Anterior pituitary

By

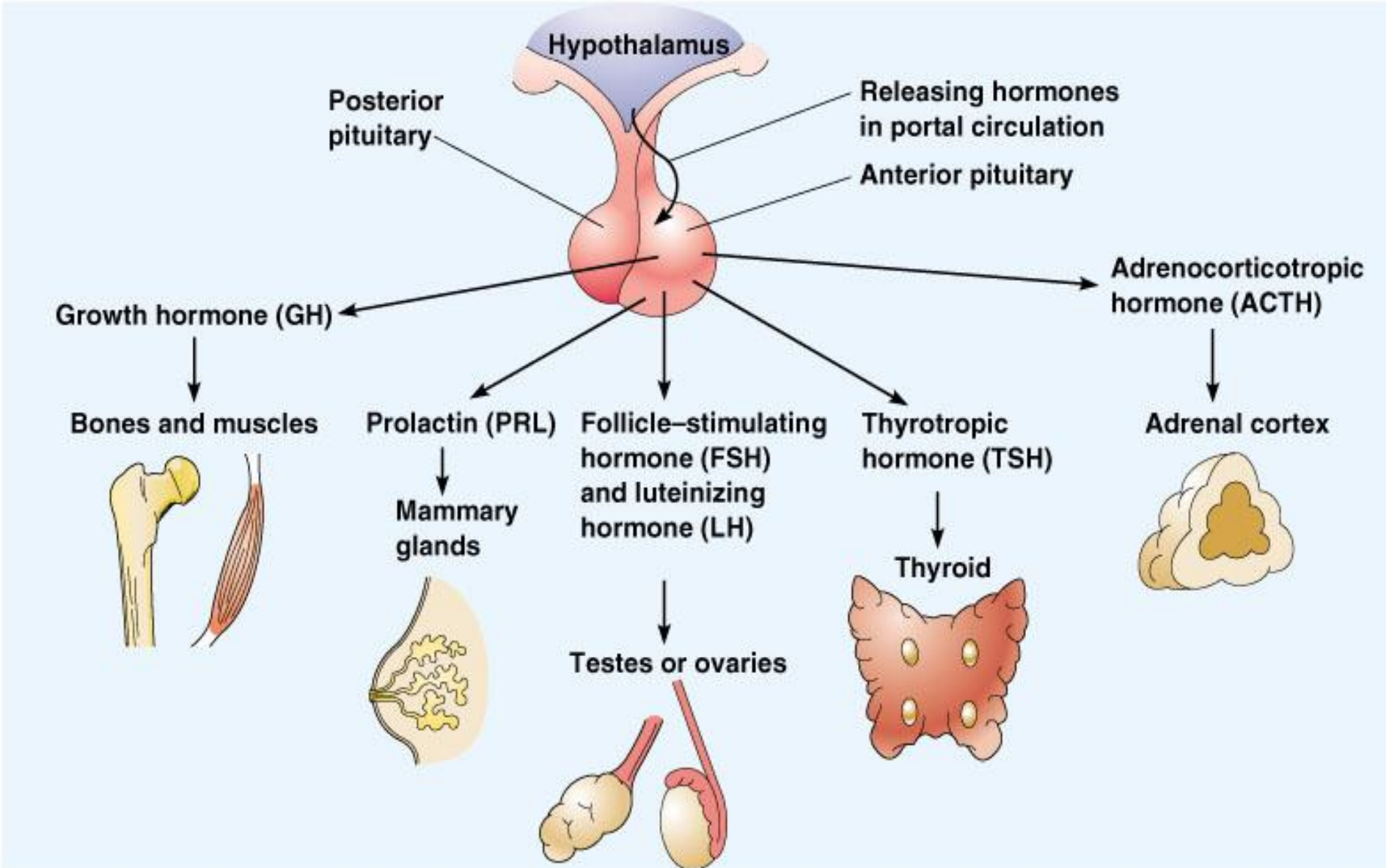
Dr. Nour A. Mohammed

MUTAH SCHOOL OF MEDICINE

Anterior Pituitary (Adenohypophysis)

- "Master Gland" (makes & secretes various **trophic** hormones)
- Trophic Hormones
  - Act on other Endocrine Glands
  - Stimulate release of their hormones

Hormones of the Anterior Pituitary



Hormones of Anterior Pituitary

1. **Thyroid Stimulating 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 formation.

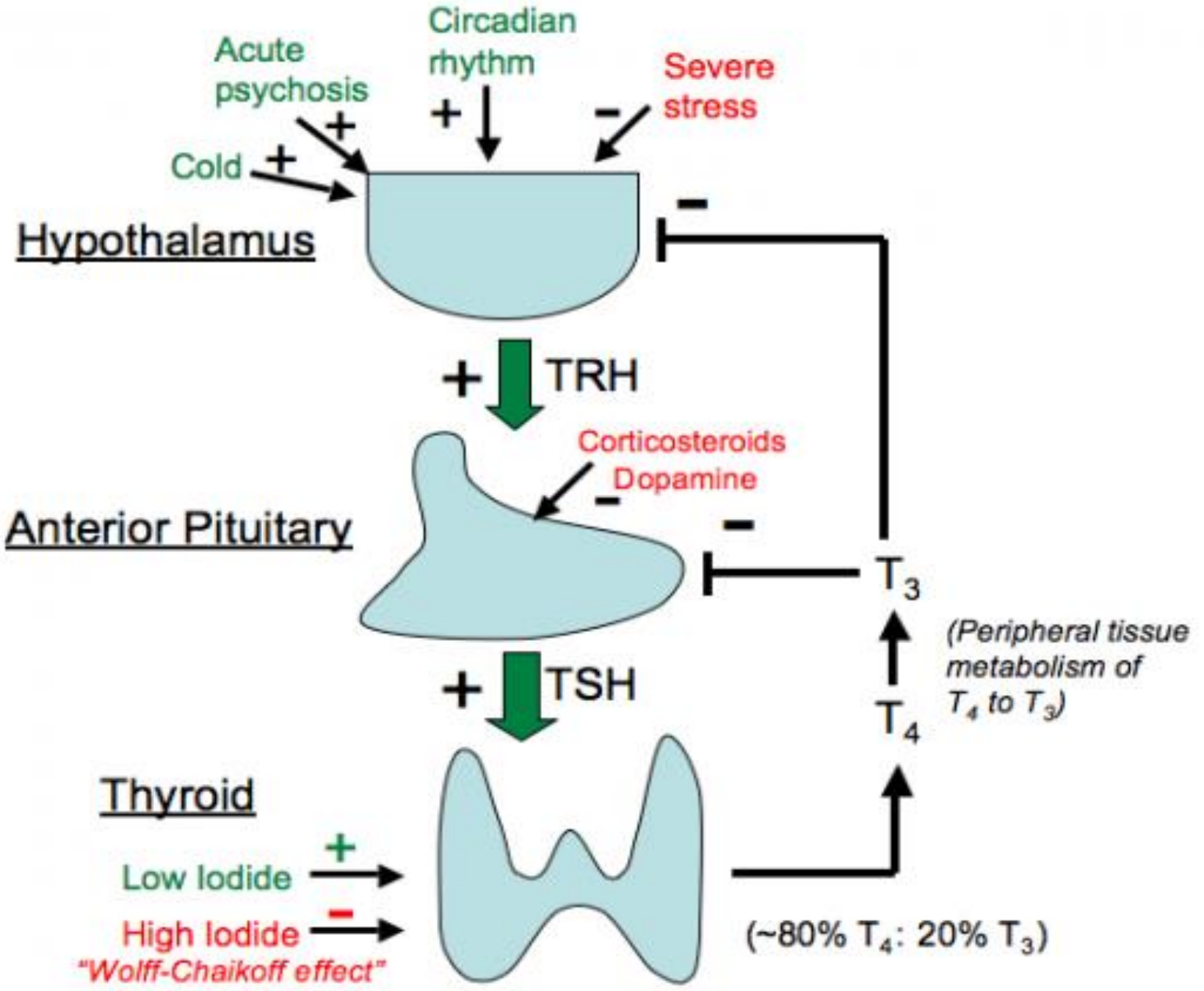
Control:

1- Negative Feedback Mechanism:

increase thyroxine in blood inhibits TSH secretion and inhibits the thyrotropin releasing factor from the hypothalamus,

2-Thyrotropin releasing factor:

stimulates TSH secretion


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

Adrenocorticotrophic hormone (ACTH) -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

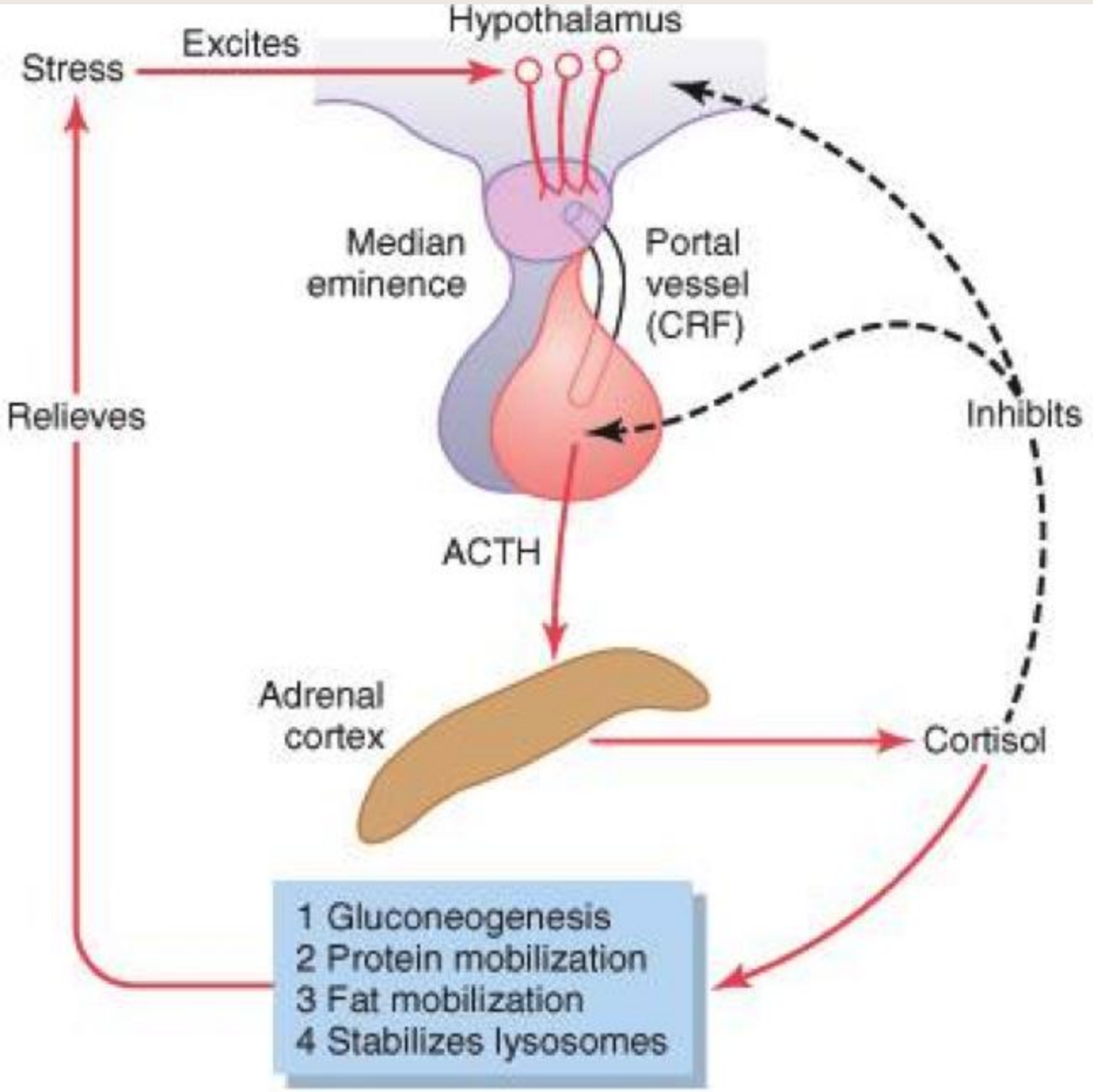
4- It has melanocyte-stimulating effect.

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 corticotrophin release


Hypothalamus
Stress
Excites
Median eminence
Portal vessel (CRF)
Relieves
Inhibits
ACTH
Adrenal cortex
Cortisol
1 Gluconeogenesis
2 Protein mobilization
3 Fat mobilization
4 Stabilizes lysosomes

Gonadotrophins:

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 oestrogen from it .

In Males It stimulates spermatogenesis.

B-Luteinizing hormone (LH) or interstitial cell stimulating hormone:

In Female

- It stimulates 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. .

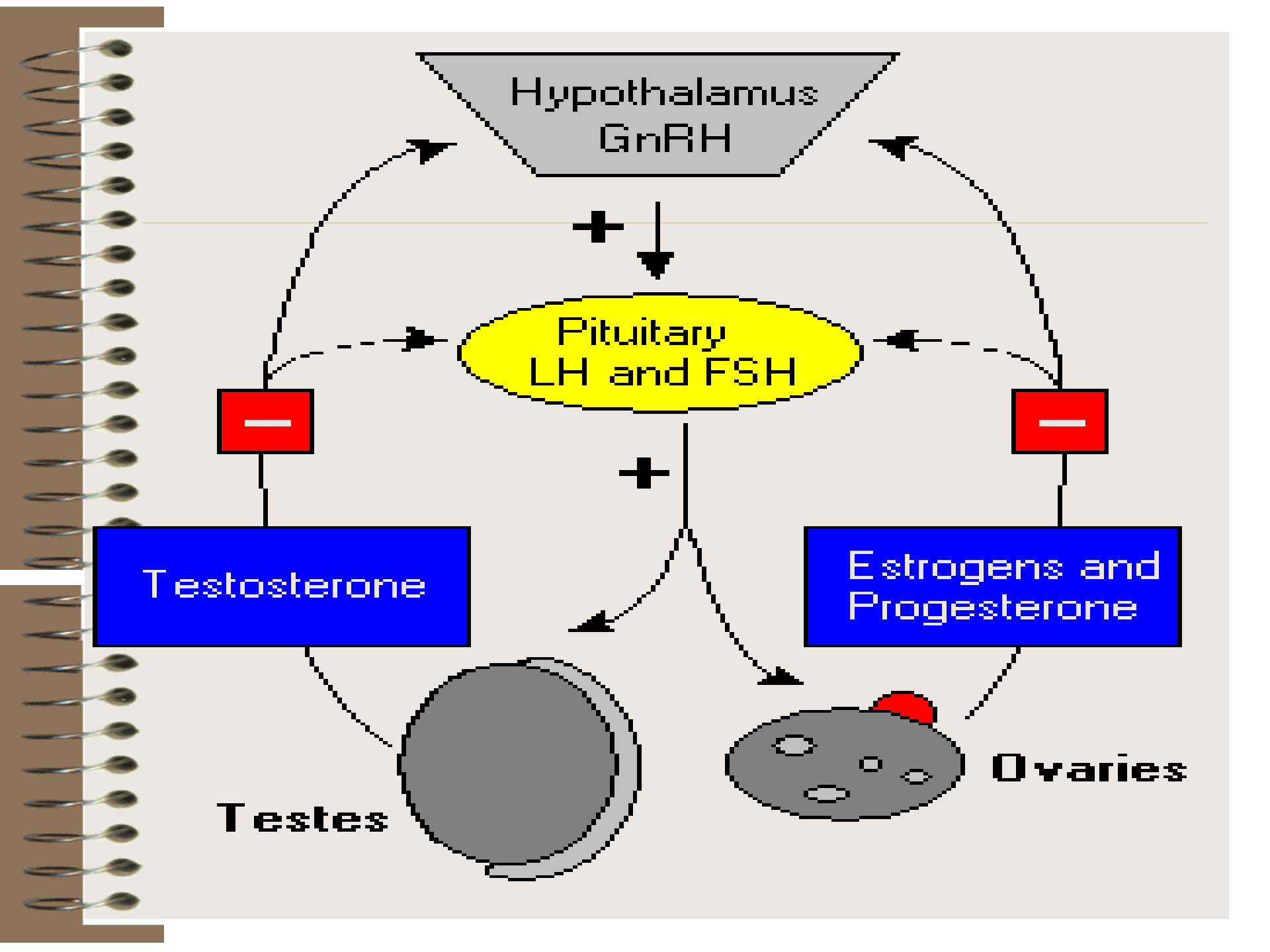
- **Moderate dose of estrogen** stimulates LH secretion.

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

2- *Hypothalamus*

- It secretes Gonadotropin-releasing factor (*LH-FSH-Releasing factor*) .

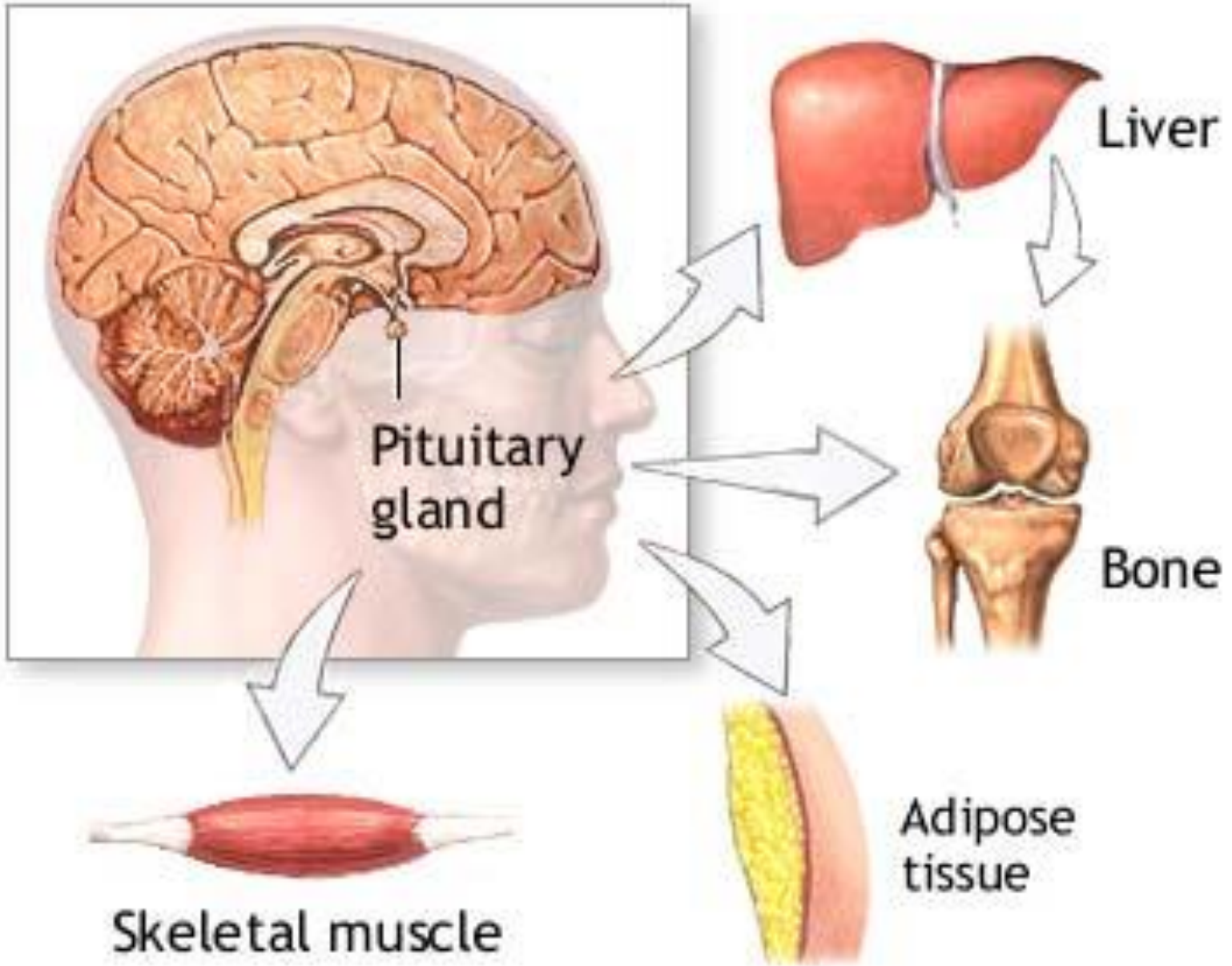
- Fear of pregnancy in girls and emotional upsets inhibit the releasing factors → inhibit FSH and LH secretion → stoppage of menstrual cycle .


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

Growth hormone (GH) Somatotropin

*__It is__ 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) .


Liver
Pituitary gland
Bone
Adipose tissue
Skeletal muscle

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.
- So, excess hormone → ketosis

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 C1-** from the kidney and so , helping bone matrix formation.

6-Chondrogenesis and Bone Growth :

- 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 are closed the linear growth is impossible.

Control of Growth hormone secretion :

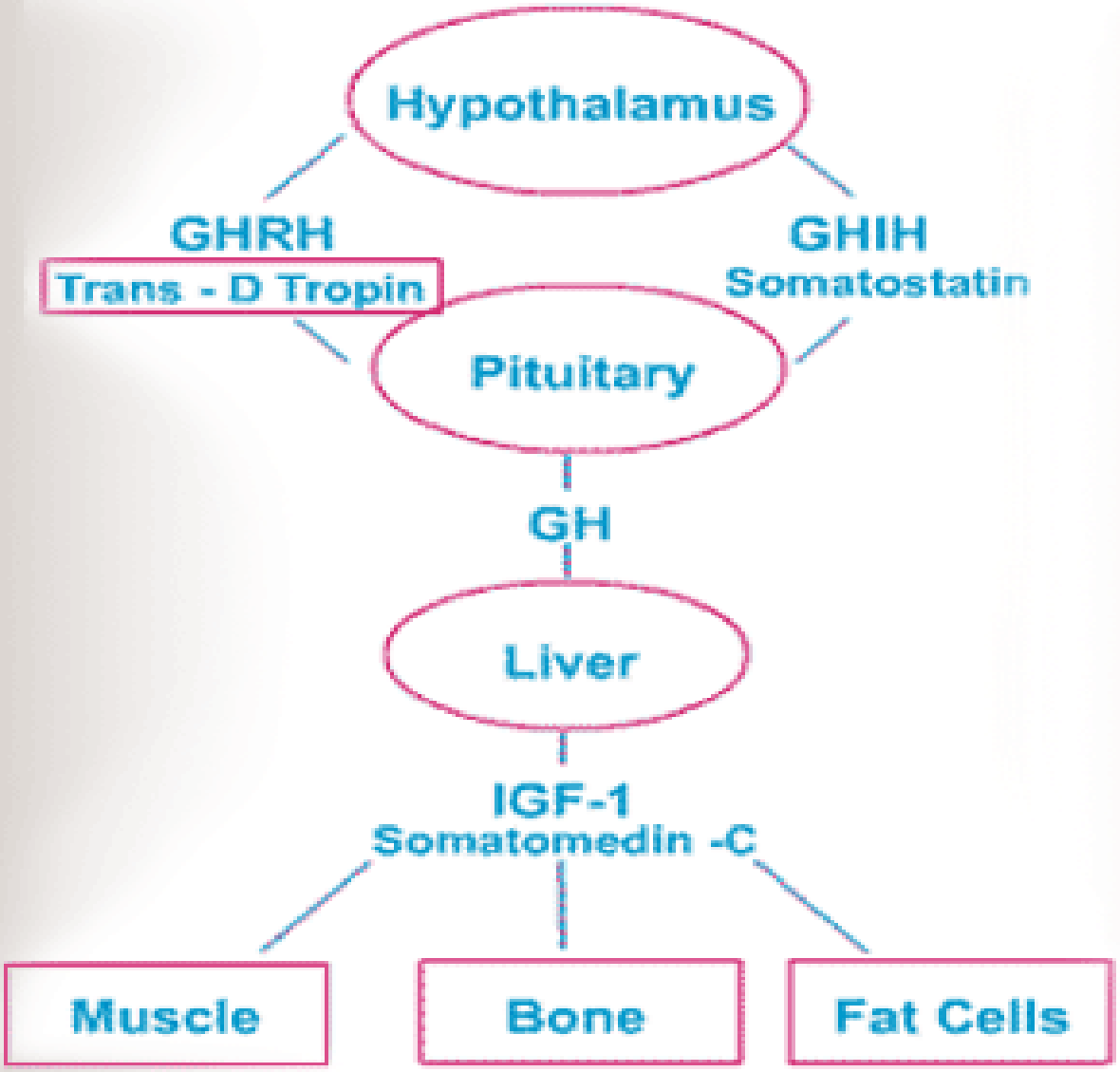
1-Feedback Mechanism:

- 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:

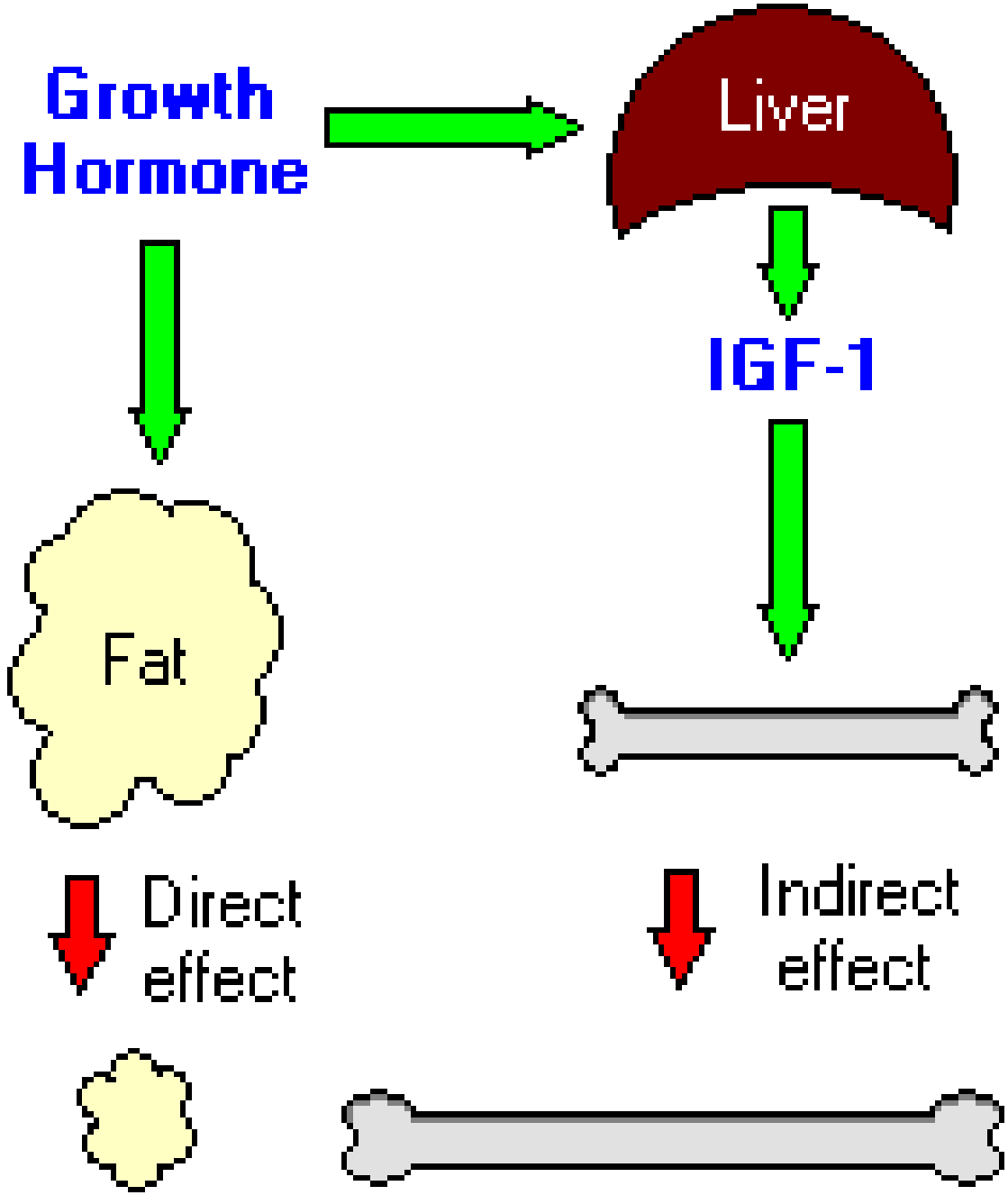
- It secretes a **Somatotropin- releasing factor** (SRF) which stimulates the release of G.H. Cellular depletion of proteins enhances SRF secretion (to correct the protein deficiency) beside stressful stimuli.
- The hypothalamus also release an inhibitory factor , **Somatostatin**.

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

Prolactin hormone

- **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:

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

- Prolactin Release Inhibiting Factor: Dopamine

- Prolactin Releasing Factor: TRH

2.Hormones

Thyroxine → inhibit prolactin secretion via -ve feedback

Estrogens → stimulate the release of prolactin via:

a- increase the number of TRH receptors on the lactotrophs

b- stimulate lactotrophs to secrete prolactin.

c- increase proliferation 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.
- In breast-feeding woman , suckling increases the prolactin level to 400-800 ng/ml

Functions of prolactin:

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

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

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.


THank you