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Sheet

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PHYSIOLOGY

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Price :

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Done by :

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Hormones

Hormones: Chemicals that are secreted from glands and make response on target cells.

Human body has two controlling systems

1. Neural system: usually control contraction – relaxation of the muscles or controlling the secretion mechanism.
2. Endocrine system: it acts through hormones. These hormones are using to control body's cells by changing the metabolism of the cells and regulate growth and reproduction.

Hormones are two kinds according to their solubility in water or lipids:

1. Water soluble Hormones

- They are polar

These hormones could move through solutes outside the cell

BUT they cannot pass through the plasma membrane of the cell as they are lipid Insoluble.

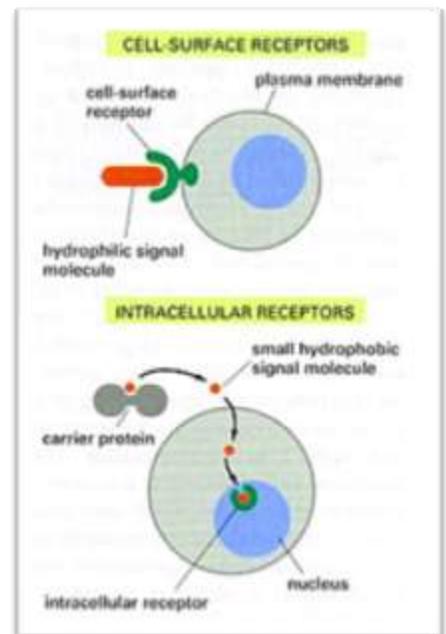
So we expect that their receptors would be on the OUTSIDE of the cell membrane.

2. Lipid soluble Hormones.

- They are non polar

Although, lipid soluble hormones could pass through the plasma membrane of the cell, they cannot move through the extracellular fluids.. and they have to be carried by transporters proteins –hydrophilic transporters- .

So we expect that their receptors would be found INSIDE the cell (intracellular) .



Some receptors of the Hormones are coupled with Na-channels → so binding of the hormone to these receptors changes the permeability of these channels.(Dr. Eman is going to explain this point later).

Intercellular communication

There are many types (mechanism) of intercellular communication:

1. Endocrine : **circulating**

“System of glands, each of which secretes different types of hormones directly into the bloodstream ... to maintain homeostasis.”

So:

hormone secreted from endocrine gland → circulates in the blood → binds to its receptors on the target cell.

*target cell: the cells where hormones have their effect and they are having the receptors for the hormone and they might be too far from the gland that secretes the hormone.

E.g: hormones from Pituitary gland → blood → target cells (**thyroid, adrenal...**)

NOTE: All hormones must have receptors on their target cells; or else, the body would suffer from diseases as that:

If the cell is defecience from receptors = there is no response.

E.g: Some males have such problems in order to the absence of testosterone hormone’s receptors. So, some of them look like females; however, they had a high concentration of testosterone hormone in their body.

2. Paracrine

Here hormones are not acting on a far target cells –as in the endocrine mechanism- but they act on a neighboring (near) cells

3. Autocrine

Here the receptors of the hormone are found on the same cell that secretes the hormone.

4. Neural endocrine

Where a neuron secretes some hormones → blood → target cells.

E.g: Ach (Acetylcholine) which is secreted by neurons as a hormone to act on target cells.

* Specialized neurons that secrete chemicals into the blood rather than synaptic cleft. The secreted chemicals are called neurohormone.

Note: the hormone could be a gas!!

Yes a gas, like NO (Nitric Oxide).

Types of hormones:

We already mentioned that hormones are mainly divided to

Water soluble hormones (hydrophilic)	Lipid soluble hormones (lipophilic)
<p>1. Proteins and peptide hormones :</p> <p>a- Polypeptide hormones: less than 100 amino acid. E.g: ADH hormone (is a deca peptide)</p> <p>b- Protein hormones: more than 100 amino acid. E.g: growth hormone</p>	<p>1. Steroids hormones : (derived from cholesterol) Especially They are secreted from the adrenal cortex.</p>
	<p>2. Gases hormones : E.g: Nitric Oxide (NO)</p>
	<p>3. Prostaglandin : Any member of a group of water-soluble compounds that are derived enzymatically from fatty acids and have important functions in the animal body. Every prostaglandin contains 20 carbon atoms, including 4 double bonds.</p>
<p style="text-align: center;">Amines hormones : Derived from Just ONE amino acid. E.g: tyrosine that gives: *thyroxin (the hormone of thyroid gland) This is lipid soluble *Epinephrine & norepinephrine These are water soluble</p>	

Note: the names of the previous hormones are not needed... But try to keep in mind.

Conclusion:

The chemical classes of hormones are:

1. Amines hormones
2. Proteins and polypeptides hormones
3. Steroids hormones
4. Gases hormones
5. **Glycoproteins hormones**

They have two chains:

1. **α chains** : they are the same wherever they found, in other words, all glycoproteins have the same α chains.
 So: the genetic processes that produce the α chains are the same.
2. **β chains** : unlike α chains , β chains are specific for each hormone.
 So: when you measure the activity of any hormone >> you measured the activity of β chains.

E.g: FSH hormones, LH, HCG

For example: HCG is the hormone that is in charge of Pregnancy.. So, when we want to measure the activity of Hcg we measure the activity of β chain of Hsg.. and thus we always hears about (β Hcg).

It's important to know the classification of hormones in order to know their receptors or their mechanism.

The mechanism of the lipid soluble hormones is almost the same and so on for the water soluble hormones. Water soluble hormones' mechanism is 2nd messenger mechanism.

Second messengers are molecules that relay signals from receptors on the cell surface to target molecules inside the cell, in the cytoplasm or nucleus. They relay the signals of hormones like epinephrine (adrenaline), growth factors, and others, and cause some kind

of change in the activity of the cell.

** Hormones can also be divided into:

1-Polar:H₂O soluble.

2-Nonpolar (lipophilic):H₂O insoluble.

-Can gain entry into target cells.

-Steroid hormones and T₄ (thyroxine –tetraiodothyronine))

The production of proteins hormones:

Protein Hormones are produced in the rough endoplasmic reticulum **RER**, these proteins usually formed as a very big amino acid chain called **prohormone**, then it treated (sliced) to give a hormone.

E.g: insulin; It formed first as a proinsulin (c-subunit) → insulin .

Prohormone: Precursor is a longer chained polypeptide that is cut and spliced together to make the hormone

Note : it's very important to know that hormones come from prohormones .. Because when we want to measure the amount of protein in the Patient's body – for example insulin- we cannot determine either the insulin we measured is the exogenous or the endogenous..

So we measured the proinsulin amount to determine the amount of the endogenous hormone.

Preprohormone : it's a larger chain than prohormone and it formed it (after treating).

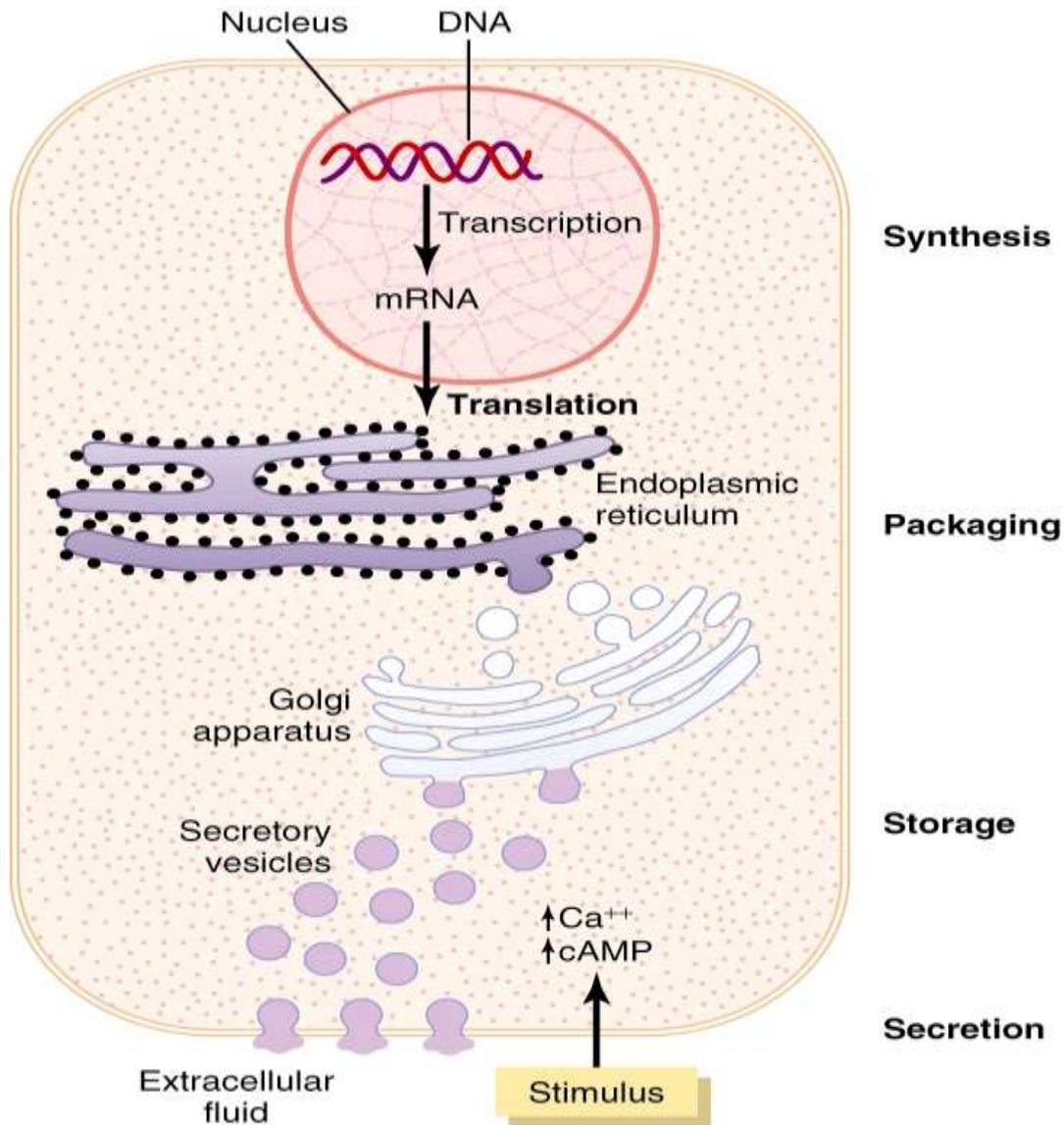
Note: there is a small phase before hormone which called prehormone.

Preprohormone → prohormone → prehormone → hormone

Prehormone: Molecules secreted by endocrine glands that are inactive until changed into hormones by target cells.

E.g: T₄ converted to T₃ (tri-iodothyronin).

Prehormones are going to golgi apparatus where hormones are packaging in vesicles and then secreted as secretory vesicles.



Don't forget to check the slides ☺

وإذا كانت النفوس كباراً
 تعبت في مرادها الأجسام..