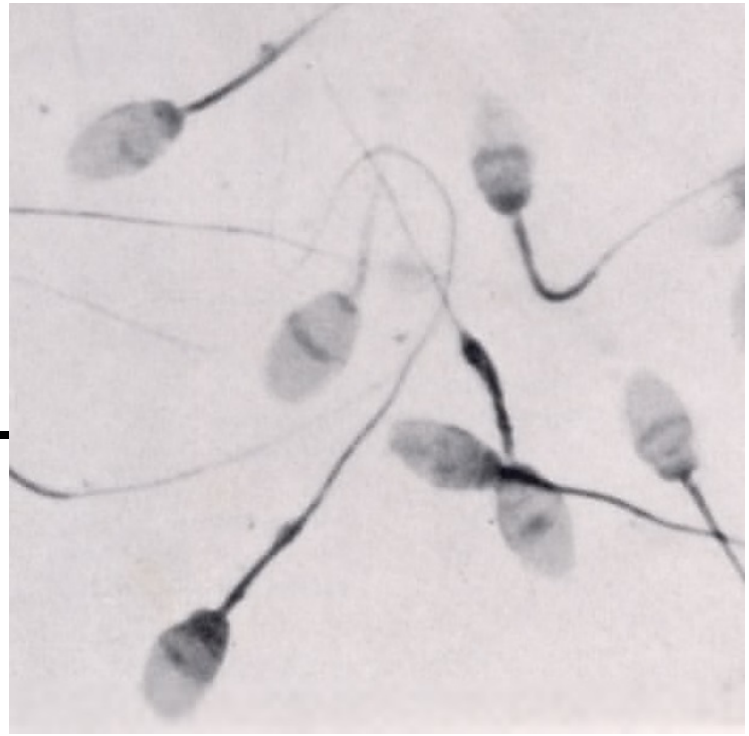
A B C

Kosen is 31 years old, and hails from Turkey. Dangi is 75 and comes from Nepal.

Sultan Kosen, a towering 8 feet, three inches tall (2.5m) shook hands with Chandra Bahadur Dangi, just 21.5 inches tall (55 cm)

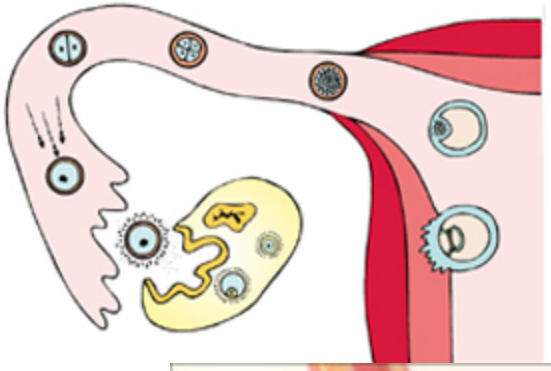
ANTERIOR PITUITARY
Follicle stimulating hormone (FSH)

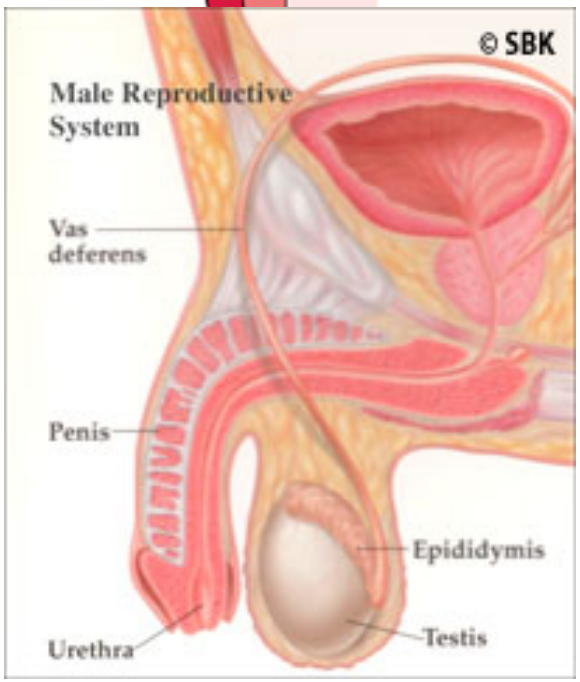
- **Production site:** anterior pituitary
- **Targets** the **ovaries and testes to undergo meiosis cell division**
- **Function:** Stimulates follicle development **production of eggs and estrogen in ovaries; and sperm in testes**



- **Hyposecretion:** inhibits sexual development, causes **sterility**

ANTERIOR PITUITARY
Luteinizing hormone (LH)



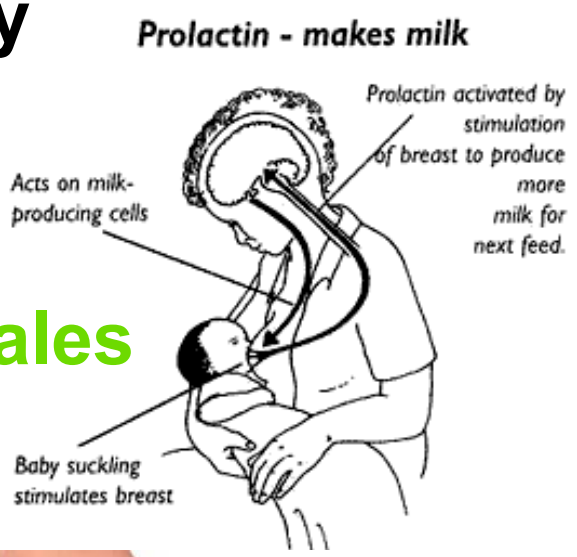


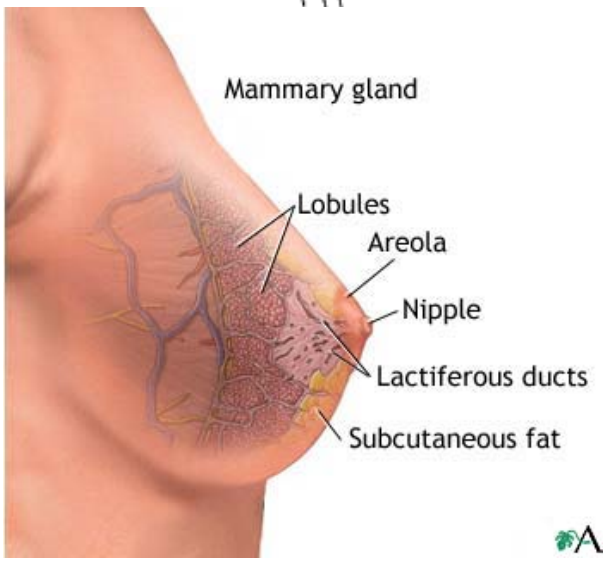
- **Production site**: anterior pituitary
- **Targets** the **ovaries and testes**
- **Functions:** Stimulates **ovulation (release of egg) and progesterone and estrogen production in females and testosterone production in males**

- **Hyposecretion:** inhibits sexual development, causes **sterility**

ANTERIOR PITUITARY
Prolactin (PRL)

- **Production site: anterior pituitary**
- **Targets** the **mammary glands**
- **Function:** stimulates and
- maintains **milk production in females**





How to Remember the Pituitary Hormones:

GH

Posterior pituitary
- Oxytocin
- ADH

TSH

FSH

LH

ACTH

PRL (prolactin)