5TH SEM MAJOR : PAPER 5.3

CLASSIFICATION OF HORMONES

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Hormones can be classified according to their chemical nature, mechanism of action, nature of action, their effects, and stimulation of Endocrine glands. i. This category of hormones are divided to six classes, they are hormones steroid; amines; peptide; protein; glycoprotein and eicosanoid.

Hormones:

Hormones are the chemical messenger produced in small amount by endocrine glands, secreted into blood stream to control metabolism and biological activities in target cell or organs.

Characteristics or properties of hormone

Low molecular weight

Small soluble organic molecules

Rate of diffusion is very high and are readily oxidized but the effect does not remains constant

It is effective in low concentration

Travels in blood

It has its target site different from where it is produce and is specific to a particular target

Hormones are non-specific for organisms and may influences body process of other individuals

Functions of hormones

Regulatory and homeostasis functions

Maintain consistency of interior of cell

Permissive functions; movement of substance in and out of cell

Integrative function; usually balance two system

Developmental function; helps in development of foetus

Classification of hormone

Hormones are classified

A.On the basis of chemical nature

B.On the basis of mechanism of hormone action

Group I hormone

Group II hormone

A. On the basis of chemical nature:

Protein hormones: insulin, glucagon

Steroid hormone: sex hormones, glucocorticoids

Aminoacids derivatives hormones: epinephrine, nor epinephrine etc

B. On the basis of mechanism of hormone action

1. Group I hormone (lipophilic hormone):

These hormones are lipophilic in nature.

They are mostly derivatives of cholesterol.

These hormones binds to intracellular receptors

Example: Steroid hormones, Estrogen, androgen, glucocorticoids, cholcalciferol, thyroxine etc

2. Group II hormones (water soluble hormone):

These hormones binds to cell surface receptors and stimulates the release of certain molecules

(secondary messengers) to perform biochemical functions

On the basis of secondary messengers group II hormones are of 3 types;

i. Secondary messenger is cAMP:

eg. Adrenocorticotropic hormone, FSH, LH, PTH,ADH, calcitonin, glucagon,

ii. Secondary messenger is phosphotidylinocitol/calcium or both:

eg. Acetylcholine, vasopressin, cholecystokinin, gastrin, gonadotropin releasing hormone, thyrotropin releasing hormone,
Insulin, chorynoic somato mamotropin, epidermal growth factors, fibroblast growth factors, GH,
Prolactin

iii. Secondary messenger is cGMP:
Atrial natriuretic peptide (ANP)

Hormones can be categorised into three distinct groups according to their chemical composition

The three types of hormones are steroid hormones, peptide hormones and amino acid derivatives

The different types of hormones will have different mechanisms of action due to their distinct chemical properties

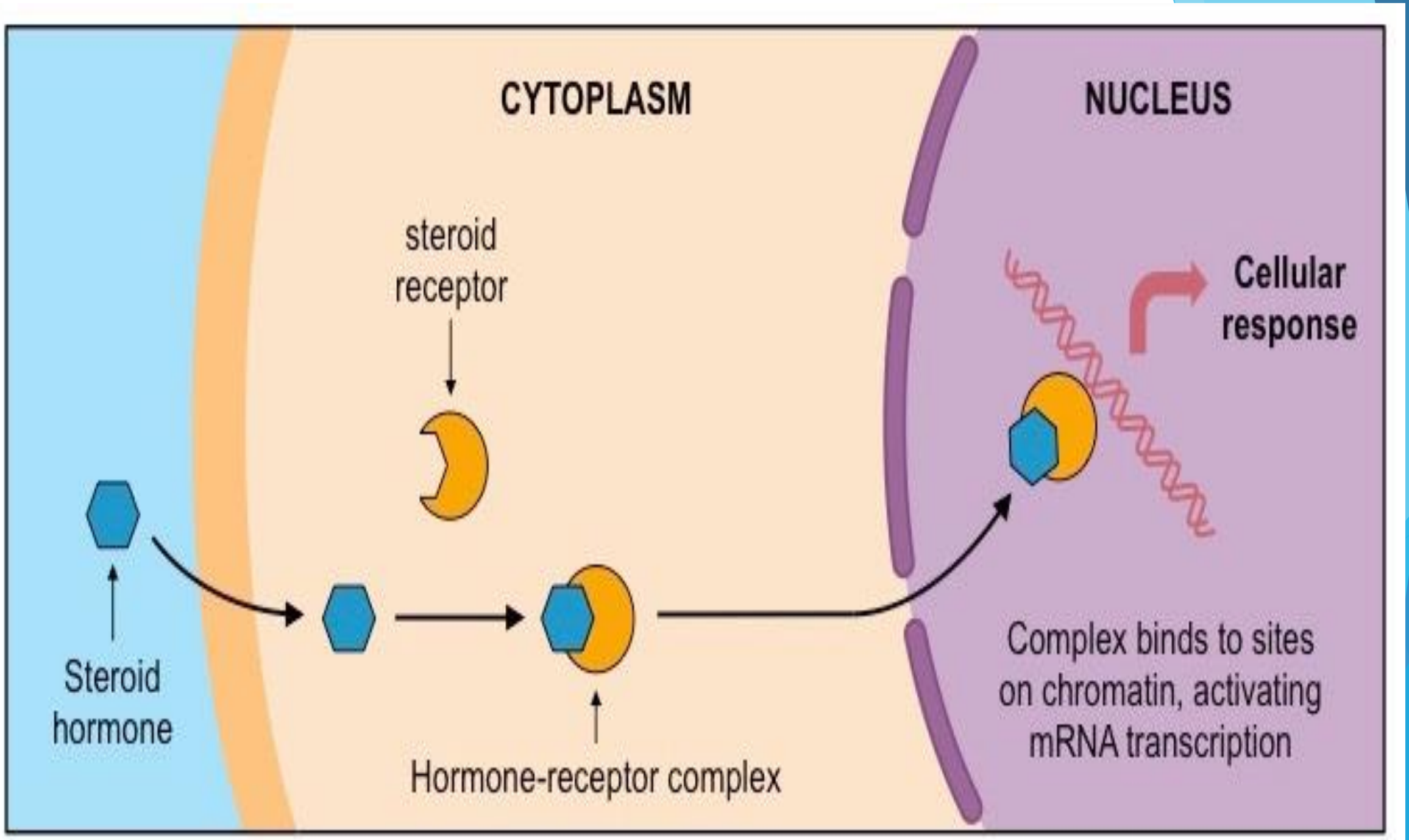
Steroid Hormones

Steroid hormones are lipophilic (fat-loving) - meaning they can freely diffuse across the plasma membrane of a cell

They bind to receptors in either the cytoplasm or nucleus of the target cell, to form an active receptor-hormone complex

This activated complex will move into the nucleus and bind directly to DNA, acting as a transcription factor for gene expression

Examples of steroid hormones include those produced by the gonads (i.e. estrogen, progesterone and testosterone)


CYTOPLASM
NUCLEUS
steroid receptor
Cellular response
Steroid hormone
Hormone-receptor complex
Complex binds to sites on chromatin, activating mRNA transcription

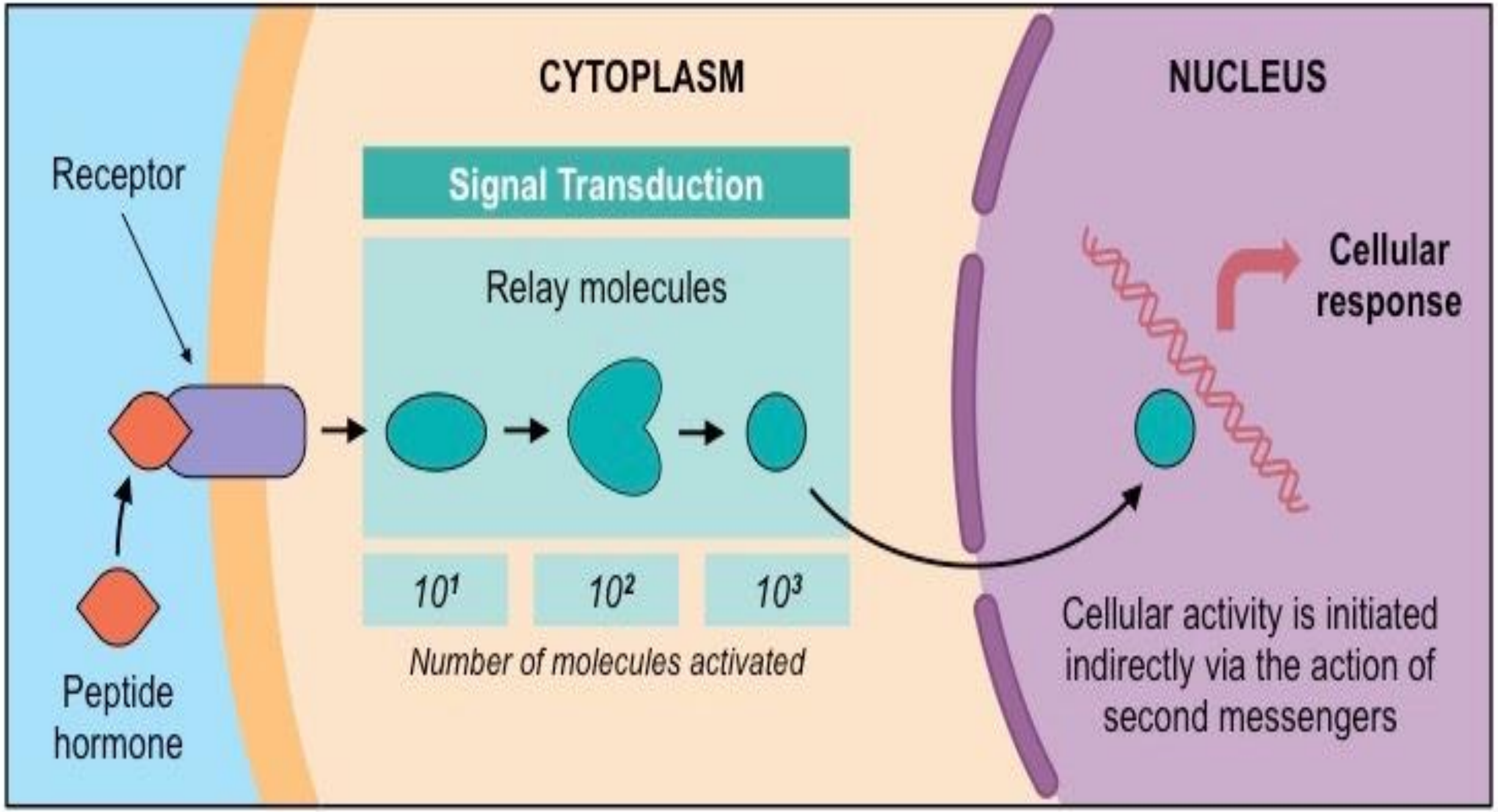
Peptide Hormones: Peptide hormones are hydrophylic and lipophobic (fat-hating) - meaning they cannot freely cross the plasma membrane

They bind to receptors on the surface of the cell, which are typically coupled to internally anchored proteins (e.g. G proteins)

The receptor complex activates a series of intracellular molecules called second messengers, which initiate cell activity

This process is called signal transduction, because the external signal (hormone) is transduced via internal intermediaries

Examples of second messengers include cyclic AMP (cAMP), calcium ions (Ca^{2+}), nitric oxide (NO) and protein kinases
The use of second messengers enables the amplification of the initial signal (as more molecules are activated)
Peptide hormones include insulin, glucagon, leptin, ADH and oxytocin


CYTOPLASM
NUCLEUS
Receptor
Signal Transduction
Relay molecules
Cellular response
10^1
10^2
10^3
Number of molecules activated
Peptide hormone
Cellular activity is initiated indirectly via the action of second messengers

Amine Hormones

Amine hormones are derived from the amino acid tyrosine and include adrenaline, thyroxin and triiodothyronine

Amine hormones do not all share identical properties and have properties common to both peptide and steroid hormones

	Peptide	Steroid	Amino acid derivative
Synthesis	Synthesised as **prohormones**, requiring further processing (e.g. cleavage) to activate	Synthesised in a series of reactions from **cholesterol**	Synthesised from the amino acid **tyrosine**
Storage	Stored in vesicles (regulatory secretion)	Released immediately (constitutive secretion)	Stored before release (storage mechanism varies)
Solubility	Most are polar and water soluble, can travel freely in the blood	Generally non-polar and require carrier proteins to travel in blood	Some are polar (adrenaline), others must be protein-bound
Receptors	Bind receptors on cell membrane and transduce signal via the use of second messenger systems	Bind to intracellular receptors to change gene expression directly	Adrenaline acts on membrane receptors, while thyroid hormones act directly on nuclear receptors
Effects	Often fast onset transient changes in protein activity, though gene expression changes can occur	Alterations in gene expression; slower onset but longer duration than peptide hormones	Adrenaline functions like peptides, thyroid hormones function in a similar manner to steroids
Examples	Insulin, glucagon, prolactin, ACTH, gastrin parathyroid hormone	Cortisol, aldosterone, estrogen, progesterone, testosterone	Adrenaline, thyroxin, triiodothyronine

THANK YOU