بسم الله الرحمٰن الرحيم

(وَفَوْقَ كُلِّ ذِي عِلْمٍ عَلِيمٌ)

Endocrine Pharmacology | FINAL 1

Hypothalamic & & Pitutary Hormones

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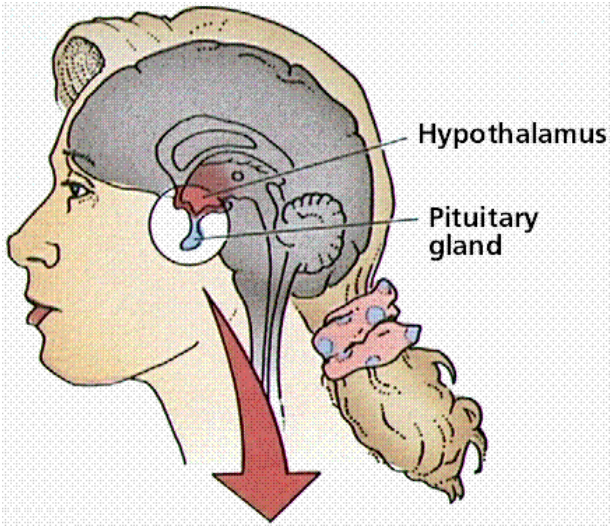
Hypothalamic and pituitary hormones

Introduction

- The endocrine system is regulatory system.
- The Neuroendorine system is controlled by the pituitary and hypothalamus.
- The endocrine system releases hormones into the bloodstream >>>> throughout the body.
- Hormones have a much broader range of response than the nerve do.



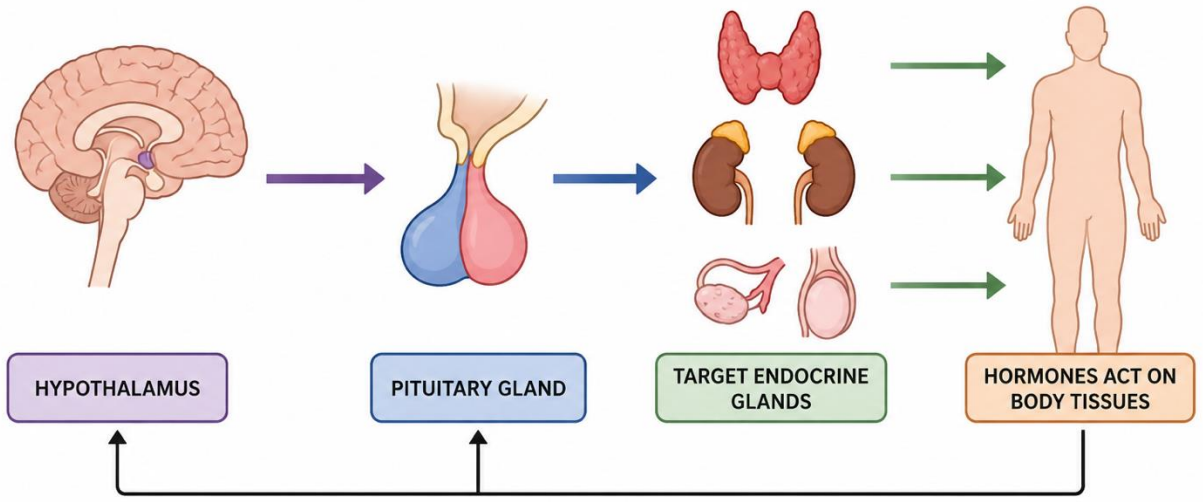
- The endocrine system controls the functions of many other organs and body systems. Therefore, any change or disorder in the endocrine system has a much greater impact than a disorder affecting a single organ.

- To illustrate this idea, the doctor gave the example of a company: if the management changes, the effect extends to the entire company and all employees. In contrast, changing a single employee has a much smaller effect on the overall function of the company.

- Similarly, endocrine glands act as the “management” of the body because they regulate the activity of many organs through hormones.

- Therefore, dysfunction of an endocrine gland can affect multiple organs and physiological processes simultaneously.

The endocrine system is organized in a hierarchical manner. In most endocrine axes, regulation begins at the **hypothalamus**, which controls the **pituitary gland**. The pituitary then secretes tropic hormones that regulate the activity of the **target endocrine glands**, which finally produce the hormones that act on body tissues.



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Clinically, when treating a patient with a hormonal imbalance, the goal is usually to treat the final target organ or replace the deficient hormone,
rather than treating the hypothalamus or pituitary directly.

The reason is that the **hypothalamus and pituitary regulate multiple endocrine glands simultaneously**. Therefore, interfering with these higher regulatory centers may disturb several hormonal pathways at once and produce many unwanted side effects.

For this reason, When we want to prescribe a medication let it be directed at the last step in the endocrine axis (the target gland or its hormone), as this is more specific and minimizes unnecessary systemic side effects.And keep the hypothalamus as the LAST choice .

Scientific note: There is no absolute rule that endocrine disorders must always be treated at the final target organ.

Hypothalamic and pituitary hormones

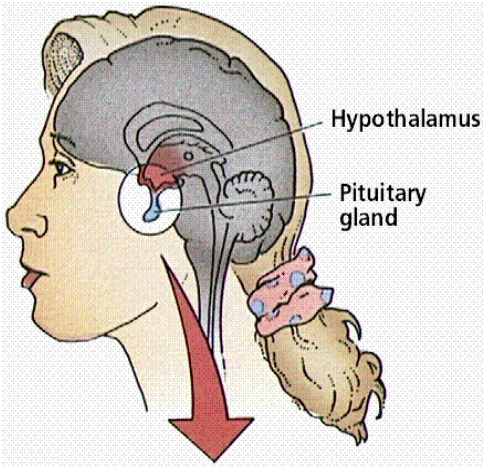
- The hormones secreted by the hypothalamus and the pituitary are all peptide proteins that act by binding to specific receptor sites on their target tissues.

The explanation in the next slide

- The hormones of the anterior pituitary are regulated by neuropeptides that are produced in hypothalamus.

- Each hypothalamic regulatory hormone controls the release of a specific hormone from the anterior pituitary.

- Hormones of the pituitary are administered either intramuscularly, subcutaneously,or intranasally, but **NOT** orally (WHY?) >>> They are Proteins!!!



- **Why are most hypothalamic and pituitary hormones not administered orally?**

Relating this to biochemistry

As we know, proteins have a specific **three-dimensional (3D) structure**, and this structure is **essential for their function**. If the 3D structure is altered, the protein loses its biological activity, and therefore its function is lost.

So, what is the clinical importance of this?
If a protein drug is given **orally**, it first passes through the acidic environment of the stomach, where it becomes denatured. Once denatured, it loses its three-dimensional structure and can no longer function as a hormone.

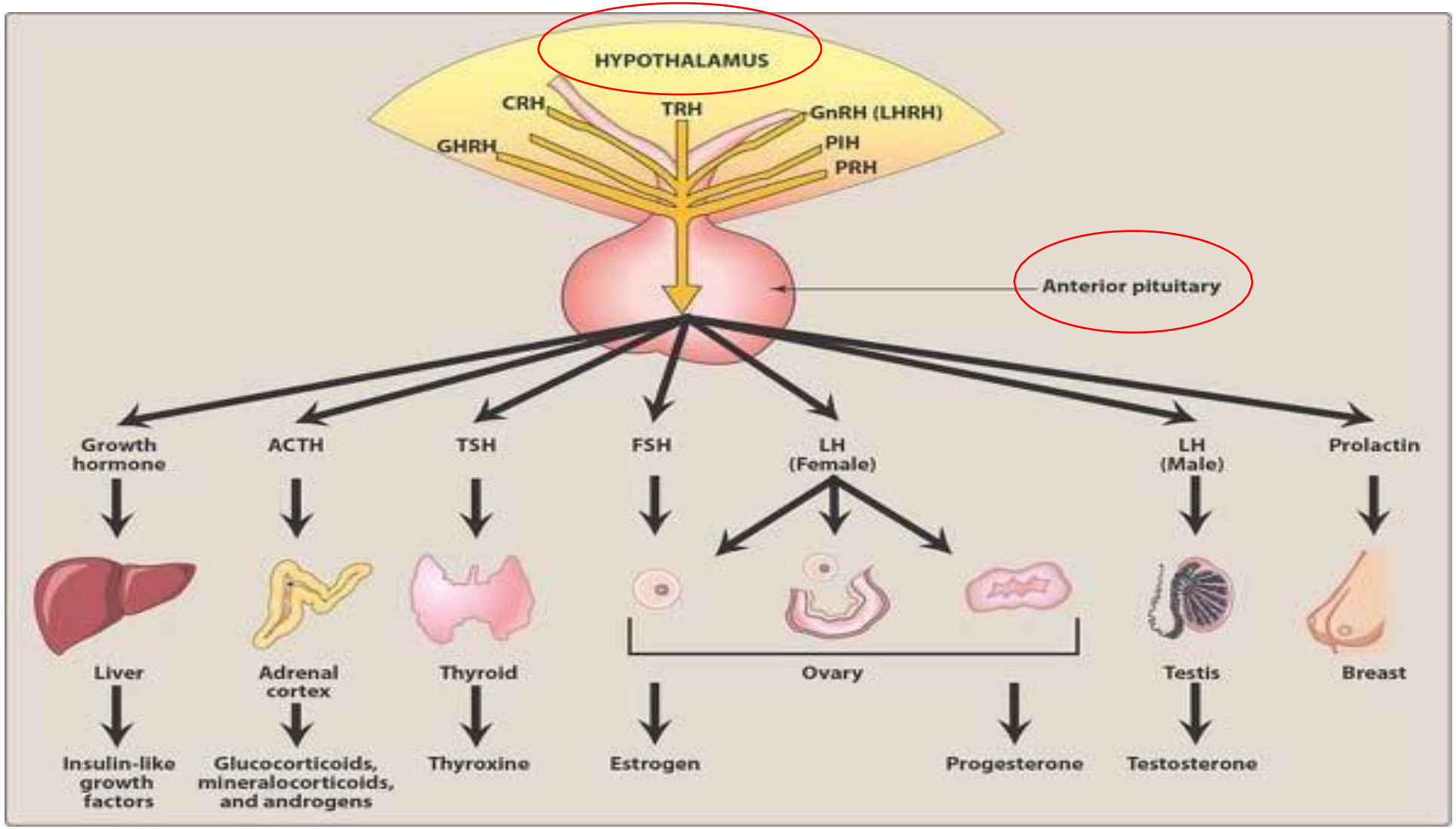
For this reason, protein hormones are generally not administered orally. Instead, they are given through alternative routes such as intravenous (IV), intramuscular (IM), subcutaneous (SC), or intranasal administration, which bypass the stomach and preserve the hormone's structure and function.

For now you have to get two ideas

 The key point 1: To treat the last step in the endocrine axis whenever possible, not the hypothalamus, to achieve a more specific effect with fewer side effects.

 The key point 2: The Route of administration depends on the nature of the hormones . Since protein hormones are denatured in the stomach, they are generally not given orally.

Hypothalamic and pituitary hormones



Anterior pituitary hormones

Hypothalamic and pituitary hormones

Growth hormone (somatotropin)

- Somatotropin is released by the anterior pituitary in response to **growth hormone (GH)-releasing hormone** produced by the hypothalamus.

- Secretion of GH is inhibited by another pituitary hormone, somatostatin.

Wrong / Somatostatin is hypothalamic hormone

- GH is released in a pulsatile manner, with the highest levels occurring during sleep.

- With increasing age, GH secretion decreases, being accompanied by a decrease in lean muscle mass.

Growth Hormone (GH) – Physiology

Growth hormone (GH) is a peptide hormone released from the anterior pituitary gland. After secretion, it produces its biological effects through two main pathways.

The first is a direct action, where GH binds to growth hormone receptors on target tissues and directly produces metabolic effects.

The second is an indirect action, where GH acts mainly on the liver and stimulates the production of somatomedins, especially Insulin-like Growth Factor-1 (IGF-1). IGF-1 mediates many of the growth-promoting effects of GH, particularly on bone and cartilage.

So the sequence can be simplified as:
Anterior pituitary → GH → direct effects on tissues
and
Anterior pituitary → GH → liver → IGF-1 → growth of bone and cartilage

Hypothalamic and pituitary hormones

Growth hormone (somatotropin)

- Somatotropin influences a wide variety of biochemical processes:

GH has an important anabolic effect :-

1. Stimulation of protein synthetic processes
2. Cell proliferation
3. Bone growth are promoted.
4. Increased formation of hydroxyproline from proline boosts cartilage synthesis.

At the same time, GH also promotes li**polysis**, meaning that it increases the breakdown of stored fat and the use of fatty acids as an energy source.

GH also has an **anti-insulin or diabetogenic effect**. It decreases glucose uptake by some peripheral tissues and increases glucose production, which can lead to an increase in blood glucose.

Hypothalamic and pituitary hormones

Growth hormone (somatotropin)

Mechanism of action:

A. **Direct** at its targets by binding to its receptors on target tissues and produces metabolic effects.

B. **Indirect**: mediated through the somatomedins-insulin-like growth factors I and II (IGF-I and IGF-II).

Therapeutic uses:

1. In the treatment of GH deficiency in children.
2. GH is antiaging hormones!!!! Is misused with Athletes >>> Diabetes
3. Human synthetic GH, **somatrem**, induces the release from the liver of IGF (formerly somatomedin C), which is responsible for subsequent GH-like actions.
4. Somatotropin and somatrem should not be used in individuals with closed **epiphyses** (stoppage of bone growth) or an **enlarging intracranial** mass.

GH and aging

Growth hormone secretion gradually decreases with age.

This reduction is associated with some of the changes seen during aging, such as:

↓ muscle mass

↑ fat accumulation

However, these age-related changes are not caused by GH alone; many other hormonal, metabolic, and lifestyle factors are involved.

Is GH the “elixir of life”?

Scientifically, no.

Although GH can promote muscle growth and reduce fat mass, giving excessive GH does not simply reverse aging and may cause serious adverse effects.

GH with athletes;

GH is also commonly misused by athletes to bodybuilding by increase lean muscle mass and reduce fat. However, this misuse is associated with important adverse effects

The side effects of GH that is mentioned in this lecture:

- Excessive GH stimulates cell proliferation, which may increase the risk of cancer.
- GH is diabetogenic, as it increases blood glucose levels.
- It also increases vasoconstriction, leading to increased peripheral resistance and, consequently, increased blood pressure.

Therefore, GH should only be prescribed when there is a true Growth Hormone Deficiency.

In endocrine disorders, In general, people with hormonal imbalance have two possibilities: either hormone deficiency or hormone hyperproduction.
Hormone deficiency is treated by replacement therapy.

Growth hormone increases bone growth in both length and width.

Before prescribing GH, the physician should always **consider the patient's age** and whether the epiphyseal growth plates are still open.

❖ ***Children:-***

One of the concerns of prolonged or high-dose GH therapy in children is the possibility of premature closure of the epiphyseal plates. As a result, a child receiving GH for a long period and in excessive doses may stop growing in height earlier than expected and may no longer grow like other children of the same age.

📝 Note: The doctor explained it this way to simplify the concept that anabolic hormones, including growth hormone, promote bone maturation and are associated with epiphyseal closure. However, the detailed physiological mechanism of epiphyseal closure is more complex and is discussed separately.

As a physician, if a child has Growth Hormone Deficiency, give only the amount of GH that the child needs (replacement dose). Do not give excessive amounts, because the goal is to replace the missing hormone, not to exceed the normal physiological level.

❖ **In adults:-**

the epiphyseal growth plates are already closed, so growth hormone can't longer increase bone length. Instead, excessive GH stimulates appositional bone growth (growth in width), leading to **acromegaly**.

As a result, the bones of the skull become enlarged, and the peripheral bones, especially those of the hands and feet, also enlarge.

Acromegaly is associated with many systemic side effects due to prolonged GH excess.

Development of Long-Acting GH Analogs:-

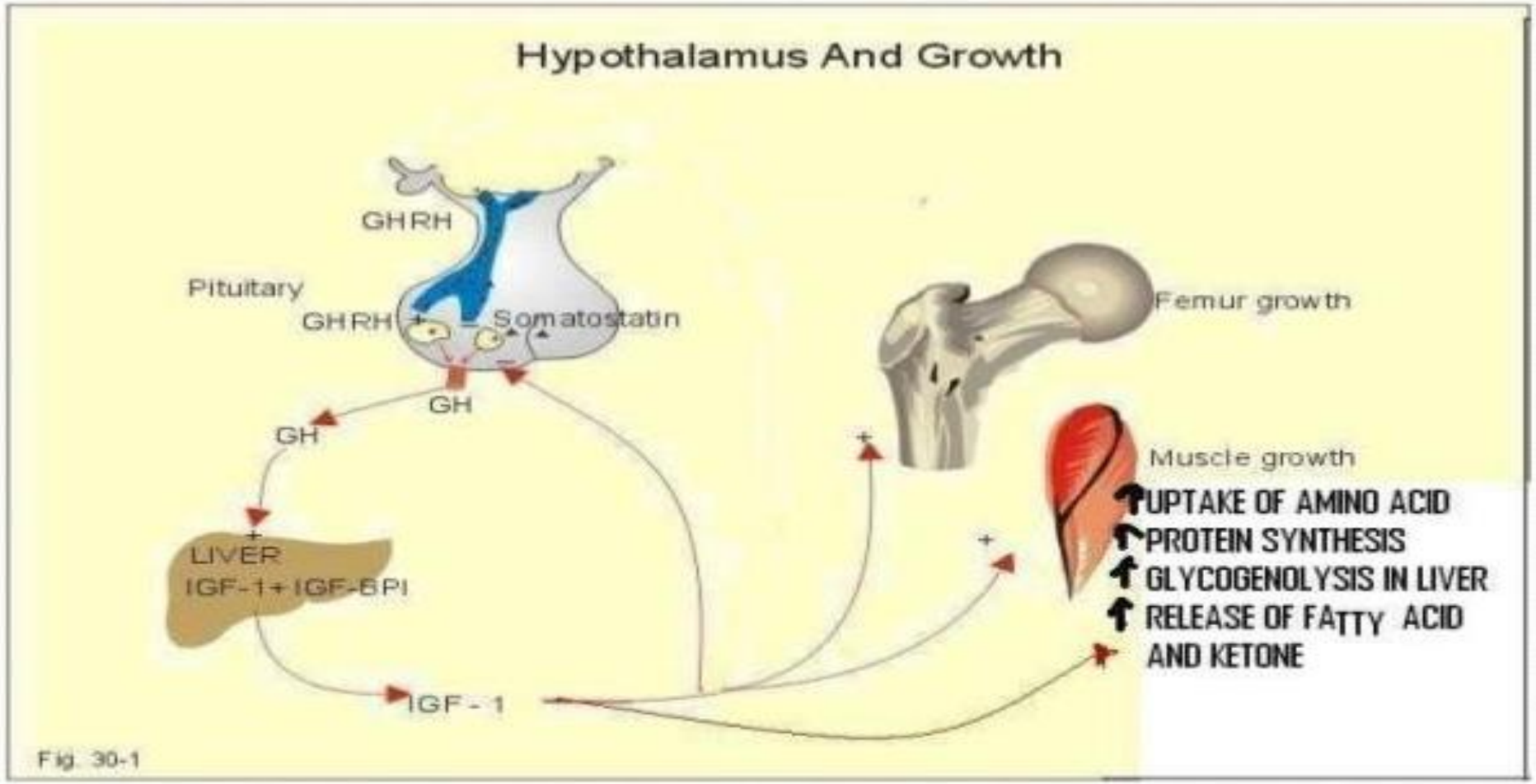
One limitation of growth hormone (GH) therapy is that GH has a short duration of action. In addition, because it is a protein hormone, it cannot be administered orally and must be given by injection, which may be painful and inconvenient for patients. To overcome these limitations, GH analogs with a longer duration of action were developed, such as Somatrogon (Somatron/Somatropin analog, depending on the lecture naming). These analogs reduce the frequency of injections while maintaining the therapeutic effect.

How was this analog developed? (Explained by dr but Not required)
GH is a protein, and proteins are composed of amino acids. Each amino acid is encoded by a specific codon, and each codon consists of three nucleotides.

Within the protein structure, there are functional domains responsible for the biological activity of the hormone, as well as peripheral (structural) domains whose main role is to stabilize the protein structure.

Scientists modified the amino acids in these peripheral domains by introducing changes into the DNA sequence, while preserving the functional domains. The modified gene was then inserted into bacteria using recombinant DNA technology, allowing the bacteria to produce the modified hormone on a large scale. The resulting product has a longer duration of action while maintaining the same biological function.

Summary: By modifying the amino acids in the structural (peripheral) domains of GH through recombinant DNA technology, scientists developed long-acting GH analogs that require fewer injections than native GH. This increases the compliance of the proteins


Hypothalamus And Growth
GHRH
Pituitary
GHRH
Somatostatin
GH
GH
LIVER
IGF-1+IGF-BPI
IGF - 1
Femur growth
Muscle growth
UPTAKE OF AMINO ACID
PROTEIN SYNTHESIS
GLYCOGENOLYSIS IN LIVER
RELEASE OF FATTY ACID
AND KETONE
Fig. 30-1

Hypothalamic and pituitary hormones

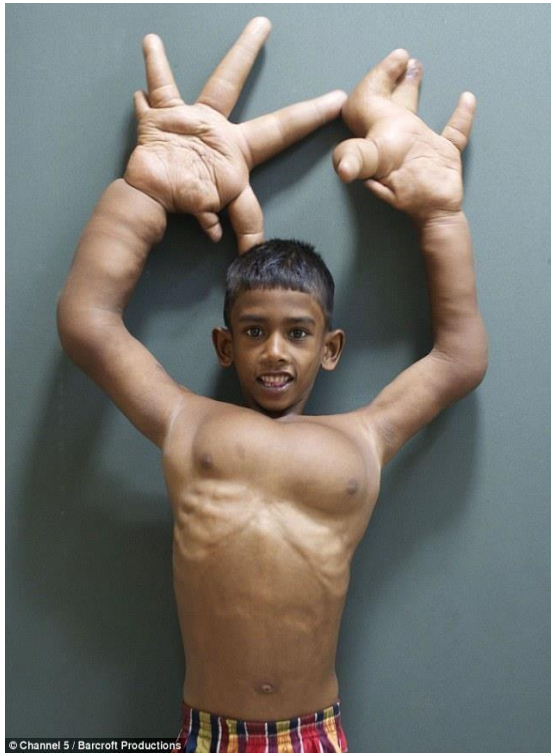
Growth hormone-inhibiting hormone (somatostatin)

- Is found mainly in the hypothalamus.
- Is also found in neurons throughout the body and in the intestine and pancreas.
- In the pituitary, somatostatin binds to distinct receptors, somatostatin receptor (SSTR2) and (SSTR5), which suppress GH and TSH release.
- It inhibits GH, insulin, glucagon, and gastrin release.

Somatostatin normally suppresses the release of growth hormone (GH) from the anterior pituitary. Therefore, theoretically, it could be used to treat conditions associated with GH hypersecretion, such as acromegaly.
However, **natural somatostatin has a very short half-life**, so its effect does not last long enough to make it practical as a medication for chronic GH hypersecretion.
For this reason, **somatostatin analogs were developed**. These drugs mimic the inhibitory action of somatostatin but have a **longer half-life and longer duration of action**. One important example is octreotide, which suppresses GH secretion and can therefore be used in the treatment of GH hypersecretion.

Hypothalamic and pituitary hormones

Octreotide



- is a synthetic analog of somatostatin.
- Its t1/2 is longer than that of somatostatin.
- Suppress GH and IGF-I.

Used in:

1. The treatment of <u>acromegaly</u>.
2. Secretory diarrhea associated with tumors producing vasoactive VIP (VIPomas). VIPoma causes cells in the pancreas to produce a high level of a hormone called vasoactive intestinal peptide (VIP).

Adverse effects:

1. Flatulence, nausea, and steatorrhea. the excretion of abnormal quantities of fat with the faeces owing to reduced absorption of fat by the intestine. >>> GH plays a major role in fat absorption
2. Gallbladder emptying is delayed, and asymptomatic cholesterol gallstones can occur with long-term treatment.

Somatostatin and its analog octreotide are considered **universal inhibitors** because they suppress the secretion of several hormones and peptides.

Because of this broad inhibitory effect, they may also produce multiple side effects. One important effect is on the pancreas. **Somatostatin inhibits the secretion of both insulin and glucagon**. the effect of inhibition of insulin is greater than the effect of inhibition of glucagon, so the overall result may be **hyperglycemia**.

Somatostatin analogs also **inhibit vasoactive intestinal peptide (VIP)**.
VIP increases intestinal secretion and promotes intestinal motility, so excessive VIP can cause watery diarrhea.
By inhibiting VIP, octreotide can reduce these intestinal effects and control the diarrhea. Therefore, this represents another important therapeutic use of somatostatin analogs.

The main uses discussed are:
Acromegaly → by inhibiting excessive GH secretion.
VIP-related diarrhea → by inhibiting VIP secretion and its intestinal effect.

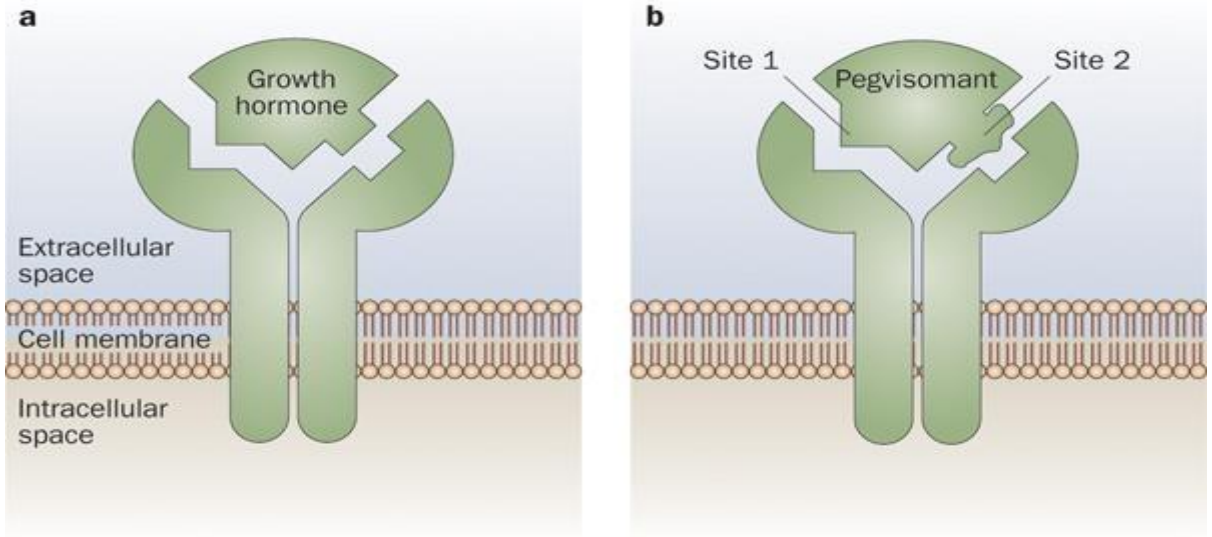
Hypothalamic and pituitary hormones

Pegvisomant

- It acts as an antagonist at one of the GH receptors and results in the normalization of IGF-I levels.

- Is employed in the treatment of refractory acromegaly.

An **antagonist** competes with the hormone for binding to its receptor but does **not necessarily reduce the secretion or concentration of the hormone itself**. Instead, it prevents the hormone from binding to its receptor, thereby **blocking** the receptor-mediated **biological response**.



Refractory acromegaly refers to acromegaly that does not respond adequately to the initial medical treatment.

If the patient does not respond sufficiently to a **somatostatin analog (octreotide),** the second therapeutic option is **pegvisomant**.

Pegvisomant is a **growth hormone receptor antagonist**. It does not mainly decrease the secretion of GH itself. Instead, it competes at the **GH receptor** and prevents GH from producing its biological effects. Therefore, GH may still be present in the circulation, but its action on target tissues is blocked.

Why use octreotide before pegvisomant?

The main problem in acromegaly is **excessive secretion of GH**. Therefore, it is preferable to first target the **cause of the hormonal excess** by using octreotide to suppress GH secretion. Pegvisomant, on the other hand, does not correct the excessive secretion itself; it mainly **blocks the action of the excessive GH at its receptors**. Therefore, it is used when suppression of GH secretion is insufficient.

Note: This may seem to contradict the general rule discussed at the beginning of the lecture, where treatment is preferably directed toward the affected hormone or target organ rather than a higher regulatory level. However, in acromegaly, octreotide is used to suppress the excessive GH secretion itself, while pegvisomant blocks GH action at the receptor level. Therefore, the choice depends on which therapeutic strategy provides better control of the disease and is better tolerated by the patient.

- Growth hormone promotes body growth. Why, then, is GH **misused by athletes**, and what is one important adverse effect?

Previously explained through the slides
So, you can answer why by yourself ☺

Hypothalamic and pituitary hormones

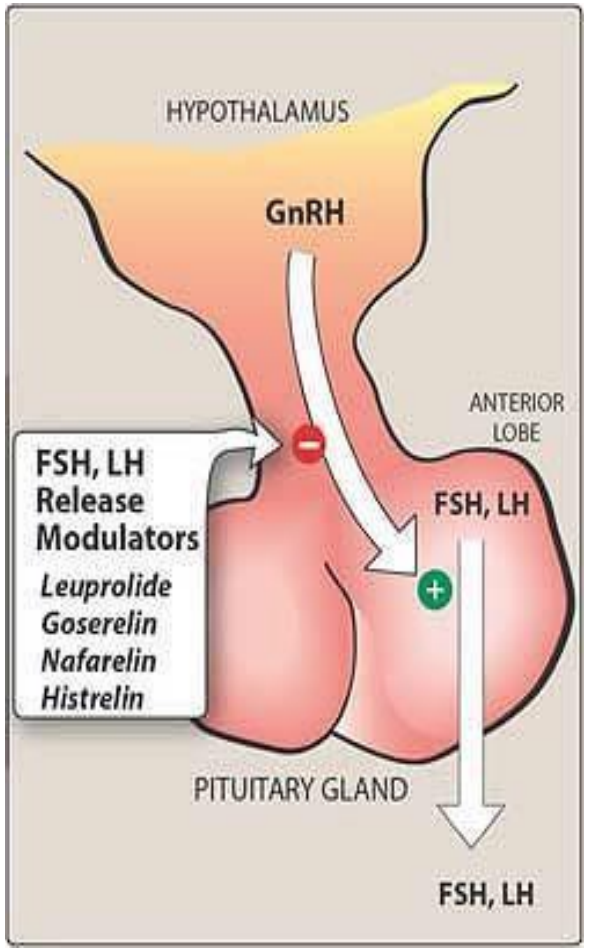
Gonadotropin-releasing hormone/luteinizing hormone-releasing hormone

- Gonadotropin-releasing hormone (GnRH), also called **gonadorelin.**

- GnRH is released from the **hypothalamus**.

- GnRH is essential for the release of Follicle-stimulating hormone (FSH) and luteinizing hormone (LH) in the **pituitary**.

- GnRH stimulates gonadal hormone production in **hypogonadism**.(diminished functional activity of the gonads – the testes and ovaries in males and females)



Hormone	In Females	In Males
FSH	Causes maturation of the ovary	Causes spermatogenesis
LH	Causes ovulation	Causes production of testosterone

FSH & LH Hormones

Infertility and Gonadotropin Therapy

In patients with infertility, the cause may be reduced release of gonadotropins (FSH and LH).

Since it is difficult to obtain FSH and LH directly from the blood, we use two preparations for injection:

1. HMG (Human Menopausal Gonadotropin):

It is obtained from the urine of postmenopausal women, which is rich in FSH.

Menopause: The stage when there is a sharp decrease in estrogen production in the woman's body.

Therefore, HMG provides FSH activity.

2. hCG (Human Chorionic Gonadotropin):

The urine of pregnant women is rich in hCG, which is secreted by the placenta.

hCG has a similar effect to LH and therefore acts as an LH analogue.

In short:

HMG → FSH-like activity

hCG → LH-like activity

Q: If a female patient comes with infertility, how can we give her the injection?

A: First, keep in mind that in pharmacology, when a patient has a deficiency in a certain hormone, we understand the normal physiology of that hormone and then try to mimic it.
For example, cortisol is secreted mainly in the morning and afternoon. Therefore, when we give cortisol to a patient, we give it at the appropriate physiological time and not at night.

Q: How do we apply this principle to gonadotropins in females?

We follow the normal pattern of the menstrual cycle. During the first 12 days, FSH secretion gradually increases, leading to estrogen production.
Around days 13 and 14, LH increases, producing the LH surge and ovulation.

Q: So, what do we give to a female patient with infertility?

A: First, we give HMG (Human Menopausal Gonadotropin) to provide FSH activity.
Then, we give hCG (Human Chorionic Gonadotropin), which acts similarly to LH.

Hypothalamic and pituitary hormones

Gonadotropins: Human menopausal gonadotropin (hMG), follicle-stimulating hormone, and human chorionic gonadotropin (hCG)

- They are used in the treatment of infertility in men and women.
- **Menotropins (hMG)** are obtained from the urine of menopausal women and contain FSH and LH.
- hCG is a placental hormone and an LH agonist, to which it is structurally related. It is also excreted in the urine.
- Urofollitropin is FSH obtained from menopausal women.
- Follitropin beta is human FSH manufactured by recombinant DNA technology.

Hypothalamic and pituitary hormones

- *Gonadotropins: Human menopausal gonadotropin (hMG), follicle-stimulating hormone, and human chorionic gonadotropin (hCG)*

- *Injection of hMG or FSH over a period of 5 to 12 days causes ovarian follicular growth and maturation, and with subsequent injection of hCG, ovulation occurs.*

- **In men** lacking gonadotropins, **hCG** causes external sexual maturation, and with the subsequent injection of **hMG**, spermatogenesis occurs.

Adverse effects:

1. ovarian enlargement and possible hypovolemia.
2. Multiple births.
3. Men may develop gynecomastia (is a non-cancerous increase in the size of male breast tissue).

Treatment of Excess Gonadotropins

Q: What if a patient, male or female, has an excess amount of gonadotropins?

A: The treatment can be summarized in one word: Inhibition

.

Q: Which drugs can be used in this case?

A: Leuprolide and Nafarelin

.

Q: What are Leuprolide and Nafarelin?

A: They are analogs of Gonadotropin-Releasing Hormone (GnRH).

Q: If the patient already has an excess amount of gonadotropins, how can we give a GnRH analog, which normally stimulates gonadotropin release?

A: These drugs initially cause an increase in gonadotropin secretion.

- However, with continuous administration, an interesting phenomenon occurs called: Tachyphylaxis/Desensitization/Tolerance

With continued stimulation by GnRH analogs, the body becomes less responsive by decreasing the number of GnRH receptors (downregulation).
Therefore, after a period of continuous treatment, the response decreases, leading to decreased gonadotropin secretion.

Q: Why don't we directly use a GnRH antagonist to decrease the increased gonadotropin levels?

A: There are several reasons:
They are expensive.
There is limited clinical experience with their use.
This may change in the future as more clinical experience becomes available

To avoid harming the patient, and because there is initially an excessive amount of gonadotropins, we have to give another drug to reduce the effects of the end products.

What are the end products of gonadotropins?

- A: Gonadotropins cause an increase in sex hormones:
- FSH → ↑ Estrogen in females
- LH → ↑ Progesterone in females
- LH → ↑ Testosterone in males
- During the first weeks, we use drugs that block the effects of these end products: Anti-estrogen,Anti-progesterone,Anti-testosterone

We continue this until downregulation of the GnRH receptors occurs.

Upregulation & Downregulation — Simple Example

Imagine that **the hormone is the sound** 🔊
and **the receptors (response)are your ears** 👂.

Upregulation:

Imagine the sound is very quiet 🔉. You can barely hear it.
Your body says: **“I need to hear this better!”**
So, it increases the number of receptors.
→ **Weak hormone signal** → ↑ **receptors** → **stronger response**

Downregulation:

Now imagine the sound is extremely loud 🔊🔊 and keeps playing for a long time.
Your body says: **“This is too much! I need to reduce my response.”**
So, it decreases the number of receptors.
→ **Too much hormone stimulation** → ↓ **receptors** → **weaker response**
Easy way to remember:

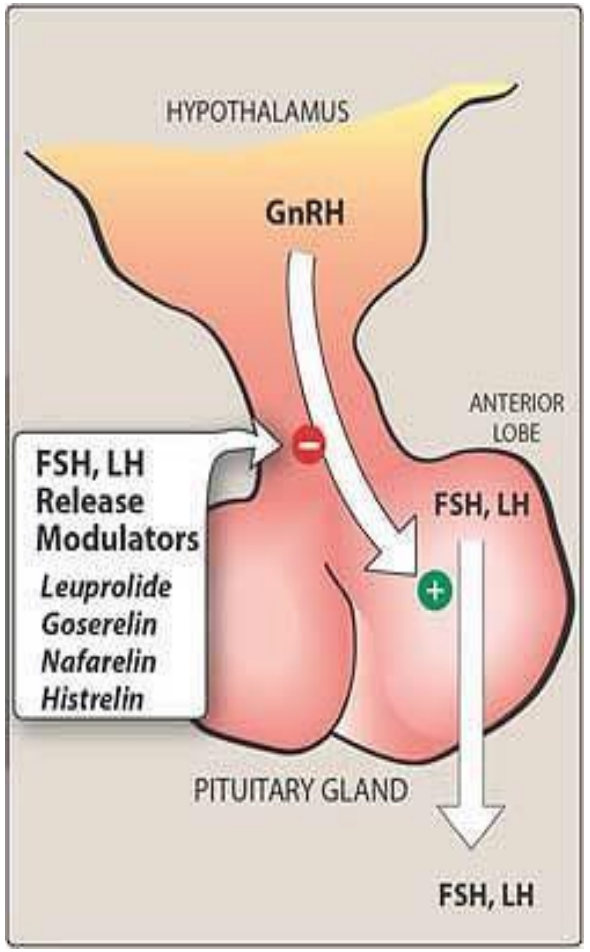
Too little → get more ears (upregulation)
Too much → use fewer ears (downregulation)

Hypothalamic and pituitary hormones

- *Gonadotropin-releasing hormone/luteinizing hormone-releasing hormone*

- Leuprolide and nafarelin are:

1. Synthetic analogs to GnRH.
2. Act as <u>agonists</u> at GnRH receptors. This causes marked increases in LH, FSH and testosterone.
3. Are effective in suppressing production of the gonadal hormones Sustained pituitary overstimulation will eventually down-regulate/desensitize GnRH receptors with a consequent decrease in hormone levels).
4. Therefore, are effective in the treatment of prostatic cancer, endometriosis, and precocious puberty.)next slide)



1. In males: Prostate cancer

GnRH analogs can be used in the treatment of prostate cancer by reducing gonadotropin secretion and consequently decreasing testosterone levels.

2. In females: Endometriosis

Endometriosis is a condition in which endometrial tissue grows outside the uterus. GnRH analogs can be used to reduce ovarian hormone stimulation and therefore help control the growth and symptoms of endometriosis.

3. Precocious puberty

Precocious puberty means the early appearance of secondary sexual characteristics. For example, a young girl may start showing signs of sexual maturation much earlier than the normal age.

Hypothalamic and pituitary hormones

Gonadotropin-releasing hormone/luteinizing hormone-releasing hormone

- Adverse effects of gonadorelin include:

1. Hypersensitivity
2. Dermatitis

- **In women**, the **analogs** may cause hot flushes and sweating as well as diminished libido, depression, osteoporosis and ovarian cysts (is a fluid-filled sac within the **ovary)**.

- They are **contraindicated** in pregnancy (may cause miscarriage) and breast-feeding (small amounts are found in breast milk).

- **In men**, they initially cause a rise in testosterone result in bone pain; hot flushes, edema, gynecomastia, and diminished libido also occur.

- Leuprolide is a GnRH agonist.

If it is an agonist, why does it decrease testosterone after long-term administration?

Posterior pituitary hormones

Hypothalamic and pituitary hormones

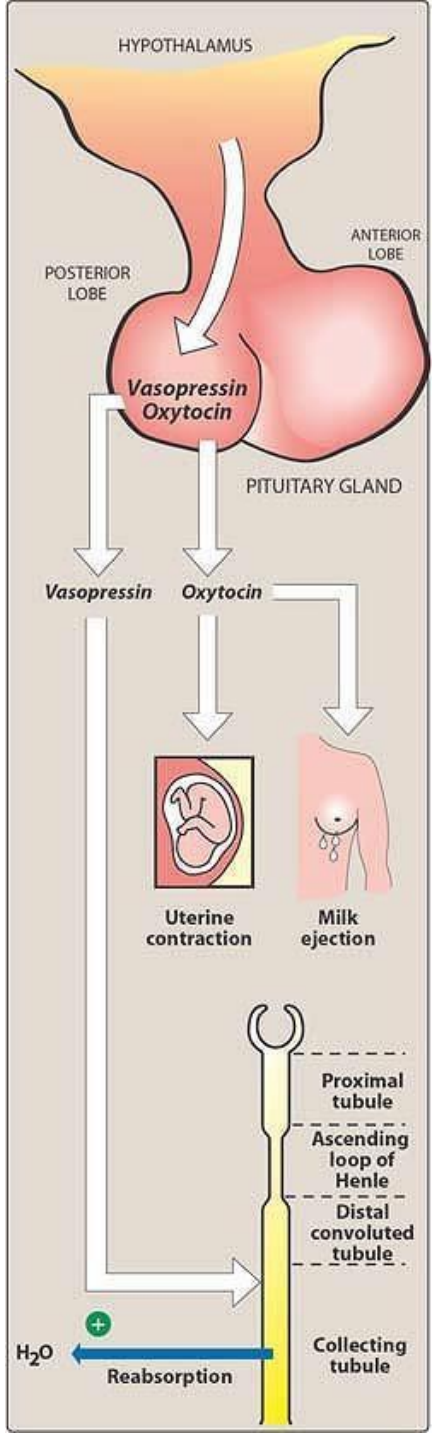
Oxytocin

- Its only use is in obstetrics to:

1. Stimulate uterine contraction to induce or reinforce labor
2. To promote ejection of breast milk.

- The sensitivity of the uterus to oxytocin increases with the duration of pregnancy when it is under estrogenic dominance.

- Oxytocin causes milk ejection by contracting the myoepithelial cells around the mammary Alveoli حويصلات الثدي. given as a nasal spray.



Oxytocin

Oxytocin increases the contractility of smooth muscle.

- In the breast: Oxytocin causes contraction of the myoepithelial cells, leading to milk ejection (milk let-down).
- In the uterus: Oxytocin increases uterine contractions, helping with delivery of the baby.

Clinical Use

In hospitals, oxytocin is used for induction of labor.
We can also use Carbetocin, which is an oxytocin analogue.
Usually, we use oxytocin itself rather than carbetocin, despite oxytocin having a short duration of action.

Side Effects

Chemically, oxytocin is structurally similar to vasopressin (ADH).
Therefore, when oxytocin is given, we may expect some vasopressin-like effects, such as:

- ↑ Blood pressure
- Water retention

Note: Oxytocin After Delivery

We use oxytocin after delivery to prevent bleeding.

How?

First, the cause of bleeding is the vasodilation of the blood vessels in the uterus.

The smooth muscles are around the blood vessels.

Oxytocin causes contraction of the smooth muscles, which squeezes the blood vessels.

Therefore, oxytocin prevents bleeding after delivery.

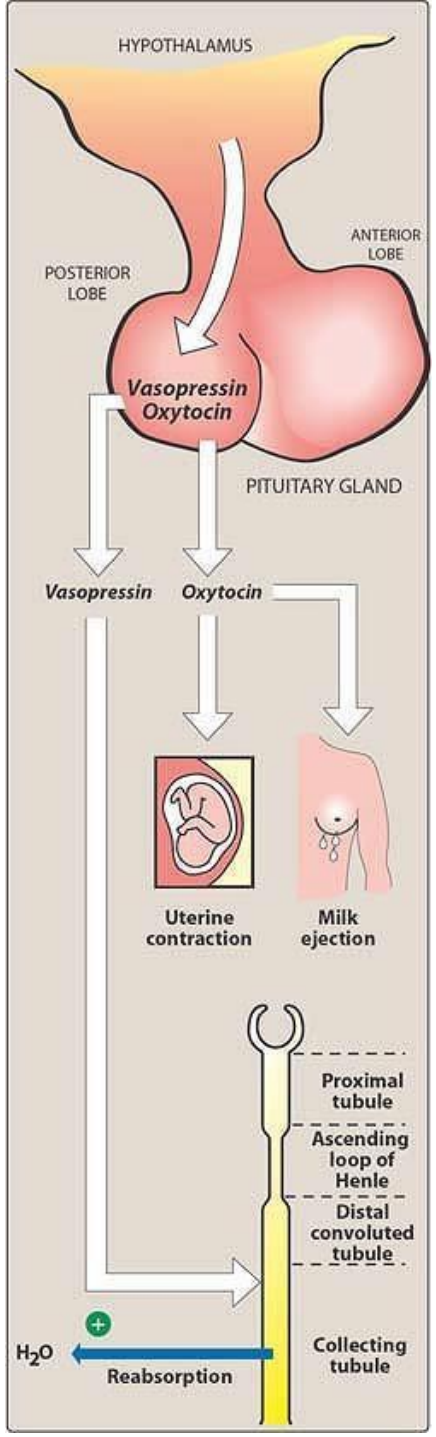
Hypothalamic and pituitary hormones

Oxytocin

Side effects:

1. Toxicities are uncommon when the drug is used properly.
2. Hypertensive crises
3. Uterine rupture
4. Water retention
5. Fetal death have been reported

- Its antidiuretic and pressor activities are very much lower than those of vasopressin.



Vasopressin (ADH)

Vasopressin is an agonist, and every agonist needs to bind to a receptor to produce its effect.
There are two main types of receptors: V1 and V2.

V1 Receptors

- Location: Blood vessels
- Effect: Vasoconstriction

Therefore, vasopressin can be used to:

1. Reduce bleeding
2. Treat esophageal varices

V2 Receptors

- Location: Kidney, specifically the collecting tubules
- Effect: Increase water reabsorption
- Therefore, vasopressin can be used to treat diabetes insipidus, which causes polyuria. Normal urine output: 1–2 L/day
- In diabetes insipidus: up to 20 L/day

Hypothalamic and pituitary hormones

Vasopressin

- Vasopressin (ADH), is structurally related to oxytocin.

Vasopressin has both:

1. Antidiuretic (V2 receptorin the kidney) and
2. Vasopressor (V1 receptor in BV) effects.

Major uses are:

- To treat diabetes insipidus
- Control bleeding of esophageal varices or colonic diverticula (saclike protrusion in the colonic wall).

Side effects:

1) Water intoxication 2) hyponatremia 3) bronchoconstriction 4) tremor

- Caution must be used in patients with CAD, epilepsy, and asthma.

Hypothalamic and pituitary hormones

Desmopressin

How can we treat diabetes insipidus without increasing blood pressure?

A: We use Desmopressin, a drug that is **selective** for the V2 receptor.
It produces the desired effect on the kidney (V2 receptors) without significantly stimulating V1 receptors in the blood vessels.

- Minimal activity at the V1 receptor, making it largely free of pressor effects >>>>> this analog is now **preferred** for diabetes insipidus and nocturnal enuresis and is longer-acting than vasopressin.

- Which receptor is responsible for the antidiuretic effect?

Which hormone from this lecture would you prescribe for each patient?

1. Child with growth hormone deficiency
2. Acromegaly
3. Diabetes insipidus
4. Induction of labor
5. Prostate cancer

Additional Resources:

رسالة من الفريق العلمي:

فقد يُغلق الله في وجوهنا أبوابًا ظننّا أن نجاتنا فيها، ثم يفتح لنا أبوابًا لم نكن نراها. وقد يخذلنا الطريق، ويتخلّى عنّا الناس، لكنّ الله لا يُخلّي من توكّل عليه، ولا يترك من علّق قلبه به.قال تعالى:﴿وَمَن يَتَوَكَّلْ عَلَى اللَّهِ فَهُوَ حَسْبُهُ ۚ إِنَّ اللَّهَ بَالِغُ أَمْرِهِ﴾

For any feedback, scan the code or click on it.

Corrections from previous versions:

Versions	Slide # and Place of Error	Before Correction	After Correction
V0 → V1			
V1 → V2			