Anterior pituitary hormones

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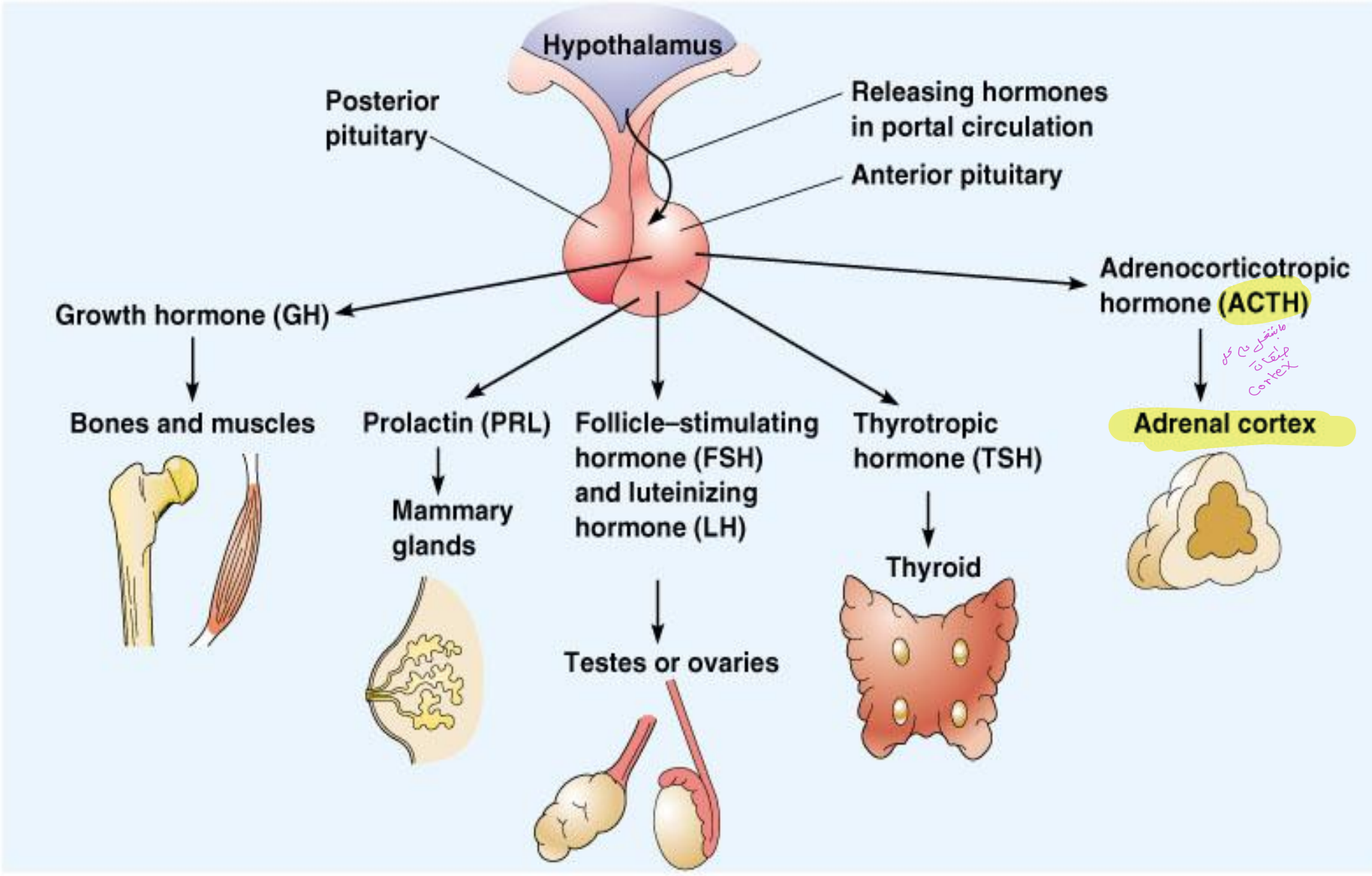
Anterior pituitary (Adenohypophysis)

- "Master gland" (makes & secretes various **tropic** or **tropin** hormones)

- **Tropic** or **tropin hormones**
  - Act on other endocrine glands
  - Stimulate release of their hormones
  - often in a negative feedback relationship

Hormones of the anterior pituitary



Hormones of anterior pituitary

1. Thyroid stimulating hormone or Thyrotropic hormone (TSH)
2. Adrenocorticotropic hormones (ACTH)
3. Gonadotropic hormones
   - Follicle stimulating hormone (FSH)
   - Luteinizing hormone (LH)
4. Growth hormone (GH)
5. Prolactin (PRL)

Thyroid stimulating hormone (TSH)
"Thyrotropin"

- **Functions**:

1- It stimulates the development of the thyroid gland, helps its growth and increases vascularity.

2 - It also stimulates the process of thyroxine hormone formation.

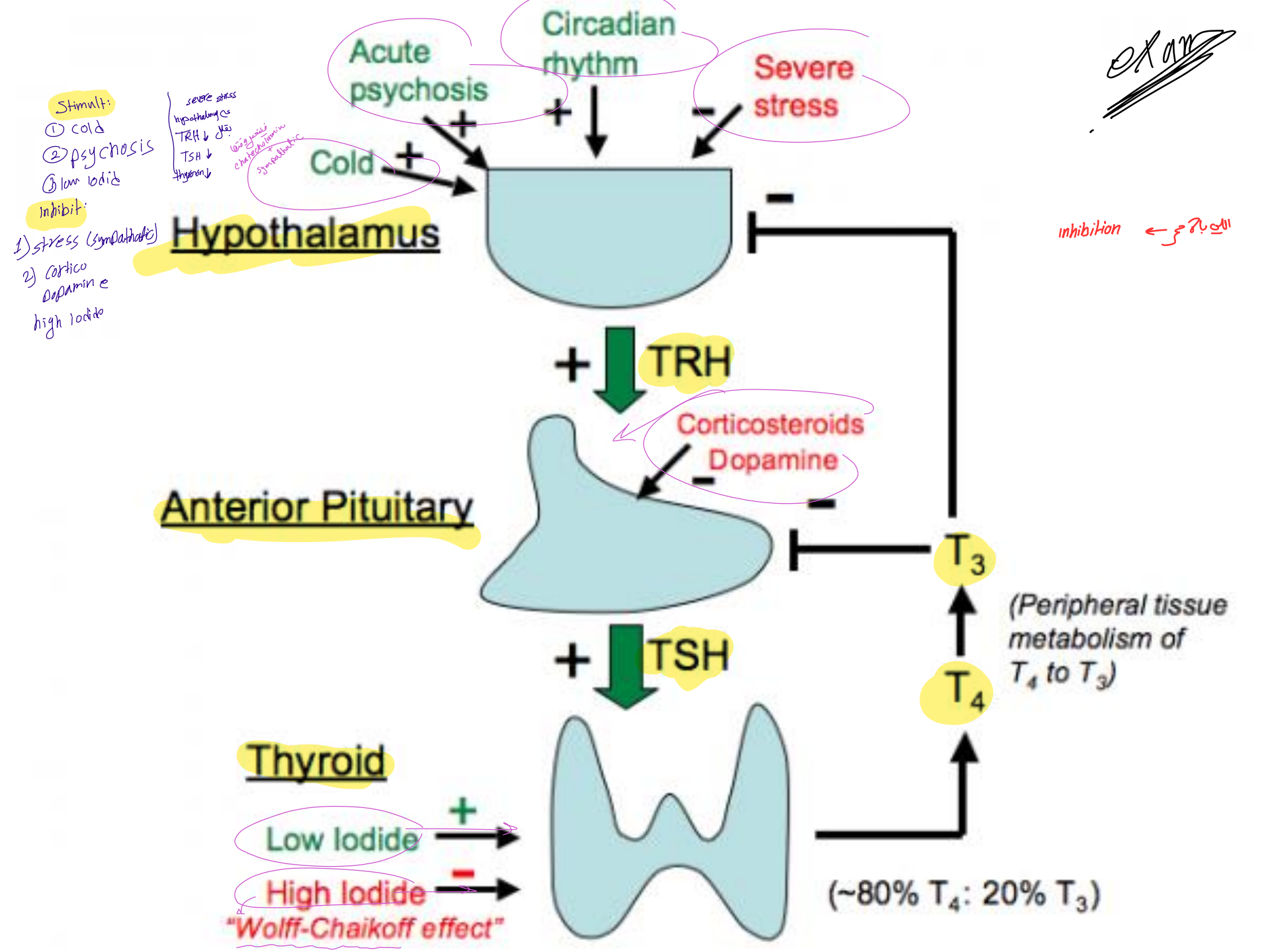
CONTROL

- ***1- Negative feedback mechanism***

  Increase thyroxine level in blood inhibits TSH secretion and inhibits the thyrotropin releasing factor from the hypothalamus.

2-Thyrotropin releasing factor or Hormone TRH

Stimulates TSH secretion


Acute psychosis
Circadian rhythm
Severe stress
Cold
+
+
+
-
Hypothalamus
-
+ TRH
Corticosteroids
Dopamine
-
-
Anterior Pituitary
T3
+ TSH
T4
(Peripheral tissue metabolism of T4 to T3)
Thyroid
+
Low Iodide
-
High Iodide
"Wolff-Chaikoff effect"
(~80% T4: 20% T3)

Adrenocorticotropic hormone (ACTH) or "corticotropin"

Functions:

1- It stimulates the development of the adrenal cortex.

2- It stimulates the formation and secretion of all the adrenal cortex hormones except aldosterone hormone .

3- It has a fat mobilizing effect.

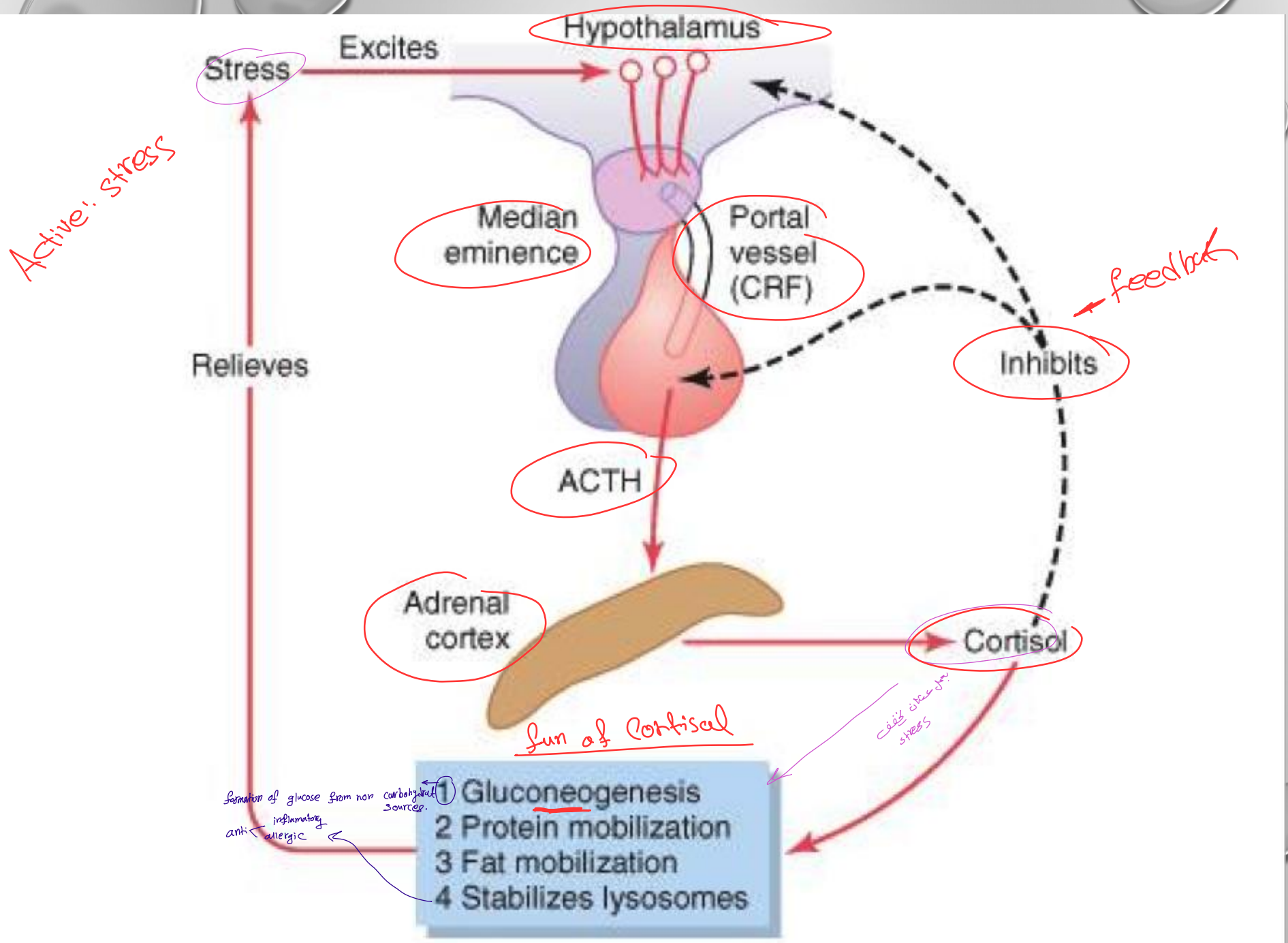
4- It has melanocyte-stimulating effect.

CONTROL

1- ***Feedback mechanism*** : Increase in adrenocortical hormones level in blood → inhibits ACTH secretion directly on the anterior pituitary and through inhibition of the hypothalamus.

2- ***Stress***: Emotional stress stimulate the hypothalamus to secrete corticotropin - releasing factor to stimulate ACTH secretion.

3- ***ADH*** : Stimulates corticotropin release.


Hypothalamus
Excites
Stress
Active: stress
Median eminence
Portal vessel (CRF)
feedback
Relieves
Inhibits
ACTH
Adrenal cortex
Cortisol
fun of Cortisol
1 Gluconeogenesis
2 Protein mobilization
3 Fat mobilization
4 Stabilizes lysosomes
formation of glucose from non carbohydrate sources.
anti inflamatory
allergic

Gonadotropins hormones

A- follicle-stimulating hormone (FSH)

B-luteinizing hormone (LH)

- Two hormones are secreted from the anterior pituitary to **REGULATE THE OVARIAN AND TESTICULAR ACTIVITY** :

FUNCTIONS:

A- Follicle-stimulating hormone (FSH):

IN FEMALES It stimulates the growth and maturation of graafian follicle and secretion of estrogen from it .

IN MALES It stimulates spermatogenesis.

B-luteinizing hormone (LH) OR Interstitial cell stimulating hormone:

IN FEMALE

- It stimulates final maturation of graafian follicle and ovulation
- Formation of corpus luteum and secretion of progesterone.

IN MALE It stimulates the interstitial cells of leydig and secretion of testosterone hormone

CONTROL

1- *FEEDBACK MECHANISM*

-**Small and moderate doses of estrogen:** Stimulate FSH secretion

- **while large dose of estrogen** inhibits FSH secretion. .

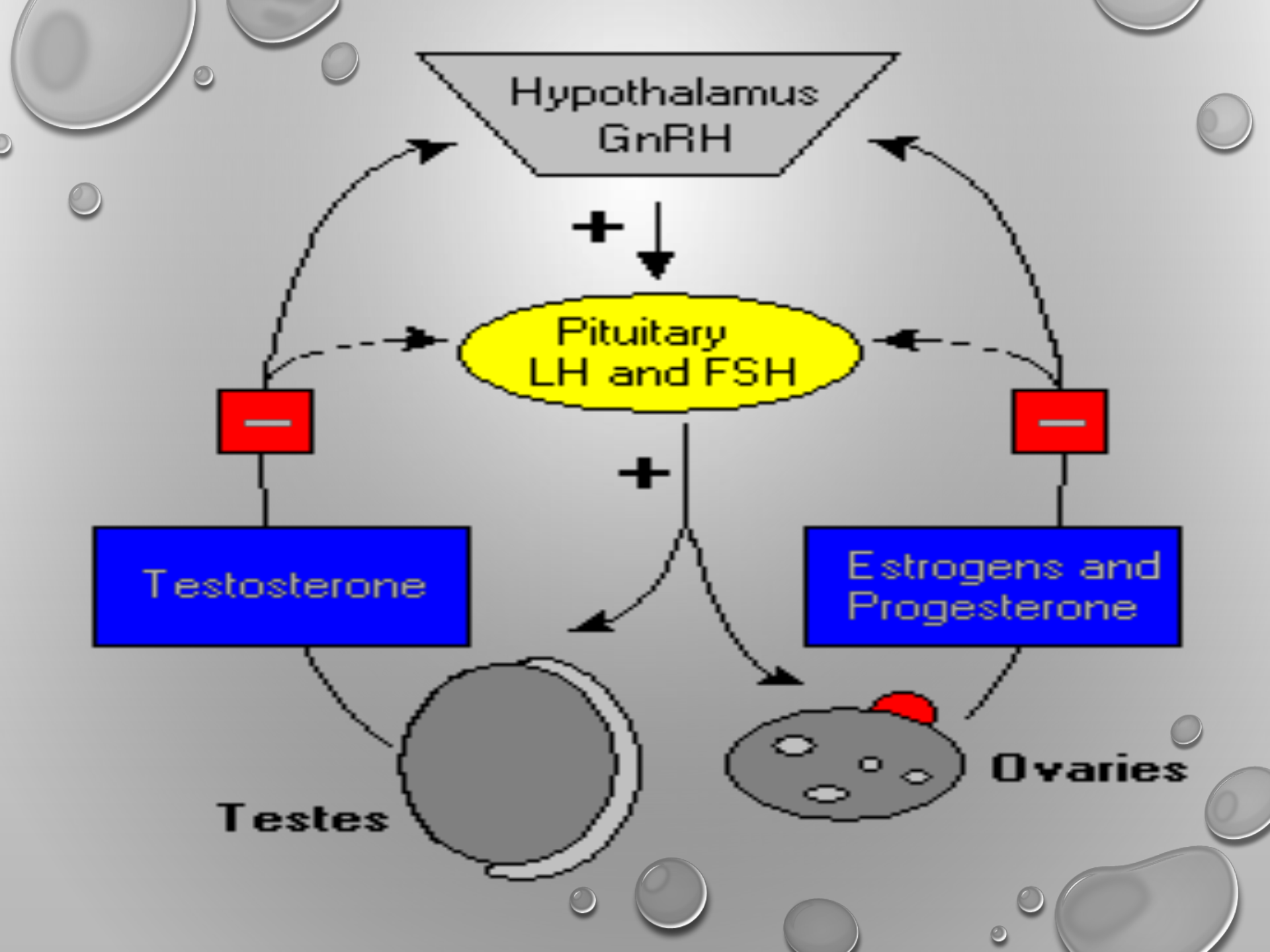
- **Moderate dose of estrogen** Stimulates LH secretion.

- **Increase in progesterone level in blood** inhibits LH secretion and vice versa

2- *HYPOTHALAMUS*

- It secretes gonadotropin-releasing factor (*LH-FSH-releasing factor*) .

- Fear of pregnancy in girls and emotional upsets inhibit the releasing factors ⟶ inhibit FSH and LH secretion ⟶ stoppage of menstrual cycle


Hypothalamus
GnRH
+
Pituitary
LH and FSH
−
−
+
Testosterone
Estrogens and
Progesterone
Testes
Ovaries

GROWTH HORMONE (GH)

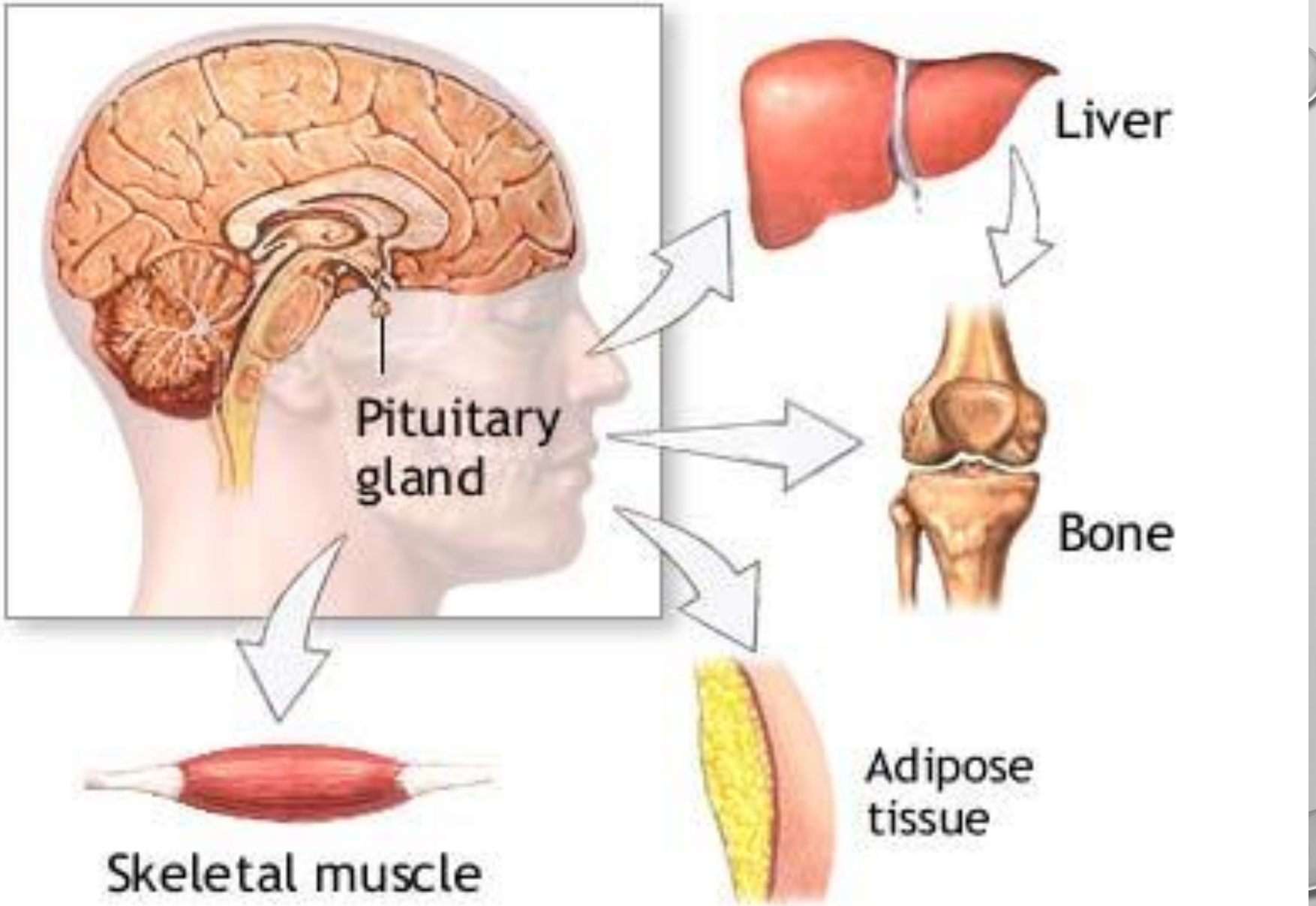
"SOMATOTROPIN"

→ skeleton
→ soft tissu
→ muscle
→ skin
→ viscra
→ Adipose..

*<u>**It is**</u> a polypeptide hormone formed of 191 amino acids.

* The growth hormone is metabolized rapidly in the liver which is responsible for its duration of action (**20 minutes**) .

يعني فترة قليلة
فلما احتاج تشتغل اطول
نعمل الاشي مرتين


Liver
Pituitary gland
Bone
Adipose tissue
Skeletal muscle
A.D.A.M.

Functions of growth hormone

This hormone stimulates growth of all tissues of the body .

it increases the size and number of the cells by :

1- Increase rate of protein synthesis

- It causes protein accumulation in all cells of the body by enhancement of amino acids transport through the cell membrane.
- This results in decreased amino acid blood level
- It increases transcription of DNA to form RNA.
- It stimulates RNA translation in ribosomes.

2- Lipolytic and ketogenic effect

- It increases mobilization of fatty acids and increases the use of fatty acids for supplying energy. as fuel
- So, Excess hormone → Ketosis or Keton Bodies
  and metabolism of fatty acid and production

3- Decreases utilization of carbohydrate for energy production

- It decreases the use of glucose for energy production as a result of increased utilization of fatty acids for energy.
- It depresses uptake of glucose by the cells , so it increases the blood glucose level = anti-insulin effect (diabetogenic effect) .
- It increases insulin release from pancreas (over stimulation) that causes burn out of the beta cells of the pancreas.

4- it increases calcium absorption from the G.I.T.

5- it causes reabsorption of Na+ , K+, Ca++, PO4--, and CL- from the kidney and so , helping bone matrix formation.

6-chondrogenesis and bone growth

(young) GH ↑ ← linear growth ← epiphyseal plate
(adult) GH ↑ ← widning of peripheral bone (acromegaly) no linear growth
hand
feets

- In young subjects in which the epiphysis have not yet fused to the long bones , growth hormone stimulates chondrogenesis (proliferation of epiphyseal cartilage), and as the cartilaginous epiphyseal plates widen, they lay down more matrix at the end of long bones with stimulation of osteoblastic activity (bone forming cells) → increased length of long bones.

- In adult subjects in which the epiphysis a
linear growth is impossible.

نمو العظام في الأطفال (young subjects):

1. وضع صفيحة النمو (epiphyseal plate):

- في الأطفال، لم تلتحم نهايات العظم (epiphysis) مع جسم العظم (diaphysis).
- هذا يعني أن **صفيحة النمو** (وهي منطقة غضروفية بينهما) ما زالت **مفتوحة** وقادرة على النمو.

2. دور هرمون النمو (GH - Growth Hormone):

- هرمون النمو يعمل على **تحفيز خلايا صفيحة النمو الغضروفية**.
- هذا التحفيز يؤدي إلى **chondrogenesis**:
  - وهي عملية **تكاثر الخلايا الغضروفية** داخل الصفيحة.
  - هذه الخلايا تفرز **مادة بينية (matrix)** تُستخدم لاحقًا لتكوين العظم.

3. توسع صفيحة النمو:

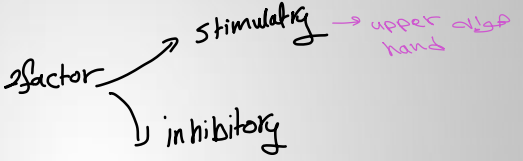
- كلما تكاثرت الخلايا الغضروفية وزاد إفرازها للمادة البينية:
  - تزداد **سُمك صفيحة النمو**.
  - تبدأ الخلايا البانية للعظم **(osteoblasts)** بتحويل هذا الغضروف إلى **نسيج عظمي**.

Control of growth hormone secretion

1-feedback mechanism:

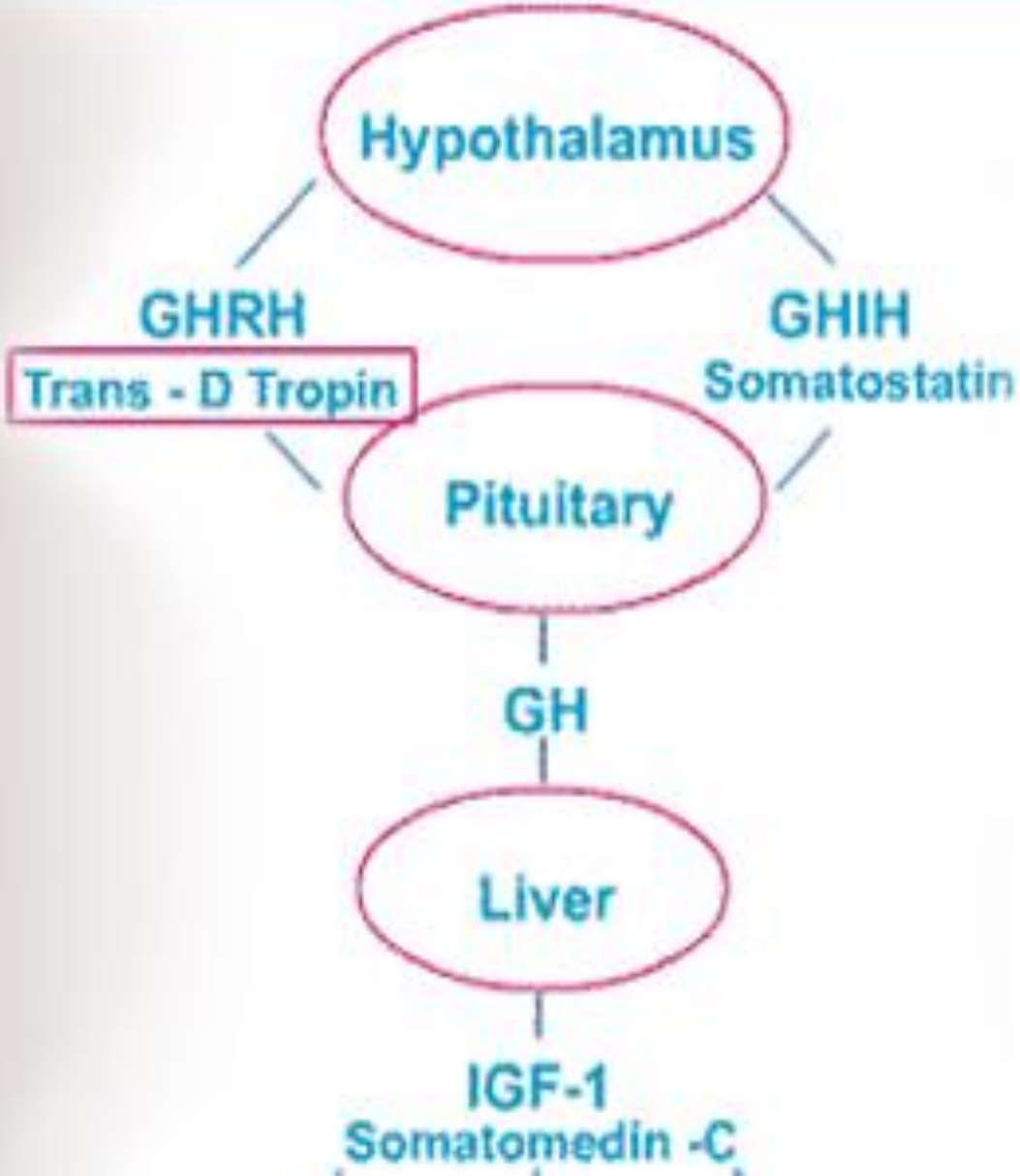
- Hypoglycemia and increased amino acid concentration in blood, stimulate the release of G.H.
- Growth hormone feeds back to inhibit its own secretion.

2- hypothalamus:



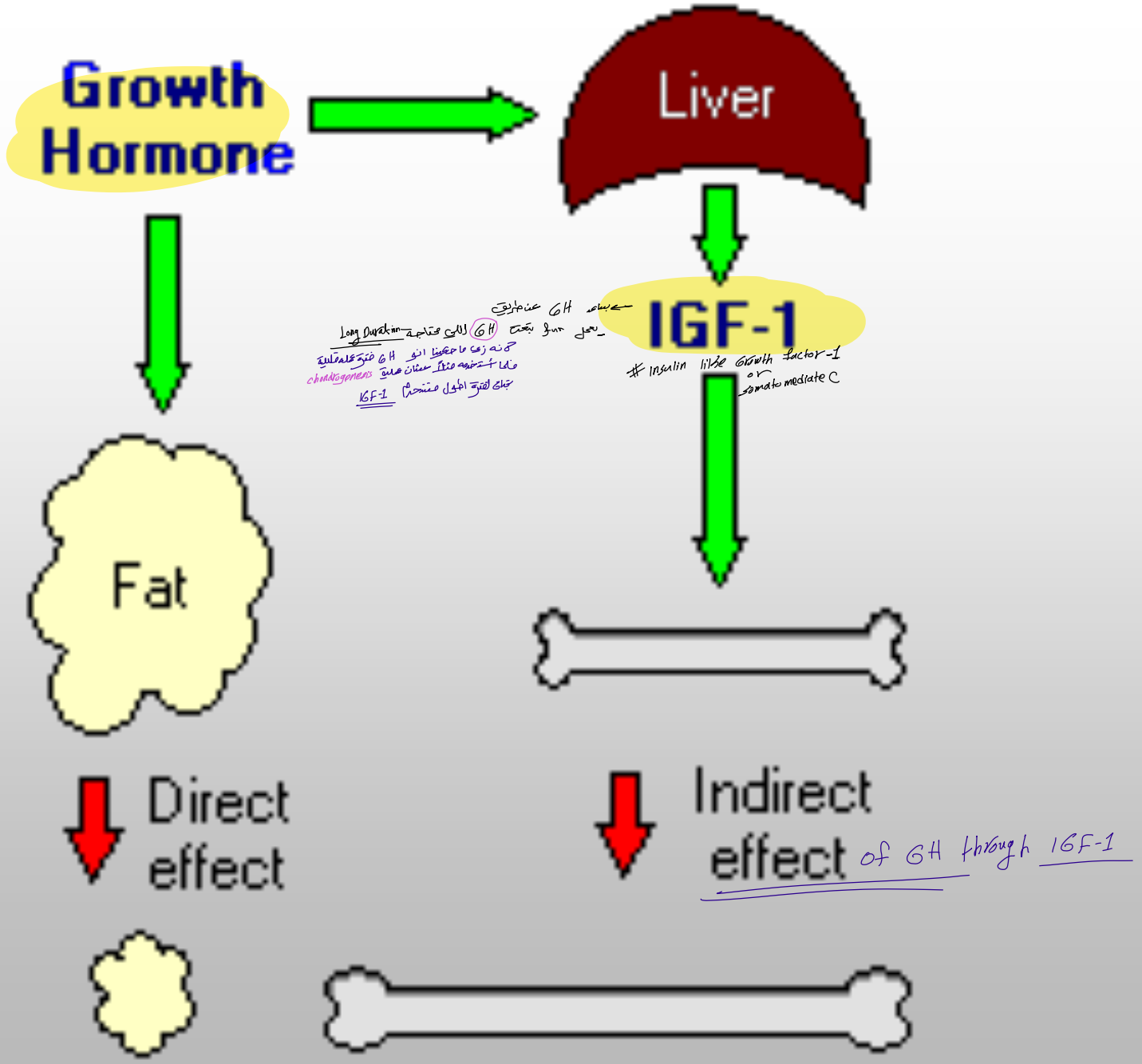
- It secretes a **somatotropin- releasing factor** (SRF) which stimulates the release of G.H. Cellular depletion of proteins enhances SRF secretion (to correct the protein deficiency) beside stressful stimuli.
- The hypothalamus also release an inhibitory factor , **somatostatin**.

Flow Chart Representing Growth Hormone Production



Mechanism of action of growth hormone

- G.H. Acts on the liver to produce **somatomedin C** (**IGF-1**)
- Induce growth promoting activities in many tissues as cartilage with a prolonged duration of action.


Growth Hormone
Liver
IGF-1
Fat
Direct effect
Indirect effect of GH through IGF-1

Prolactin hormone

↳ Main fun : mills formation.
oxytocin : ⁄⁄ ejection

exam

- **It is** one of the hormones of the anterior pituitary gland , secreted by the lactotroph cells (alpha cells).
- It is a protein consists of 170 amino acids.

Control of secretion

1. Hypothalamic control:

predominant

- The hypothalamic effect is mainly inhibitory.
- Two hypothalamic factors for prolactin regulation

- **Prolactin release inhibiting factor: Dopamine**

- **Prolactin releasing factor: TRH**

2.Hormones

1-Thyroxine → Inhibit prolactin secretion via -ve feedback

2-Estrogens → Stimulate the release of prolactin via:

A- increase the number of TRH receptors on the lactotrophs cells.

B- stimulate lactotrophs to secrete prolactin.

C- increase proliferation (number) of lactotrophs.

3- prolactin secretion is increased also during sleep and exercise

Normal level of prolactin

- **The normal level** of prolactin is 10-25 ng/ml with diurnal variation in which the peak level occurs 4-5 hours after the onset of sleep.

- **During pregnancy** , Prolactin levels rise to high concentrations (reach 200-400 ng/ml at term)

this is due to increase in estrogen secretion from the placenta.

- In non-breast-feeding woman , Prolactin level returns to normal non pregnant level in 7 days after delivery. so no suckling
- In breast-feeding woman , Suckling increases the prolactin level to 400-800 ng/ml

اقل من اللي كان during pregnancy

Functions of prolactin

* ما بنفع أم بترضع تحمل .

1. It is the principal hormone that stimulates milk formation.
2. It inhibits ovulation by blocking the effect of gonadotropic hormone on ovaries . this is the cause of amenorrhea during lactation

لحتى تحمل أثناء ترضيع

3. It has a general metabolic functions like those of growth hormone. e.g. diabetogenic action .

4. During pregnancy , the high level of prolactin stimulates breast growth, however, no lactation occurs

صح انو estrogen زاد من prolactin وزاد من
اثناء الحمل لكن قفل effect Lactation بتعه
اثناء الحمل.

- **Lactation** is inhibited during pregnancy by estrogen and progesterone (secreted from the placenta) which interferes with lactogenic effect of prolactin.
- The rapid disappearance of estrogen and progesterone after delivery allow prolactin to stimulate milk formation.