Endocrine

434 Physiology team
presents to you:

Anterior Pituitary Gland

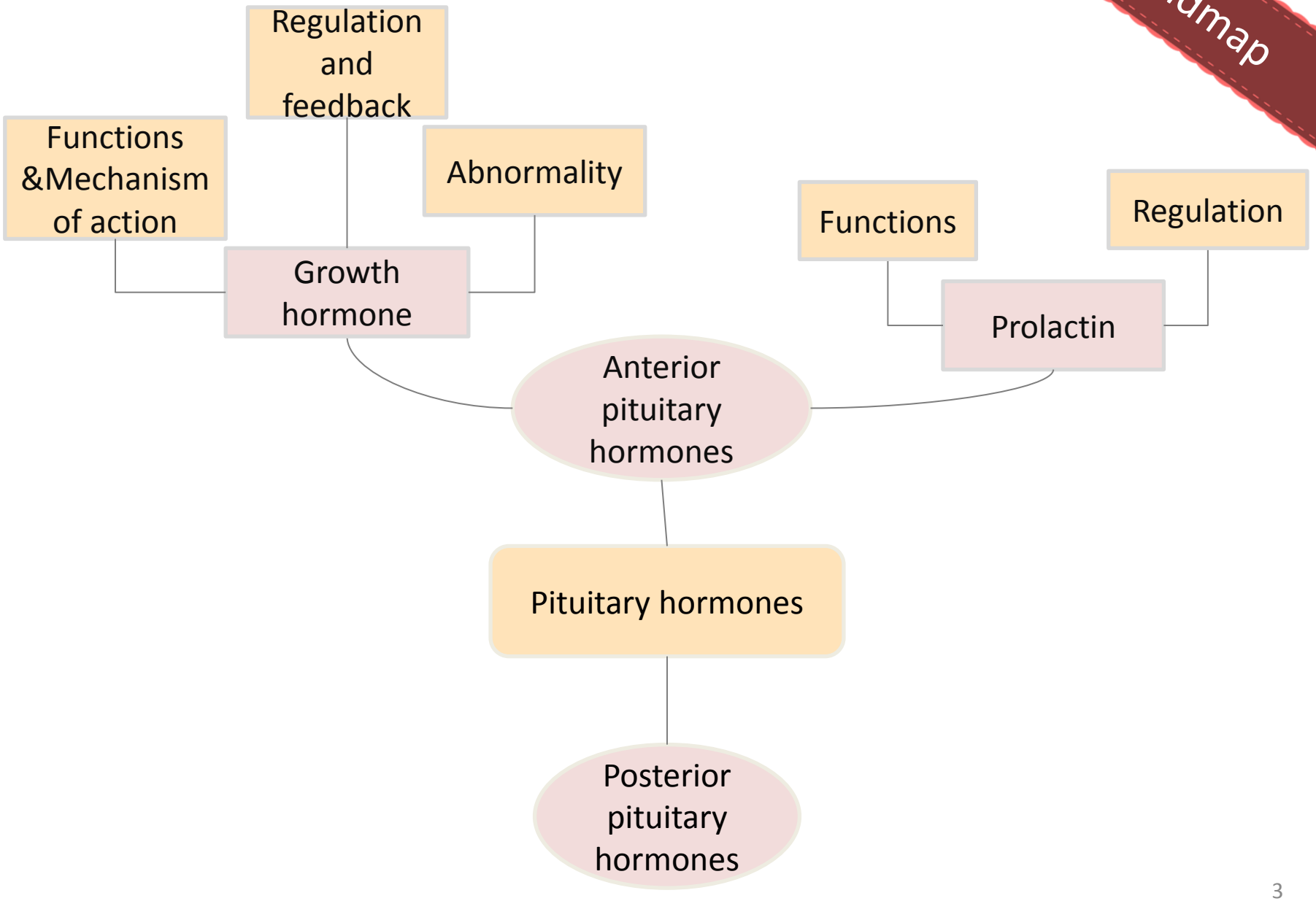
- Important
- Further explanation

Contents

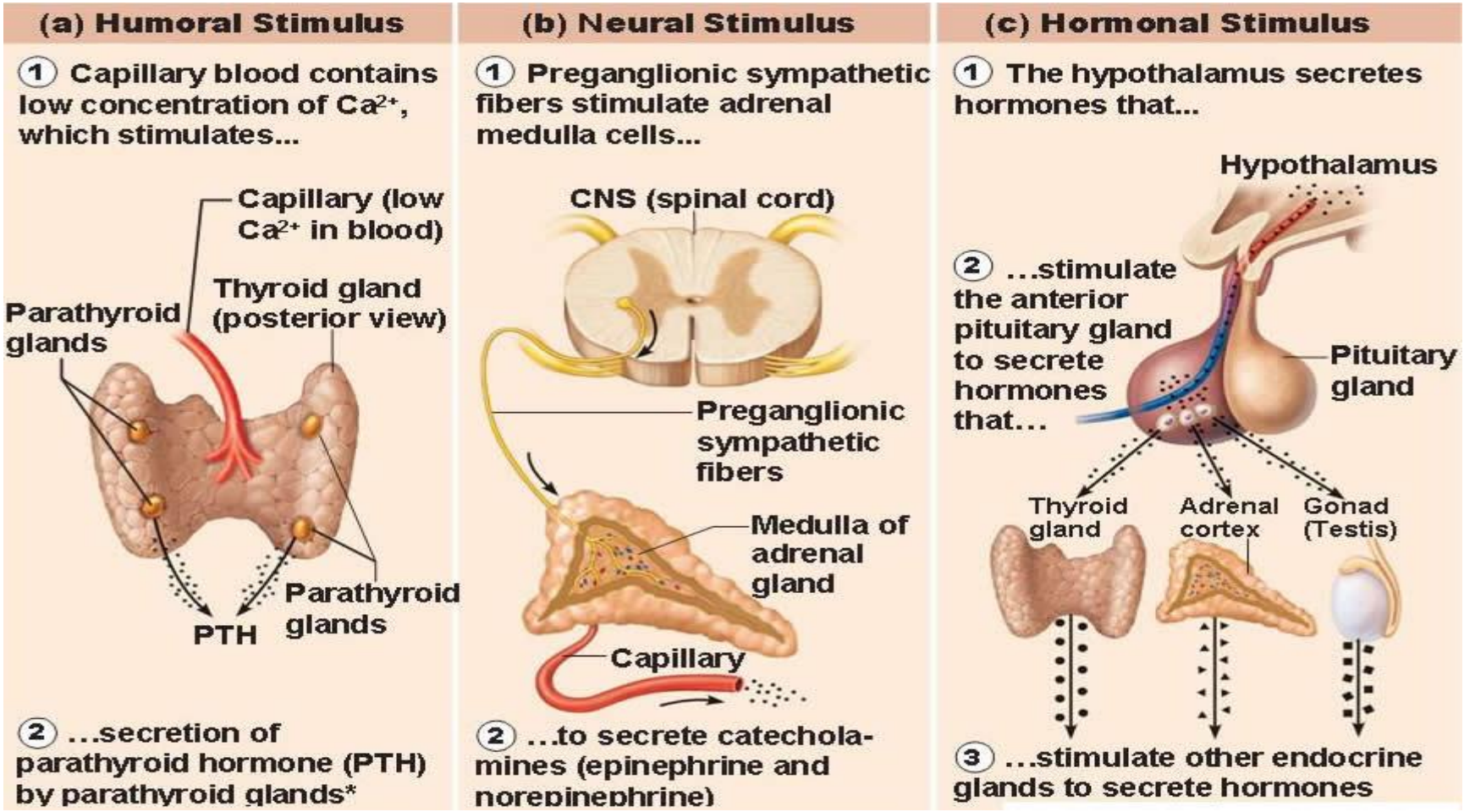
Only 1:18 mins
Highly recommended pituitary hormones mnemonic video

Please check out this link before viewing the file to know if there are any additions/changes or corrections. The same link will be used for all of our work Physiology Edit

Mindmap


Regulation and feedback
Functions &Mechanism of action
Abnormality
Growth hormone
Functions
Regulation
Prolactin
Anterior pituitary hormones
Pituitary hormones
Posterior pituitary hormones

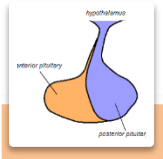
Endocrine Gland Stimuli May Be:



Pituitary gland

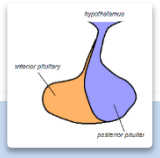
NOTE: mostly all pituitary hormones are secreted in a pulsatile manner*.

Anterior pituitary hormones

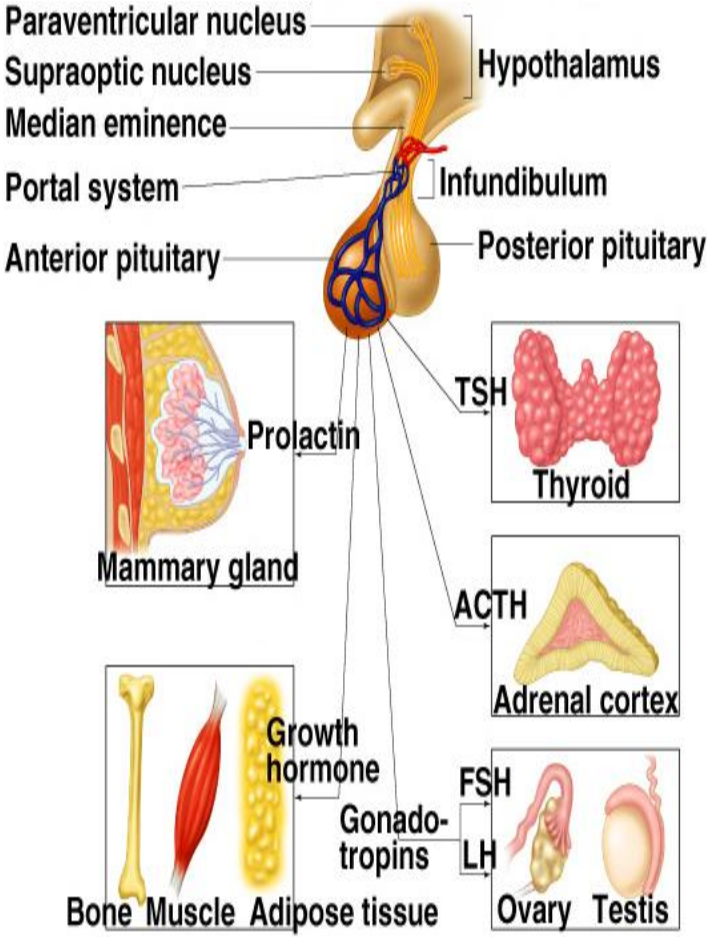


- (Adenohypophysis)connect to hypothalamus by portal system and no direct neural contact ,Synthesizes and secretes hormones
- GH
- Prolactin
- Others (TSH, ACTH, FSH, LH) Regulate the activity of other endocrine glands
- In addition (POMC)Has been isolated from the pituitary .Is enzymatically split into ACTH, opiates, and MSH

Posterior pituitary hormones



- (Neurohypophysis) **Receives**, stores, and releases hormones from the hypothalamus
- ADH
- Oxytocin



Anterior pituitary hormones

1:also called the hypophysis connected to the hypothalamus by the pituitary (or hypophysial) stalk

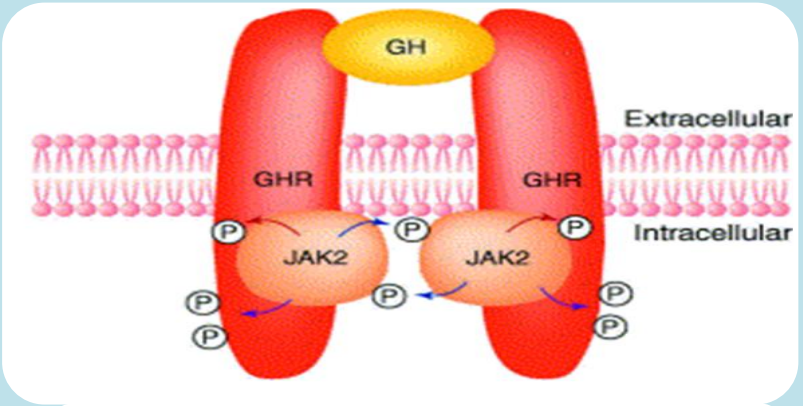
*secreted in a burst-like, rhythmic, or episodic manner rather than constantly (نبضات)

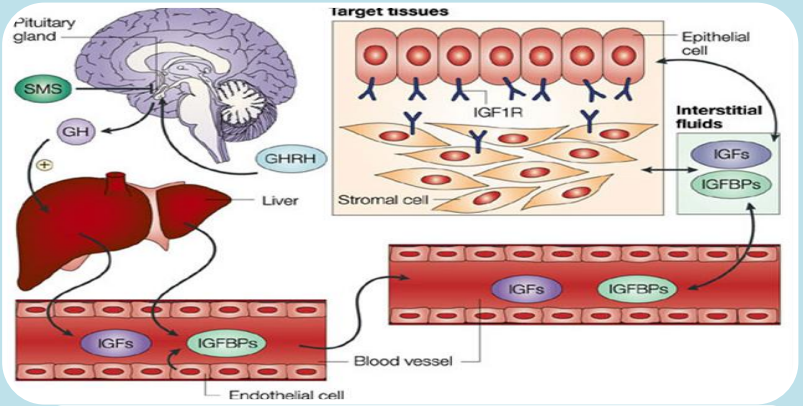
Growth hormone
(Somatotropin)

- Produced by somatotropic cells of the anterior lobe that: somatotropic cells are acidophilic cells
  - Stimulate most cells, but target bone and skeletal muscle
  - Promote protein synthesis (anabolic effect)
  - Encourage the use of fats for fuel (catabolic effect)
- Most effects are mediated

Indirectly by somatomedins

Mechanisms of Growth hormone:





Direct effect:

GH is a protein hormone **(requires a receptor to get into the cell)**

Act directly on the receptors which are located on the cell membrane.

Indirect effect:

Depend on somatomedin

(IGF*) secreted by the liver which is responsible for effect of GH on:

Bone & cartilage growth

Increase the synthesis of protein in skeletal muscles

IGF = insulin– like growth factor

Functions of growth hormone:

1) **Long term effect**

Promotion of growth

(indirect and mediated by insulin-like growth factor 1(IGF-1)

- ↑cellular sizes
- ↑ mitosis
- ↑ tissue growth &
- ↑ Organ size

Mechanisms of bone growth :

Linear growth	Deposition of New Bone
• Long bones grow in length at epiphyseal cartilages • causing deposition of New Cartilage • followed by its conversion into bone. • Occurs in long bones	• cell proliferation on surfaces and cavities of older bone • Increase the bone thickness • Occurs in membranous bones, e.g. jaw, & skull bones.

Functions of growth hormone: cont

2) Short term effect

Metabolic effects

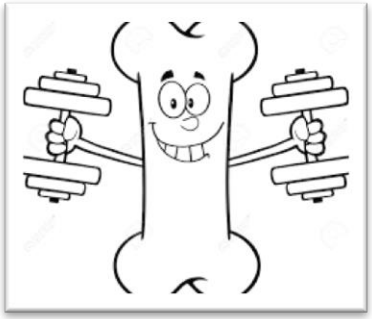
(direct)

Think about it as if you're starting losing weight and exercising. Increasing the muscle mass(protein anabolic effect) and burn your fats ☺ (fat catabolic effect)

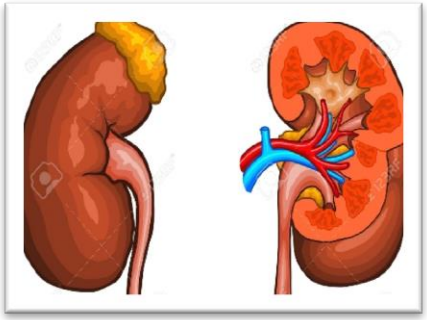
Protein metabolism: Anabolic	Fat metabolism: Catabolic	CHO metabolism: Hyperglycemic (higher the glucose concentration in the serum)
• ↑rate of protein synthesis in all cells through: • ↑AA transport into cells • ↑DNA transcription= RNA synthesis • ↑RNA translation= protein synthesis	• ↑Mobilization of FFAs from adipose tissue stores • Conversion of ⟶ FFA ⟶ acetyl CoA (provide energy)	• ↓glucose uptake by tissues • ↓rate of glucose utilization throughout the body • ↑Gluconeogenesis • insulin resistance (↑FFA)
• ↓protein catabolism "protein sparer"		• this effect called (Diabetogenic) or anti insulin effect of GH.

Other effects of growth hormone:

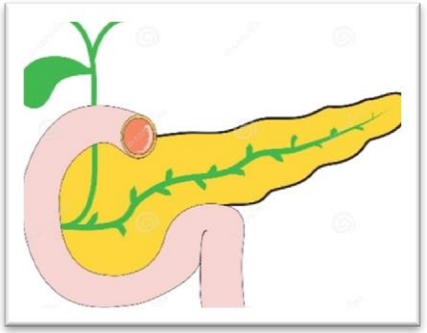
Increases calcium absorption from GIT (we need calcium for bone growing)



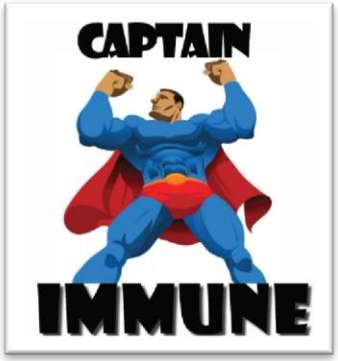
Strengthens and increases the mineralization of bone



Retention of Na+ and K+ (by acting on the renal tubules and this may increase the blood pressure)

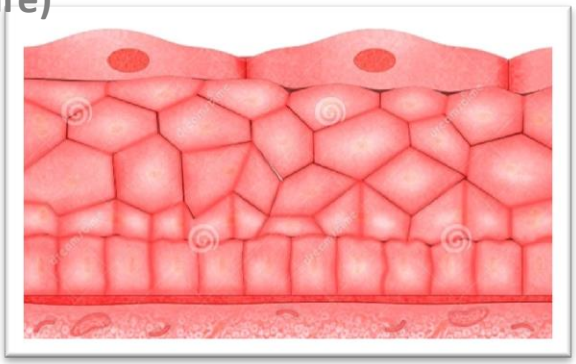


Contributes to the maintenance and function of pancreatic islets



Stimulates the immune system

Increases muscle mass



Stimulates the growth of all internal organs excluding the brain

Very important

Control of GH secretion

Stimulation
Inhibition

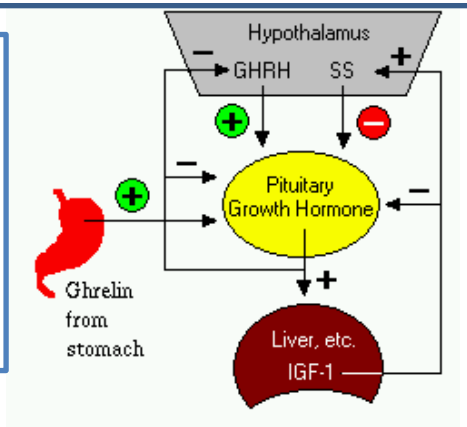
- Decreased glucose level e.g. fasting
- Intake of protein or amino acids (after meals)
- Sleep
- Exercise
- Increase grelin stomach secretion
- stress

Lead to secretion of GHRH from the hypothalamus → GH release from pituitary

- glucose Increase
- Free fatty acid increase e.g. obesity
- High level of Somatomedins &GH

Lead to secretion of GHIH(somatostatin) from the hypothalamus → GH inhibition

NOTE: both GHRH and GHIH are secreted by the hypothalamus in a neuroendocrine fashion to the hypothalamo-hypophyseal portal system. And regulate the actual secretion of the GH via somatotrophs of the anterior pituitary ☺

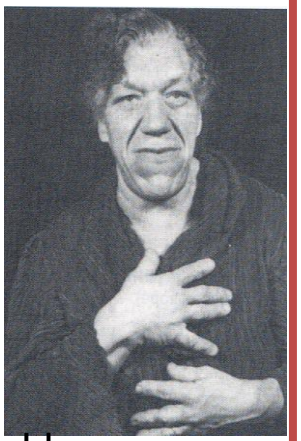


GH Abnormalities

GH

In adult

Acromegaly



- No increase in Height
- soft tissue continue to grow
- Enlargement of bones of hands & feet.
- Enlargement of membranous bones (cranium, nose, forehead bones, supraorbital ridges.)
- Protrusion of lower jaw.
- Hunched back (kyphosis)

in childhood

Gigantism

- all body tissues grow rapidly, including bones.
- increase in Height as it occurs before epiphyseal fusion of long bones with their shafts.
- Hyperglycemia (diabetes).

GH

In childhood

Dwarfism

Prolactin

Act on the epithelial cell that laying the mammary glands alveolus

Increases mRNA

Increases production of casein and lactalbumin

Inhibits the effects of gonadotropins *

Stimulates the secretion of dopamine in median eminence **(inhibits its own secretion)**

وهذا يفسر سبب انقطاع ال menstrual cycle while breastfeeding. So it lowers both (LH)&(FSH)

NOTES:

- Prolactin is responsible for the synthesis of milk
- Oxytocin (secreted through the posterior pituitary gland is responsible for ejection of milk.
- The only hormone would be elevated in events of pituitary injury. Because of the absence of the inhibitory path way (dopamine or PIH) coming from the hypothalamus.
- Link to pharmachology: Dopamein antagonists block the inhibition of the Mammotrophs so they cause galactorrhea.
- You will understand the previous two points after reading the coming slide

Prolactin

Regulation

Suckling response inhibits PIH release inhibition of the inhibition = stimulation

Release is inhibited by PIH (dopamine)

Factors increase PRL secretion:

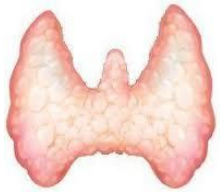
Pregnancy

Sleep

Surgical & psychological stress

Exercise

Stimulation of the nipple



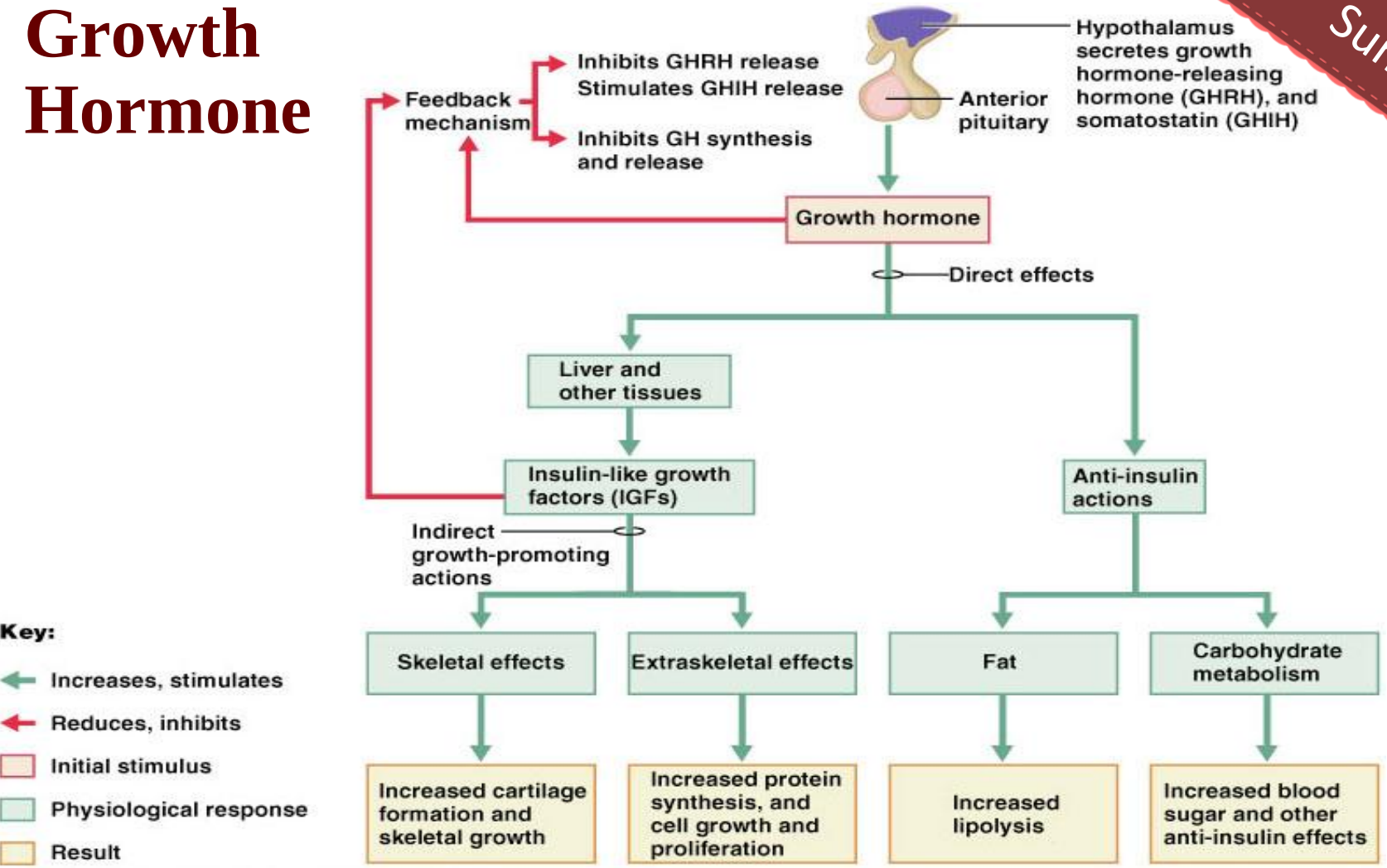
TRH

Others

Hormone	Target Tissue	Principal Actions	Regulation of Secretion
ACTH (adrenocorticotropic hormone)	Adrenal cortex	Stimulates secretion of glucocorticoids	Stimulated by CRH (corticotropin-releasing hormone); inhibited by glucocorticoids
TSH (thyroid-stimulating hormone)	Thyroid gland	Stimulates secretion of thyroid hormones	Stimulated by TRH (thyrotropin-releasing hormone); inhibited by thyroid hormones
GH (growth hormone)	Most tissue	Promotes protein synthesis and growth; lipolysis and increased blood glucose	Inhibited by somatostatin; stimulated by growth hormone-releasing hormone
FSH (follicle-stimulating hormone)	Gonads	Promotes gamete production and stimulates estrogen production in females	Stimulated by GnRH (gonadotropin-releasing hormone); inhibited by sex steroids and inhibin
PRL (prolactin)	Mammary glands and other sex accessory organs	Promotes milk production in lactating females; additional actions in other organs	Inhibited by PIH (prolactin-inhibiting hormone)
LH (luteinizing hormone)	Gonads	Stimulates sex hormone secretion; ovulation and corpus luteum formation in females; stimulates testosterone secretion in males	Stimulated by GnRH; inhibited by sex steroids

Growth Hormone

Summary



Prolactin:

Function :stimulates the mammary glands to produce milk

Release Inhibition :PIH (dopamine)that released as one of the prolactin functions so; it is inhibits its own secretion

Release Stimulation: Suckling response →inhibit PIH release

Answer key: 1-B 2-A 3-D 4- B 5-A 6-B 7- C 8-D

MCQs

1- Which one of the following is a metabolic effect caused by GH:
A. Protein catabolism
B. Fat breakdown
C. ↓ Blood Glucose level
D. NONE

2- which of the following will inhibit GH action
A. somatostatin
B. Grelin
C. Stress conditions
D. During sleep

3- Short-term effect of GH :
A. Increase cell size
B. Increase organ size
C. Increase Glucose uptake
D. Increase Glucose production

4- Which one of these hormones is not secreted by anterior pituitary:
A.ACTH
B. ADH
C. GH
D. TSH

5-recognized cause that increase growth hormone secretion is :
A. Hypoglycemia
B. Increase fatty acids
C. Hypothyroidism
D. Obesity

6-growth hormone:
A. Has predominantly catabolic effect on skeletal muscles
B. Promotes amino acid entry into cells
C.Increase gluconeogenesis from proteins
D. Increase the blood urea level

7-indirect mechanism of growth hormone depends on :
A. somatostatin
B. Somatotropin
C. Somatomedins
D .Cell membrane receptor

8-prolactin:
A.Is a hormone of hypothalamus
B.Is essential for mammary duct growth
C.Is identical with placental lactogen
D. Secretion is regulated by inhabiting factors of hypothalamus

SAQs

Q1: indirect effect of GH depend on what ?

Ans: IGF secreted by the liver

Q2:list the functions of GH

Ans:

- ❑ increases skeletal growth
- ❑increases muscular growth
- ❑ increases amino acid uptake and protein synthesis by the cells.
- ❑increased use of lipids for energy
- ❑decrease glucose re-uptake by the cells & increases blood sugar level.
- ❑decreased storage of carbohydrates

Q3:mention five factors lead to secretion of GHRH ?

Ans:1)hypoglycemia 2)sleep 3) Exercise 4)stress 5) Intake of proteins

Q4:list three clinical features and the main clinical condition name for the following cases when they develop high growth factor level ?

6 years Patient :**Gigantism**

increase in Height , Hyperglycemia , all body tissues grow rapidly

40 years patient :**Acromegaly**

Protrusion of lower jaw ,Hunched back , Enlargement of bones of hands & feet.

Q5:in brief; how the prolactin stimulated ?

Suckling response →inhibits PIH release((dopamine)the normal inhibitor)→PRL secretion

Thanks for checking our work

Good Luck

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