

## Biosynthesis of peptide hormones ①

A hormone is a class of signaling molecules produced by glands in multicellular organisms that are transported by the circulatory system to target distant organs to regulate physiology and behavior.

or  
Hormones are substances produced by highly specialized tissue called the "Endocrine" or "ductless glands" carried by blood stream to a remote tissue or viscera called the "Target organ" or which they exert characteristic physiological effects. Hormones are mainly proteinaceous in nature but there are some steroid hormones too which is secreted by human body.

Peptide Hormones ② Peptide hormones are proteins that have effect on the endocrine system of animals, the peptide hormones are synthesized in cells from amino acids according to mRNA transcript. Several important peptide hormones are secreted from the pituitary gland. The anterior Pituitary secretes three Prolactic, adrenocorticotropic hormone and growth hormone. The posterior pituitary secretes antidiuretic hormone, also called vasopressin and oxytocin. Peptide hormones are also produced by pancreas and gastrointestinal tract.

Main Peptide hormones are -

1. Insulin
2. Glucagon
3. Adrenocorticotropic hormone (ACTH)
4. Antidiuretic hormone
5. Oxytocin
6. Prolactin.

Peptide hormones have a short half life, meaning <sup>(2)</sup> they break apart quickly. This allows organisms to use peptide hormones to direct processes quickly and efficiently, ~~all~~ without the signal lingering for a long time. This makes peptide hormones ideal candidates for intracellular hormones operating within cells. However many peptide hormones are also found in extracellular application. Peptide hormones can be found in insects, all vertebrates and other animals.

Synthesis of Peptide hormones. - Like all proteins peptide hormones are described in the DNA, translated into the form of a protein, and modified or altered appropriately. A large majority of protein synthesis happens within endoplasmic reticulum. Large protein complexes known as ribosomes read the mRNA and convert the message into a sequence of amino acids. Peptide hormones can be of any length, from only a few amino acids to several hundred.

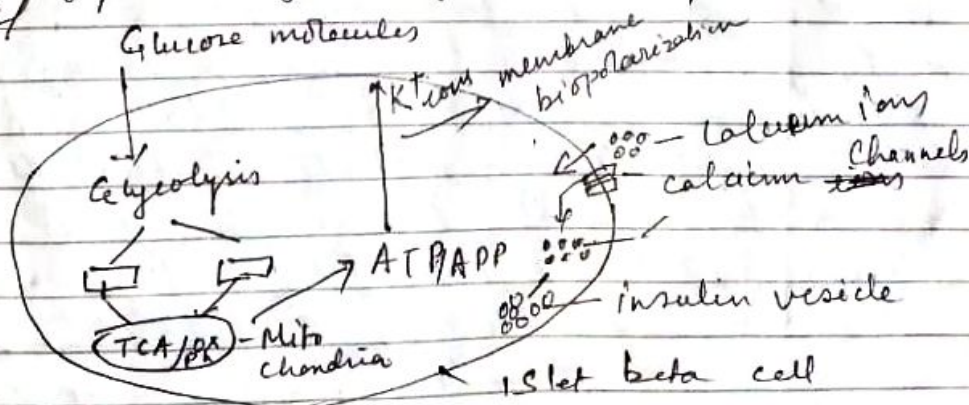
Typically cells secrete peptide hormones via one of two pathways. The first called regulated secretion works by producing lots of the hormone and storing it in a secretory granule or vesicle. When a signal is given to release the hormone, the granule bursts and hormone is released either into the cell, or into the environment.

Other peptide hormones are released via constitutive secretion. In this form of hormone release something signals the DNA to start producing the

peptide hormone. A regulator protein may be removed, or a growth factor may some low signal enzymes in the nucleus to produce peptide hormones. As they are produced, they are simultaneously released without being first stored. When the signal is over, the DNA is again protected and the organism stops producing the peptide hormone. ③

### Peptide hormone example -

Insulin is one of the most commonly known peptide hormones, Insulin is one of many peptide hormones found in animals which regulated glucose level in blood. Insulin acts on all cells of the body, binding to receptor proteins on the surface of cells and enabling the uptake of glucose. Most importantly insulin is self regulating since its release is triggered by high blood glucose level.



islet - Beta cells

fig. showing pathway of insulin synthesis. (peptide hormone synthesis)

④

This image represent a cell within the pancreas the gland responsible for secreting insulin within the pancreas. Specialized islet beta cells have an important receptor on their surface responsible for taking in glucose, the GLUT2 receptor. This protein transports glucose into the cell where the glucose undergoes the process of glycolysis. once broken into smaller pieces, it enters the mitochondria undergoes Krebs' cycle and oxidative phosphorylation to produce ATP.

In the presence of an increase concentration of ATP, the ATP sensitive  $K^+$  channel closes retaining the potassium ions building an electrical potential across membrane causing depolarisation of the membrane which travels around the membrane until it reaches voltage gated calcium channels, causing the channels to open allowing inflow of calcium ions. The calcium ion activates secretory vesicles carrying insulin, these sacs fuse with plasma membrane and dump the pre made peptide hormone into the blood stream. They can initiate the uptake of glucose by cells, when the concentration of ATP goes down the islet beta cells the synthesis of insulin decrease and the system resets.

Insulin is a longer peptide hormone having 51 amino acids.

Other examples of peptide hormone are prolactin, growth hormone.