

## Ch 14: Endocrine Physiology

*PowerPoint updated 2/17/25*

### Objectives

1. Review endocrine glands of body.
2. Understand how hypothalamus controls endocrine system & sympathetic epinephrine response.
3. Learn anterior pituitary hormones & their effects on glands of body.
4. Understand some endocrine disorders.

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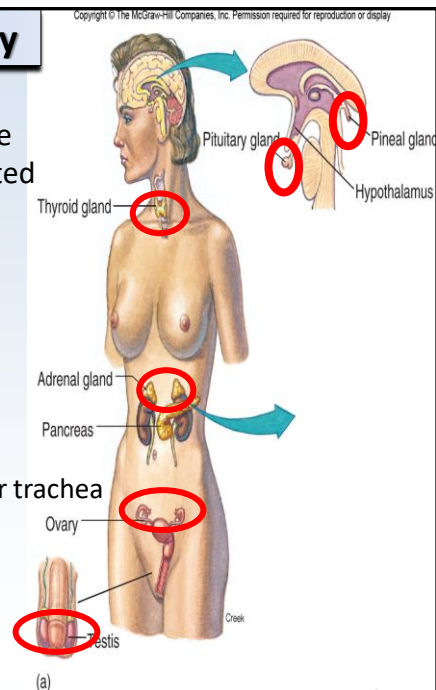
### 1. Endocrine Glands of the Body

**Endocrine System** = system involving regulation of body functions through use of chemical messengers (hormones) secreted by glands.

#### **Endocrine glands of body:**

- **Pituitary** = master endocrine gland
- **Pineal gland** = located in diencephalon
- **Adrenal glands** = located above kidneys
- **Thyroid** = located on anterior trachea
- **Parathyroid glands** = located on posterior trachea
- **Gonads** = ovaries & testes
- **GI tract**
- **Pancreas**
- **Liver**

**\*\*Most of these glands controlled by hypothalamus!**



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## 2. Hypothalamus controls endocrine system!

> Hypothalamus part of both nervous & endocrine systems

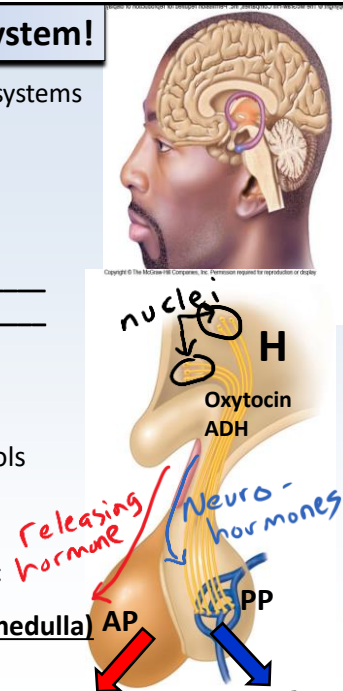
### Controls endocrine system 3 ways:

1. **Hypothalamic nuclei** secrete neuro-hormones through posterior pituitary. Pg 266-267 Wiki text

- > Supraoptic nucleus secretes \_\_\_\_\_
- > Paraventricular nucleus secretes \_\_\_\_\_

2. **Hypothalamus** secretes \_\_\_\_\_ & \_\_\_\_\_, which controls anterior pituitary.

3. **Hypothalamus** controls autonomic sympathetic secretion of **epinephrine** by the **Adrenal glands (medulla)**



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## Hypothalamus Directs Anterior Pituitary Secretions

Know hypothalamic hormone (acronym) and what it causes anterior pituitary to secrete!

Pg 267 Wiki text.

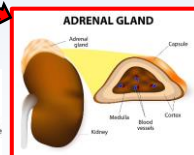
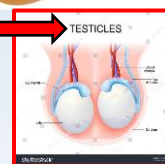
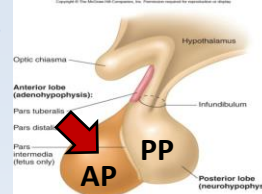
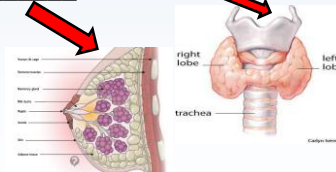
Hypothalamus secretes:

Releasing hormones (RH)

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_

Inhibiting hormones (IH)

6. \_\_\_\_\_
7. \_\_\_\_\_



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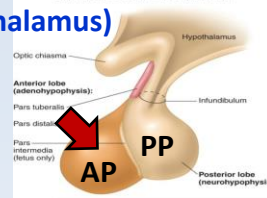
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## Anterior Pituitary Secretions (in response to hypothalamus)

Pg 267 Wiki text

Hypothalamic hormones

### Anterior Pituitary Response:

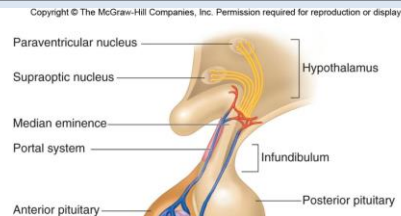


- |             |    |       |
|-------------|----|-------|
| <b>GnRH</b> | 1. | _____ |
| <b>GHRH</b> | 2. | _____ |
| <b>CRH</b>  | 3. | _____ |
| <b>TRH</b>  | 4. | _____ |
| <b>PRH</b>  | 5. | _____ |
| <b>GHIH</b> | 6. | _____ |
| <b>PIH</b>  | 7. | _____ |

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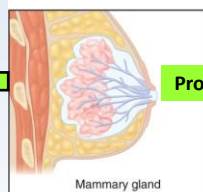
## Anterior Pituitary secretions & their effects on target organs or glands:



Pg 262 – 263  
Wiki text

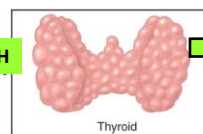
### Effects:

Stimulates mammary glands to make milk (lactation)



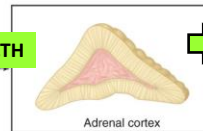
**Prolactin**

**TSH**



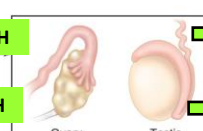
Produce T3 & T4 to regulate metabolism

**ACTH**



Produce  
- Sex steroids  
- Cortisol

**FSH**



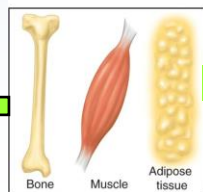
Mature eggs & sperm

**LH**



Produce estrogen & testosterone, ovulation

Stimulates body tissues to grow!



**GH**

Gonadotropins

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**Practice Endocrine Blank Flow Chart!**  
**Found on online syllabus. Key also found there.**

**HYPOTHALAMUS SECRETES:**

5 Releasing hormones & 2 inhibiting hormones

**ANTERIOR PITUITARY RESPONSE:****BODY'S RESPONSE:**

1. \_\_\_\_\_

1. \_\_\_\_\_

\_\_\_\_\_

2. \_\_\_\_\_

2. \_\_\_\_\_

\_\_\_\_\_

3. \_\_\_\_\_

3. \_\_\_\_\_

\_\_\_\_\_

4. \_\_\_\_\_

4. \_\_\_\_\_

\_\_\_\_\_

5. \_\_\_\_\_

5. \_\_\_\_\_

\_\_\_\_\_

6. \_\_\_\_\_

6. \_\_\_\_\_

\_\_\_\_\_

7. \_\_\_\_\_

7. \_\_\_\_\_

\_\_\_\_\_

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**Endocrine hormone regulation is through negative feedback.**

Pg 265 – 266

Wiki text

If blood levels of a hormone are too low, hypothalamus increases RH secretion & pituitary increase its hormone secretions.

If blood levels of a hormone are too high, hypothalamus decreases RH secretion & increases IH secretion, then the pituitary decreases its hormone secretions.

***Ques:***

*Can you think of a hormone that is not regulated through negative feedback, but by positive feedback??*

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## How hypothalamus & neg. feedback regulates anterior pituitary secretions:

### QUES:

If the hypothalamus “senses” GH in blood is too high what does it do? \_\_\_\_\_

What happens to anterior pituitary secretions of GH? \_\_\_\_\_

If GH in blood is too low, hypothalamus does what? \_\_\_\_\_

What does pituitary then do? \_\_\_\_\_

If hypothalamus “senses” high estrogen or testosterone in blood it \_\_\_\_\_

What does pituitary then do? \_\_\_\_\_

If hypothalamus “senses” low thyroid hormones it \_\_\_\_\_

What does pituitary then do? \_\_\_\_\_

### Clinical Apps:

[Anabolic steroid abuse & negative feedback](#)

[Corticosteroid use & negative feedback](#)

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## Review

- Endocrine glands of body
  - Pituitary, adrenals, thyroid, parathyroids, gonads, pineal gland, pancreas, GI tract, pancreas, liver.
- Hypothalamic controls endocrine system
  - Nuclei secrete ADH & oxytocin
  - 5 Releasing hormones (CRH, GnRH, TRH, GHRH, PRH)
  - 2 Inhibiting hormones (PIH, GHIH)
  - Controls adrenal medulla secretion of epinephrine
- Anterior pituitary secretions & their target organs
  - ACTH, TSH, GH, FSH, LH, PRL
- Negative feedback regulation of endocrine system

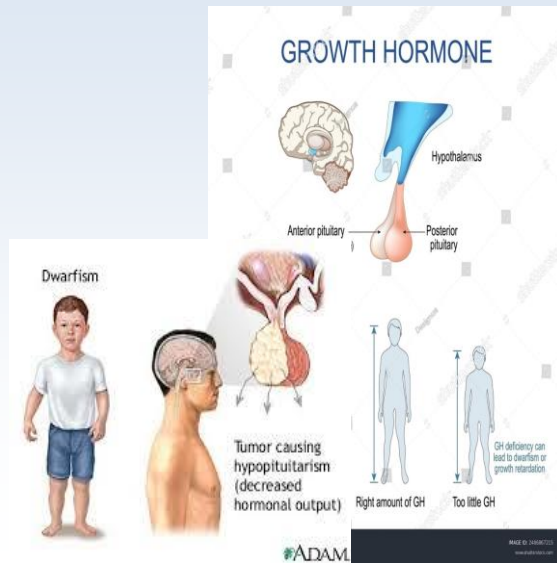
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## Growth Hormone (GH) Disorders: Clinical App [ONLINE](#)

### 1. Insufficient GH = insufficient body growth

#### > Pituitary dwarfism



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## Growth Hormone (GH) Disorders: Clinical App [ONLINE](#)

### 2. Excessive GH – excessive body growth

#### > **Gigantism** – when onset in childhood

#### > **Acromegaly** – when onset in adulthood Click [HERE](#) to read more (not required)

[Robert Wadlow 8 ft 11 in](#)



**Gigantism**



**Acromegaly**

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Pg 272 – 274 Wiki text

**Pituitary ACTH stim. Adrenal Cortex to make:**

**Under sympathetic response - hypothalamus stimulates Adrenal Medulla to make**

### 1. Sex steroids

Ex. - \_\_\_\_\_

### 2. Glucocorticoids

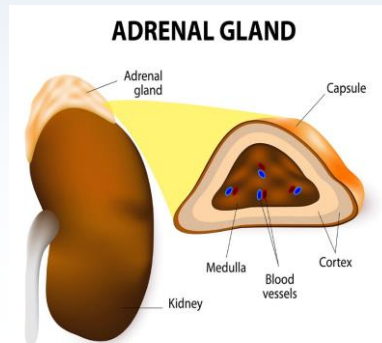
Ex. \_\_\_\_\_

**Clinical App [ONLINE](#)**

Exogenous glucocorticoids and negative feedback on adrenal cortex

**Adrenal cortex also makes Mineralcorticoids, but stimulus for secretion is low blood pressure NOT ACTH**

Ex. - \_\_\_\_\_  
(tells kidney tubules to increase **salt**, & then water retention)



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## Adrenal Cortex Disorders:

### A. Cushing's Disease ("hypercortisolism") – Excess Cortisol

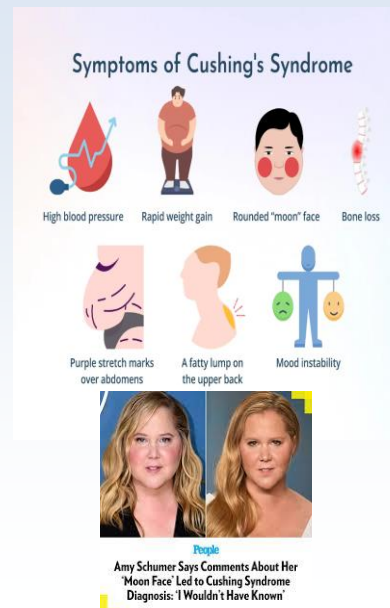
**Clinical App [ONLINE](#)**

#### Causes:

- Excess hypothalamic CRH or pituitary ACTH
- Adrenal gland tumor

#### Clinical Presentation:

- **Hyperglycemia** =
- **Hyperlipidemia** =
- **Hypervolemia** =
- **Hypertension** =



Click [HERE](#) to read more (not required)

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## Adrenal Cortex Disorders:

### B) Addison's Disease – Low Aldosterone & Low Cortisol

Often called "adrenal insufficiency"

Clinical App [ONLINE](#)

#### Causes:

- ↓ hypothalamic CRH or pituitary ACTH.
- Adrenal cortex tumor or autoimmune disorder

Click [HERE](#) to read more (not required)

#### Clinical Presentation:

- Hyponatremia =
- Hyperkalemia =
- Hypovolemia =
- Hypotension =
- Anorexia =
- Skin bronzing
- Hypoglycemia -

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Do NOT memorize!

| CUSHING'S   | vs. | ADDISON'S   |
|---|-----|---|
| Mnemonics created by: ♥ NURSE SARAH   |     |   |
| <b>Cortisol secretion HIGH</b><br>It's a <b>STRESS</b> hormone!   |     | <b>Cortisol and Aldosterone secretion LOW</b><br>They're <b>STEROID</b> hormones!   |
| <b>Causes:</b> <ul style="list-style-type: none"> <li>tumors within the pituitary or adrenal glands</li> <li>corticosteroids</li> </ul>   |     | <b>Causes:</b> <ul style="list-style-type: none"> <li>autoimmune damage to adrenal cortex</li> <li>cancer/infection</li> <li>trauma to adrenal cortex</li> </ul>  |
| <b>Signs &amp; Symptoms:</b><br><b>"STRESSED"</b>   |     | <b>Signs &amp; Symptoms:</b><br><b>"STERIODS"</b>   |
| <div style="display: flex;"> <div style="writing-mode: vertical-rl; transform: rotate(180deg); font-weight: bold; margin-right: 5px;">STRESSED</div> <div> <p>Skin fragile (thinner)</p> <p>Truncal obesity → "Buffalo Hump" "Moon Face"</p> <p>Reproductive issues → amenorrhea, erectile dysfunction</p> <p>Elevated BP</p> <p>Striae on extremities/abdomen</p> <p>Sugar high; polyuria/polydipsia</p> <p>Excessive body hair</p> <p>Decreased potassium (hypokalemia)</p> </div> </div> |     | <div style="display: flex;"> <div style="writing-mode: vertical-rl; transform: rotate(180deg); font-weight: bold; margin-right: 5px;">STERIODS</div> <div> <p>Salt hunger due to hyponatremia</p> <p>Tired and weak</p> <p>Elevated potassium (hyperkalemia)</p> <p>Reproductive issues (hormone imbalances)</p> <p>Onset of hypotension</p> <p>Increased skin pigmentation</p> <p>Depression</p> <p>Sugar low (hypoglycemia)</p> </div> </div> |
| © DIGITAL NURSING NOTES by NURSE SARAH available at:<br><a href="http://SHOP.REGISTEREDNURSE.N.COM">SHOP.REGISTEREDNURSE.N.COM</a>  |     |   |

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## Adrenal Cortex Disorders:

### C) Conn's syndrome (hyperaldosteronism)

#### Causes:

- usually adrenal cortex tumor

#### Clinical Presentation:

- Hypernatremia =
- Hypokalemia =
- Hypervolemia =
- Hypertension =
- Weight gain =

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## Adrenal Medulla Disorders:

**Pheochromocytoma** = excessive norepinephrine/epinephrine

Clinical App [ONLINE](#)

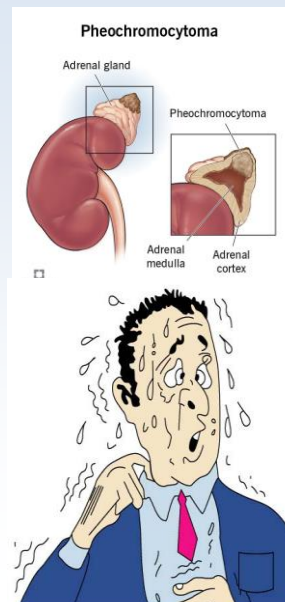
#### Causes:

- adrenal medulla tumor

Clinical Presentation: "fight or flight" symptoms

- Tachycardia
- Hypertension
- Hyperventilation
- Hyperglycemia
- Hyperlipidemia
- sweating,
- Nervousness, anxiety or panic attack

Click [HERE](#) to read more (not required)



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## Thyroid Gland Pg 269 – 270 Wiki text

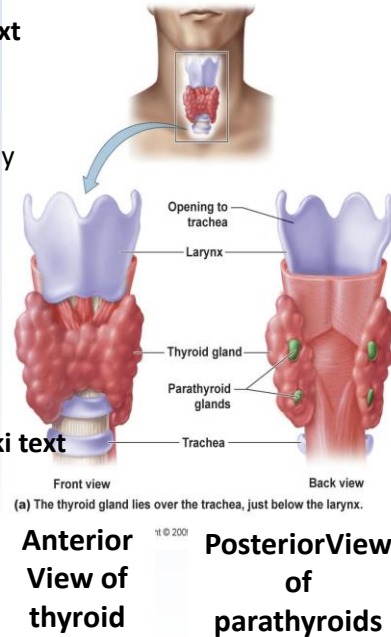
### Produces:

1. \_\_\_\_\_ (tri-iodothyronine)
  2. \_\_\_\_\_ (thyroxine)
- } Increase body metabolism
3. **Calcitonin** - ↓ blood  $\text{Ca}^{+2}$

## Parathyroid Glands Pg 270-272 Wiki text

### Produce:

**Parathyroid hormone** - ↑ blood  $\text{Ca}^{+2}$



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## Thyroid gland disorders – Clinical App [ONLINE](#)

**A. Hyperthyroidism** = excessive thyroid hormones  
(click [HERE](#) to read more)

### Causes:

- thyroid tumor
- **Graves disease** = autoimmune attack, over-stimulates thyroid receptors.

About 1% of people globally. It occurs  
More often in women.

### Clinical presentation:

- High metabolism & anxiety
- Intolerant to heat (sweating)
- Tachycardia
- Hypertension
- ↑ fluid behind eyes ("**exophthalmos**")



Cleveland Clinic

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## Thyroid gland disorders – Clinical App [ONLINE](#)

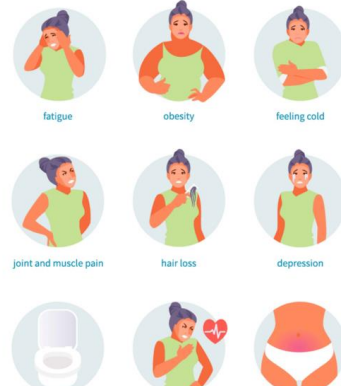
**B. Hypothyroidism** = insufficient thyroid hormones (click [HERE](#) to read more)  
Causes: thyroid tumor, goiter, insufficient dietary iodine.

5 / 100 people in US. Occurs more often in women.

### Clinical presentation:

- Low metabolism, depression
- Intolerance to cold, dry skin,
- Enlarged thyroid gland
- When in children called “**cretanism**”

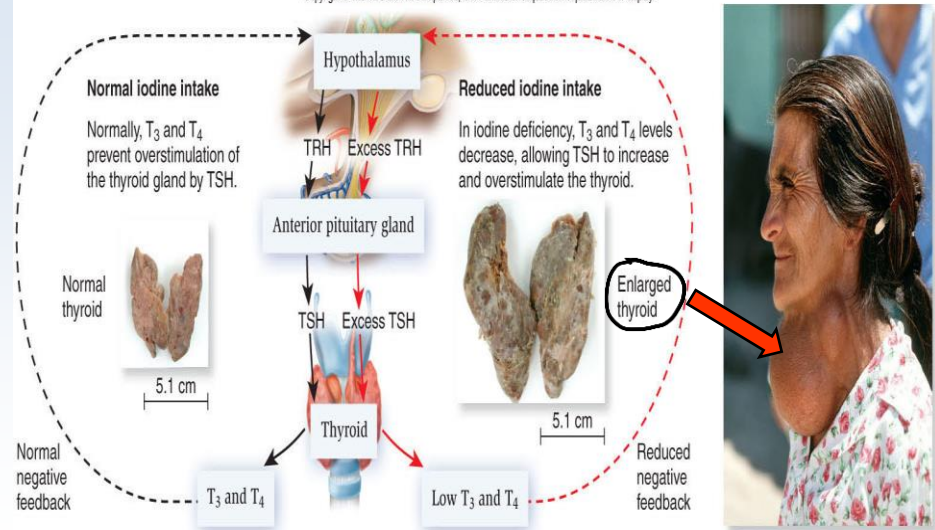
### Hypothyroidism



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**“Goiter”** = thyroid can’t make thyroid hormones, it over-grows (swells)

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(Left): S. Goodwin & Dr. Max Hinke, Division of Clinical and Functional Anatomy, University of Ottawa; (Right): © Bob Daemrich/The Image Works

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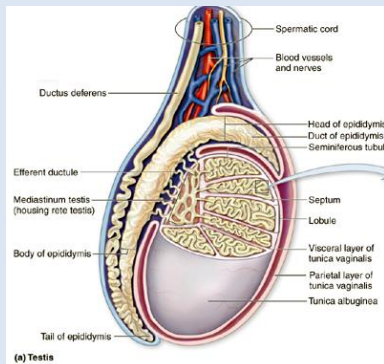
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## Gonads Pg 276-277 Wiki text

### Testes

Response to LH = \_\_\_\_\_

Response to FSH = \_\_\_\_\_

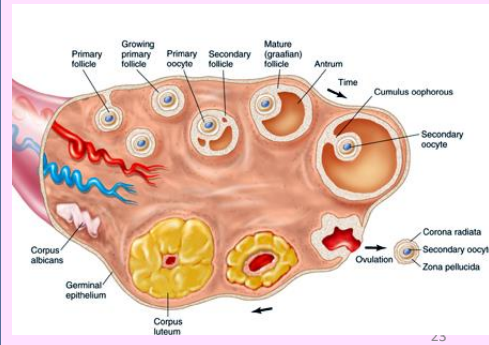


### Ovaries

Response to LH = \_\_\_\_\_ &

\_\_\_\_\_ &

Response to FSH = \_\_\_\_\_



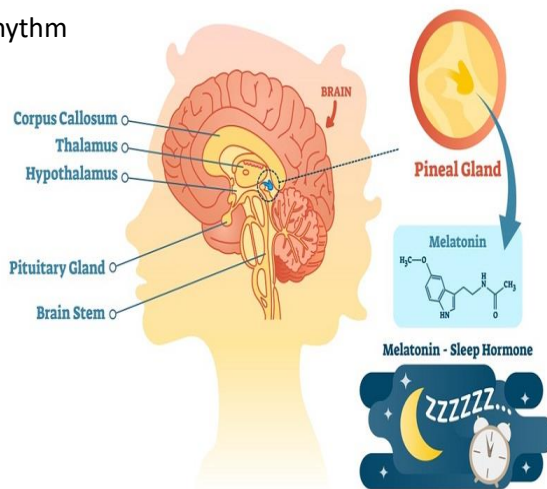
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## Pineal gland

- Makes **melatonin** at night
- helps regulate circadian rhythm

Pg 277 Wiki text

## PINEAL GLAND



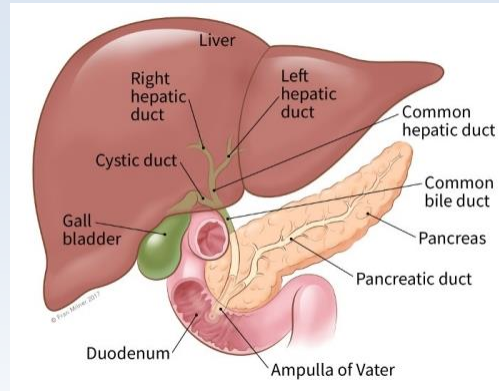
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## Pancreas

- Makes **insulin** and **glucagon**  
Pg 268, 272-274 Wiki text

### Clinical App [ONLINE](#)

Diabetes mellitus



## Liver

- Makes **erythropoietin** – stimulates RBC production
- Responds to pancreatic glucagon by engaging in Glycogenolysis (break glycogen into glucose & release into blood).

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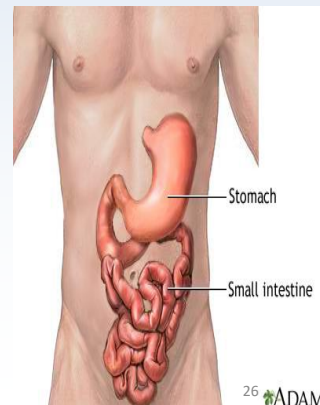
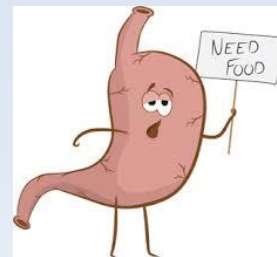
## GI Tract

1. **Gastrin** (stomach) =

2. **Secretin** (sm. intestine) =

3. **Cholecystikinin** (sm. intestine)

4. **Gastric inhibitory peptide** (sm. intestine) =



26 ADAM

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## Review

- Endocrine glands of body
  - Pituitary, adrenals, thyroid, parathyroids, gonads, pineal gland, pancreas, liver, GI tract
- Endocrine disorders
- Hormones produced by each gland

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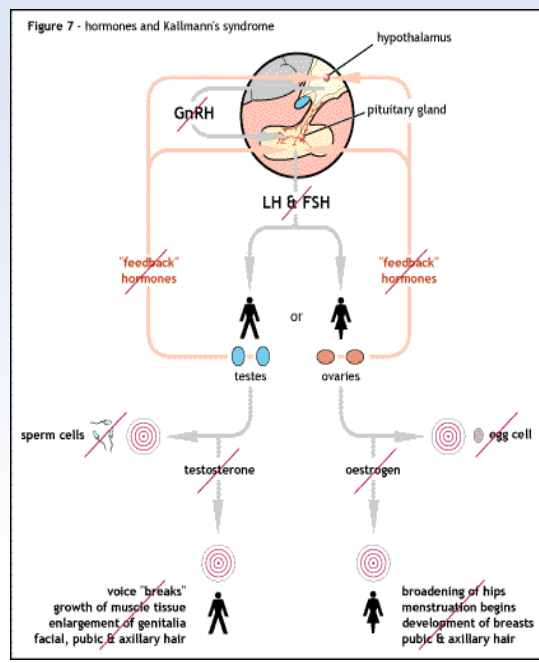
## Sex Steroid Disorders:

### A. Kallmann Syndrome

**(Hypogonadism)** = insufficient hypothalamic GnRH production. Results in less pituitary LH & FSH. Causes ↓ testes growth and ↓ testosterone and estrogen production.

In male child – can interfere with development of penis, testes, sperm production, and other masculine traits.

> Rare - 1 out of 50,000 births



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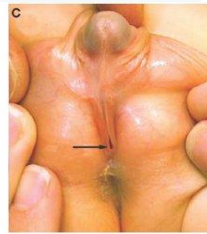
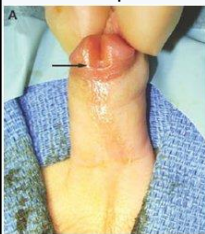
## B. Androgen Insensitivity Syndrome (AIS)

= genetic male (XY) with normal genes, testes development, normal vas deferens, normal testosterone production BUT tissues fail to respond to testosterone.  
(androgen-insensitivity)

> 1 / 13,000 male births

### Born with varying degree of intersex

- > micropenis
- > incomplete fusion of labial folds into scrotal sac
- > hypospadias
- > poor or no sperm production (sterile)
- > extra testosterone converted into estrogen & get female hip development & gynecomastia.



Partial AIS – partial fusion of scrotal skin, micropenis or enlarged clitoris

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Complete AIS

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## Review

- Intersex disorders
  - Kallman's syndrome
  - AIS

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