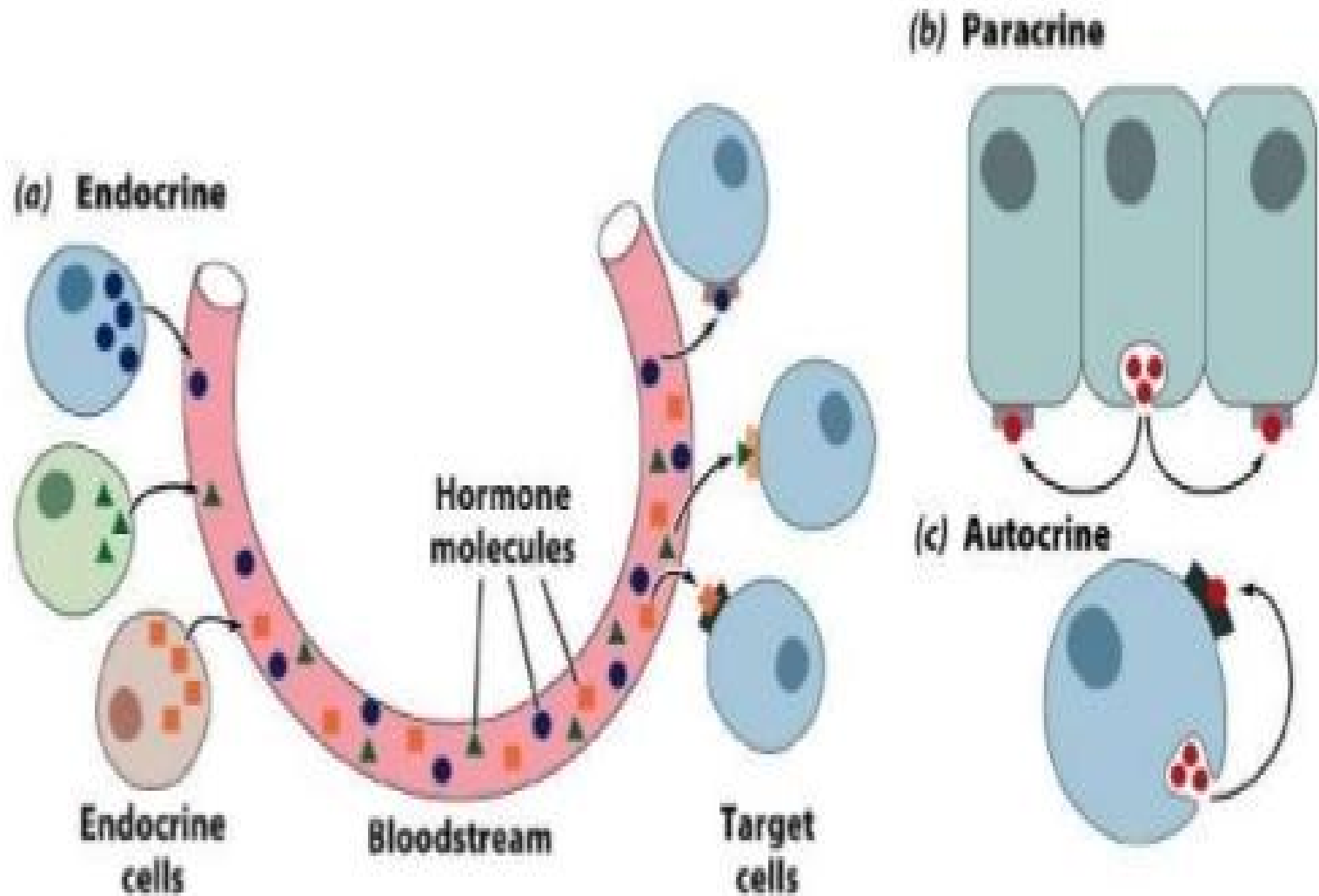


HORMONES

- Term hormone was introduced by **Starling** and **Bayliss** in 1905.
- Hormones are the **chemical messengers** produced by endocrine gland and transported by blood to other tissue or organ where these stimulate a change in some metabolic activity.
- They are produced from by **one type of cell** and have regulatory effect on the activities of **other type of cell or on itself**.
- The tissue or organ stimulated by a specific hormone are called **Target Tissue/ Target organ**



Polypeptides

Insulin
glucagon
somatotropin

FSH
LH
vasopressin

Oxytocin
thyrotropin
ACTH

Steroids

Estrogen
testosterone
cortisol

Aldosterone
corticosterone
Progesterone

Amino acid derivatives

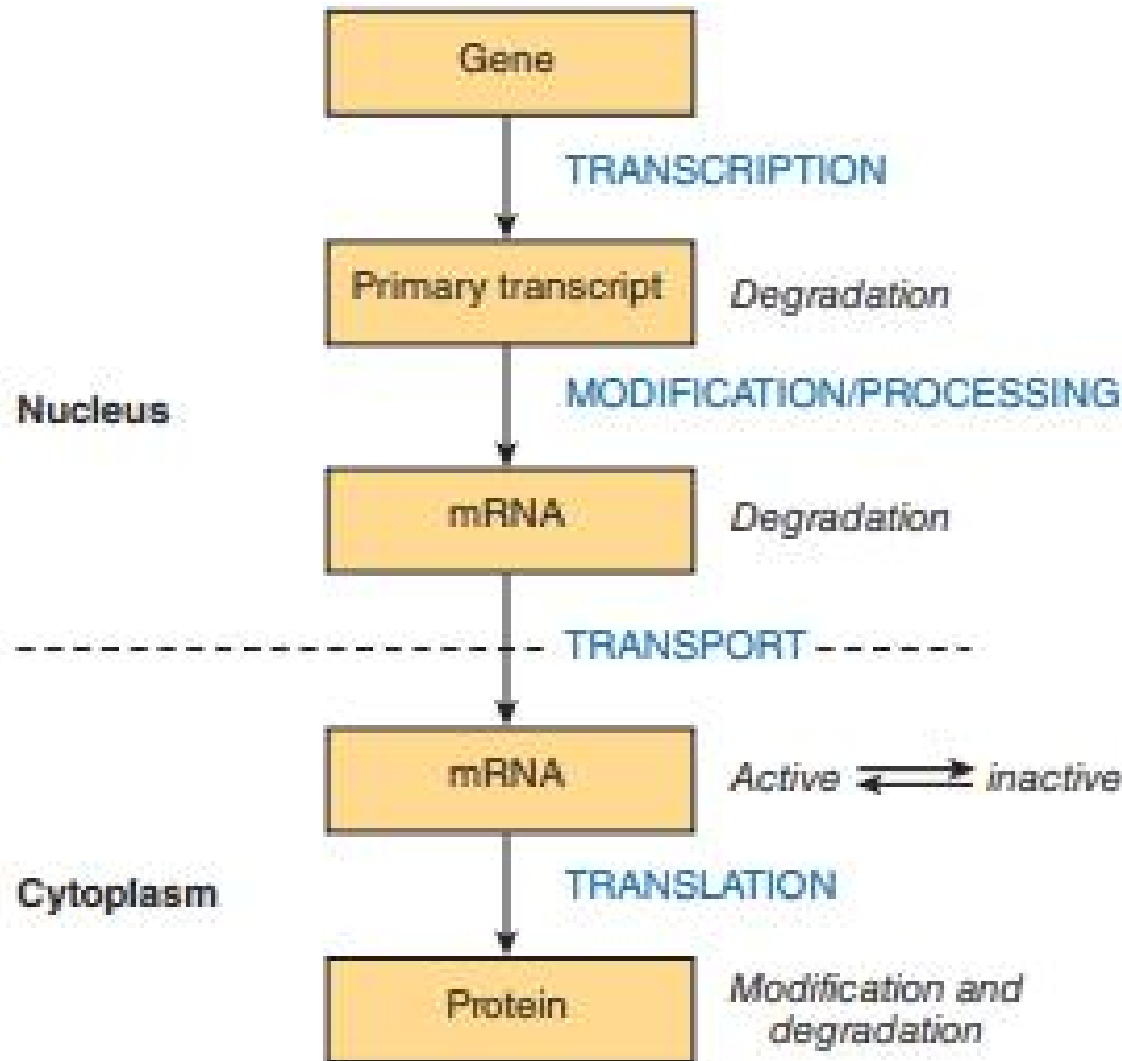
Epinephrine
norepinephrine
dopamine

Thyroxine, T3 and T4
Melatonin
Serotonin

Rule: All peptide hormones are synthesized as inactive “pre-pro” precursors

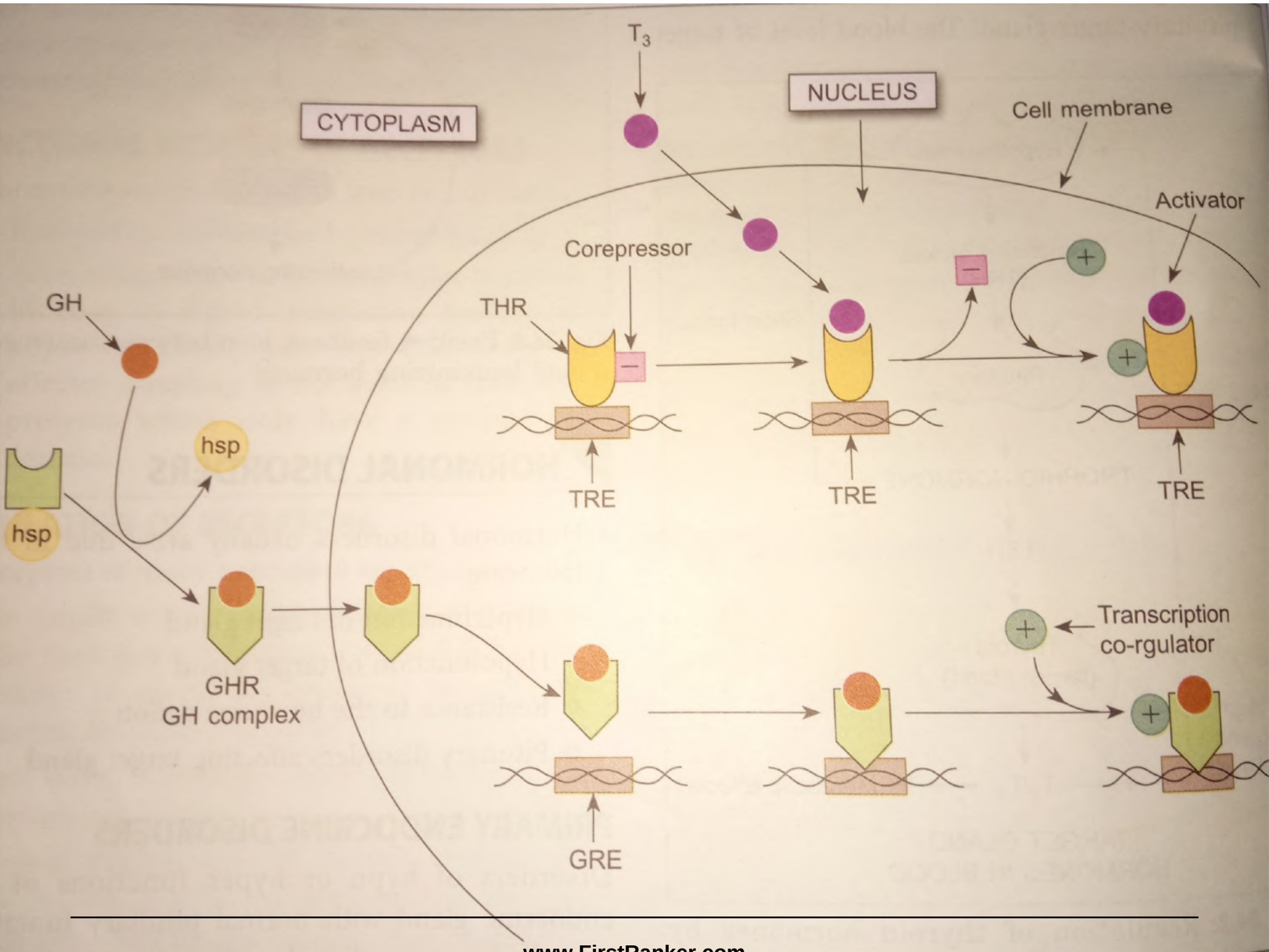
Rule: A signal peptide must be cleaved off to activate the mature form of the hormone

- Hormones act on specific cells and organs called target cell or target organ.
- **Target cell** or organ is that cell which has specific receptors for the hormone which bind to them with or without any demonstratable biochemical or physiological response
- Concentration of hormone is **very low** in blood but..
- Presence of **receptors** on target tissue
Specific binding between hormone and receptor
Very high local concentration
- Makes the target tissue highly specific to hormones



The “**information pathway**”. Information flows from the gene to the primary transcript to mRNA to protein.

Hormones can affect any of the steps involved and can affect the rates of processing, degradation or modification of the various products



CLASSIFICATION OF HORMONES BY MECHANISM OF ACTION

I. Hormones that bind to intracellular receptors

1. Androgens
2. Calcitriol (1,25[OH]₂-D₃)
3. Estrogens
4. Glucocorticoids
5. Mineralocorticoids
6. Progestins
7. Retinoic acid
8. Thyroid hormones (T₃ and T₄)

II. HORMONES THAT BIND TO CELL SURFACE RECEPTOR

A. The second messenger is cAMP

- α 2-Adrenergic catecholamines
- β -Adrenergic catecholamines
- Adrenocorticotrophic hormone (ACTH)
- Antidiuretic hormone (vasopressin)
- Calcitonin
- Human Chorionic gonadotropin, (HCG)
- Corticotropin-releasing hormone
- Follicle-stimulating hormone (FSH)
- Glucagon
- Luteinizing hormone (LH)
- Melanocyte-stimulating hormone (MSH)
- Parathyroid hormone (PTH)
- Somatostatin
- Thyroid-stimulating hormone (TSH)

B. The second messenger is cGMP

- Atrial natriuretic factor
- Nitric oxide

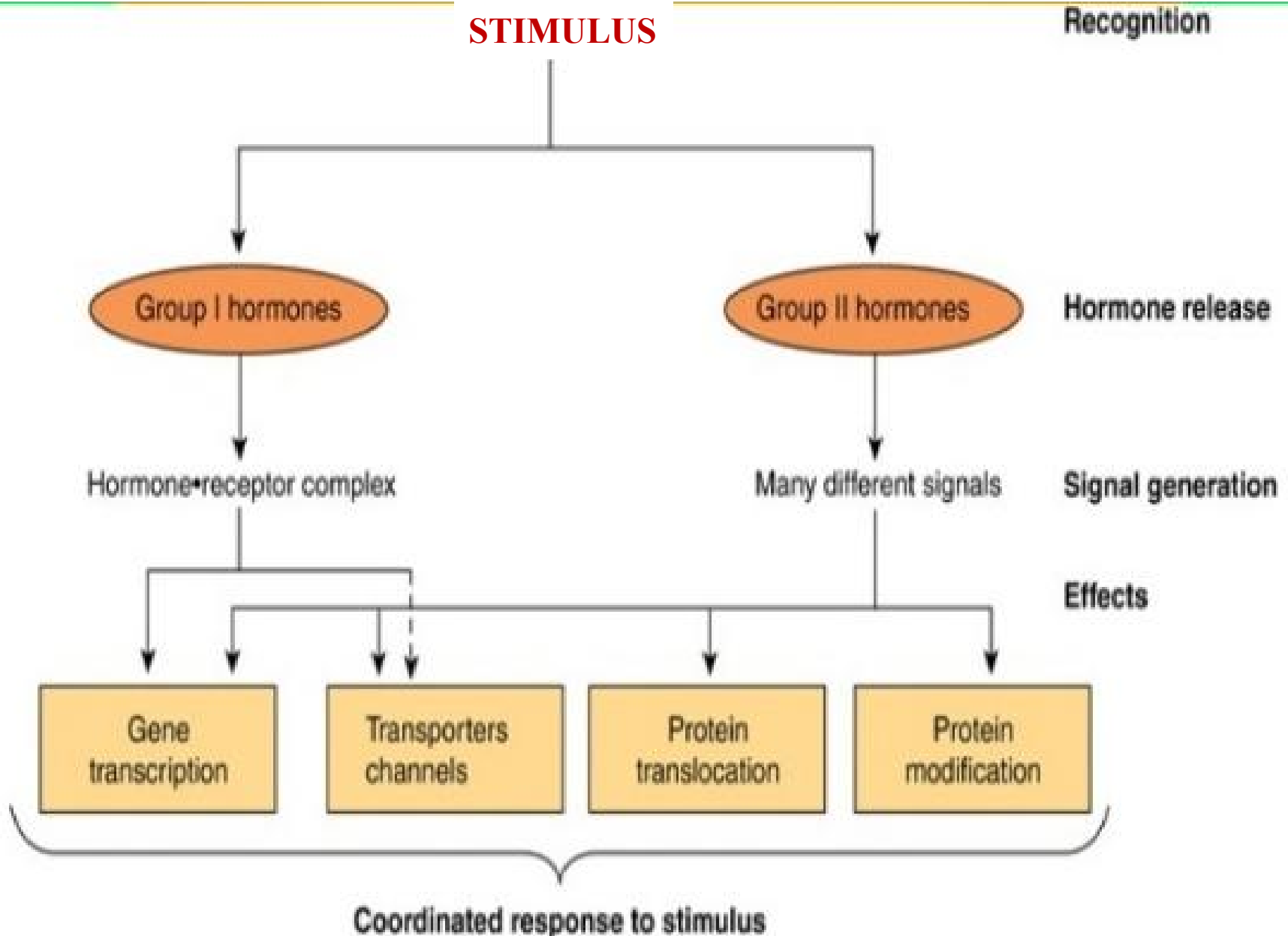
C. The second messenger is calcium or phosphatidylinositols (or both)

- Acetylcholine (muscarinic)
- α 1-Adrenergic catecholamines
- Angiotensin II
- Antidiuretic hormone (vasopressin)
- Cholecystokinin
- Gastrin
- Gonadotropin-releasing hormone
- Oxytocin
- Thyrotropin-releasing hormone (TRH)

D. The second messenger is a kinase or phosphatase cascade

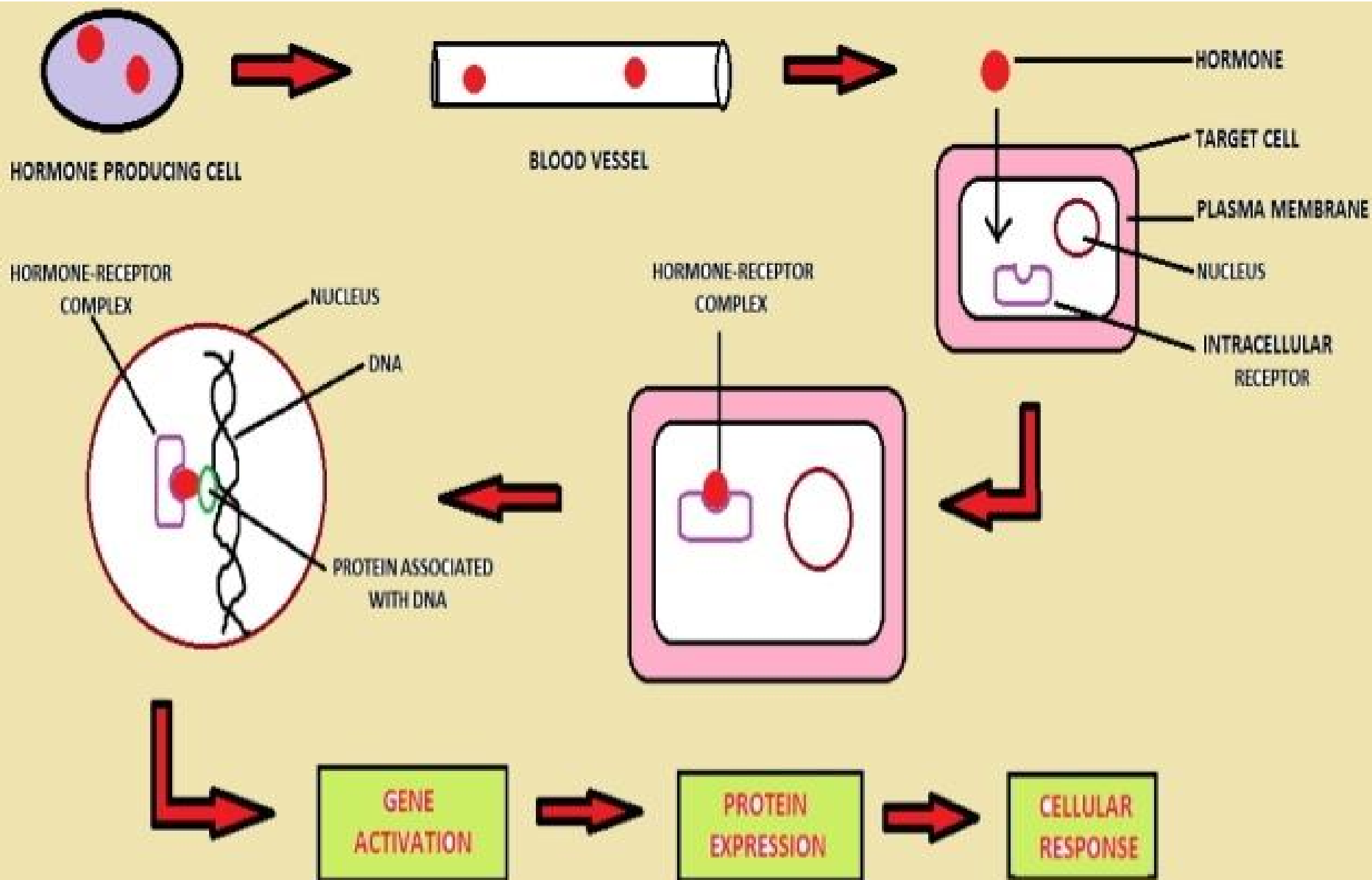
- Adiponectin
 - Chorionic somatomammotropin
 - Epidermal growth factor (EGF)
 - Erythropoietin (EPO)
 - Fibroblast growth factor (FGF)
 - Growth hormone (GH)
 - Insulin
 - Insulin-like growth factors I and II
 - Leptin
 - Nerve growth factor (NGF)
 - Platelet-derived growth factor
 - Prolactin
-

HORMONES

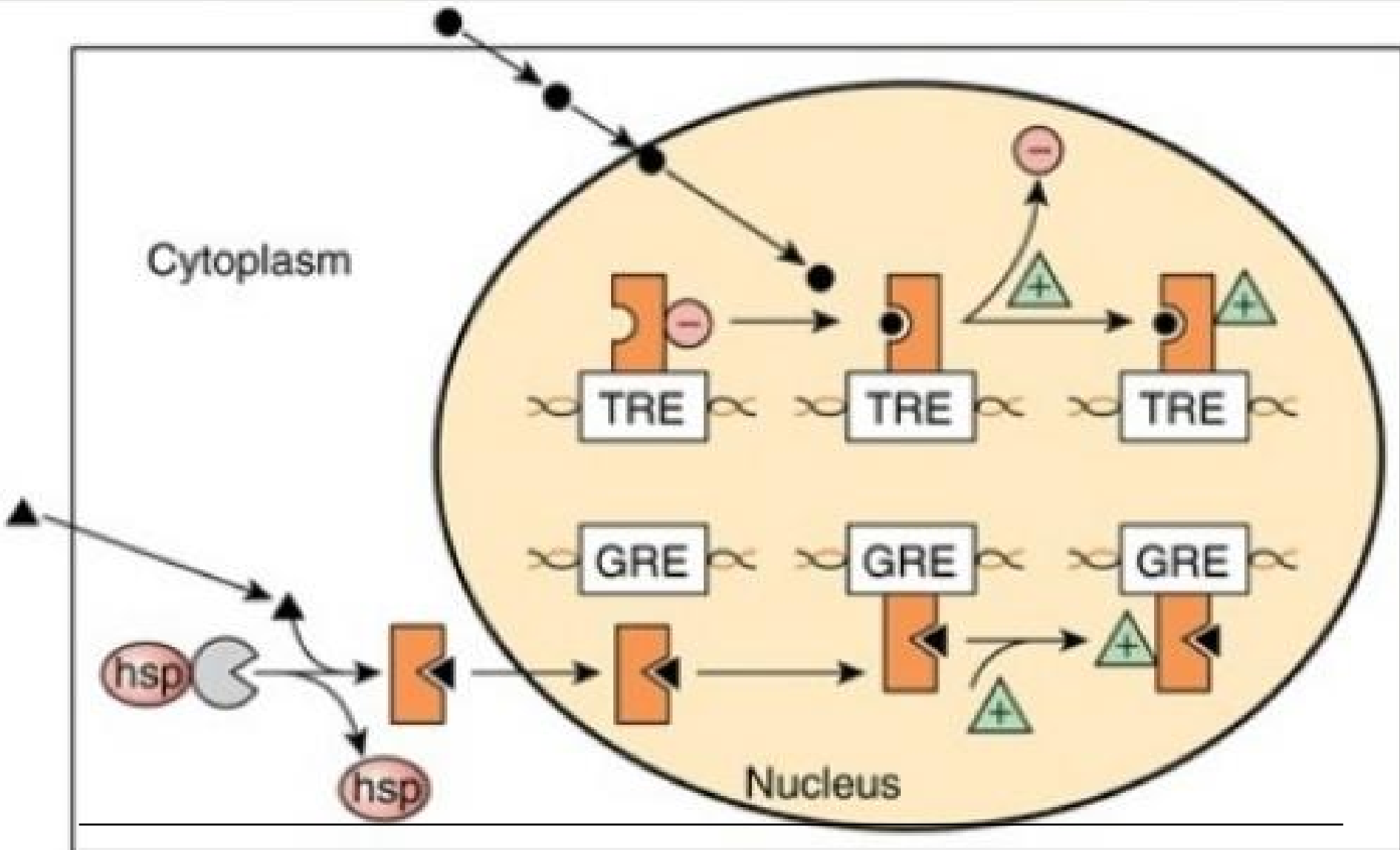


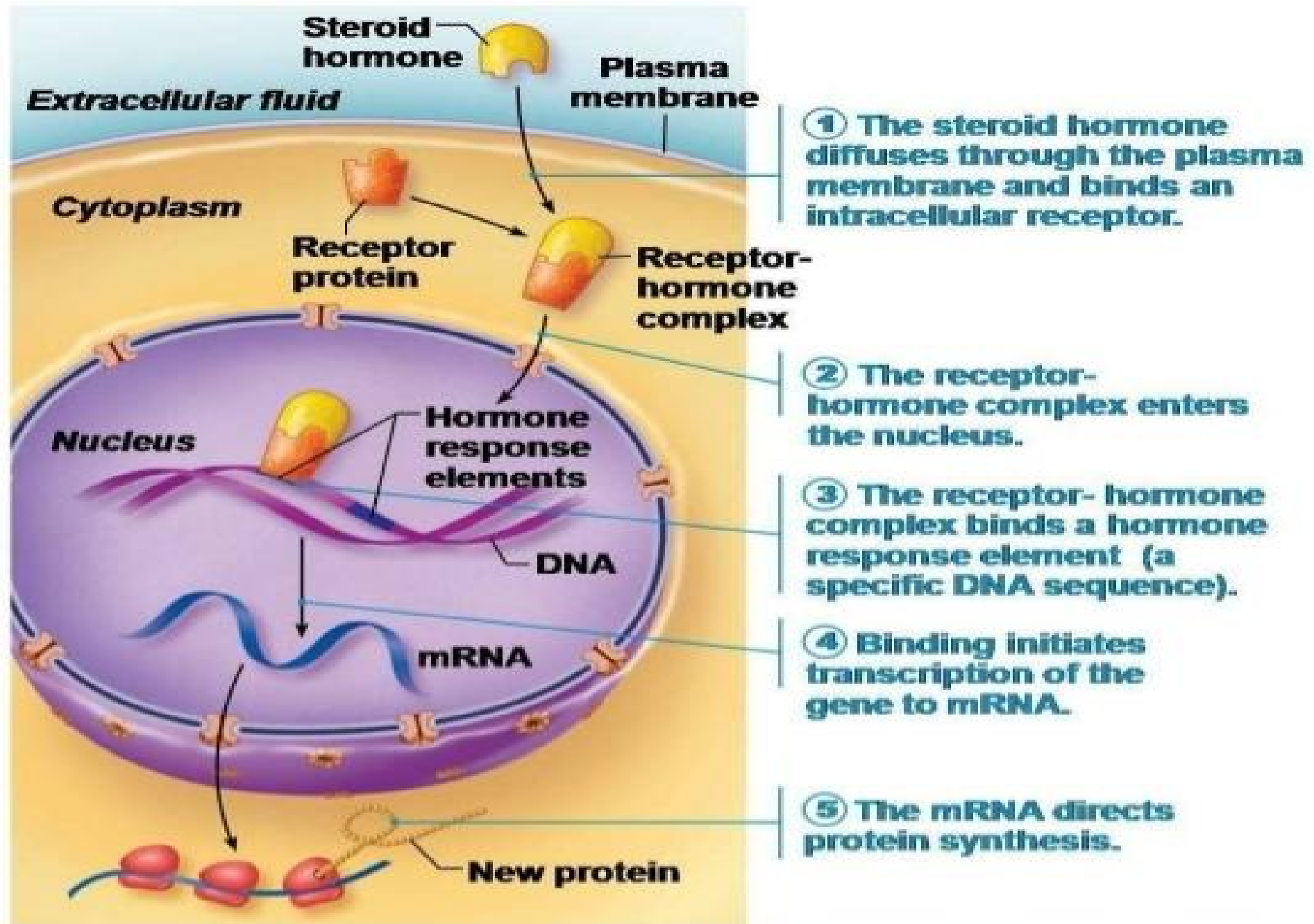
PROPERTY	GROUP I	GROUP II
1.HORMONES	Adrenal steroids, thyroid hormones, sex hormones, calcitriol ,retinoids	Hypothalamic hormones, pituitary hormones, pancreatic hormones, Adrenal hormones
2.Chemical nature	Steroids, iodothyronines, retinoids	Peptides & polypeptides, proteins, glycoproteins, Catecholamines
3.Solubility	Hydrophobic, Water insoluble	Hydrophilic Water soluble
4.Transport Protein	Required	Not required
5.Receptors location	Cytoplasm and nucleus	Cell membrane
6.Mediators of action	Hormone -Receptors Complex	• cAMP • cGMP • Ca ⁺⁺ • Phosphoinositides, kinase Cascade etc.

ACTION OF GROUP I HORMONES



MECHANISM OF GROUP I HORMONE ACTION





The DNA Sequences of Several Hormone Response Elements

Hormone or Effector	HRE	DNA Sequence
Glucocorticoids	GRE	GGTACA _{NNN} TGTTCT
Progestins	PRE	← →
Mineralocorticoids	MRE	
Androgens	ARE	
Estrogens	ERE	AGGTCA — TGACCT
Thyroid hormone	TRE	
Retinoic acid	RARE	AGGTCA _{N1-5} AGGTCA
Vitamin D	VDRE	→ →
cAMP	CRE	TGACGTCA

Another member of the steroid receptor superfamily, the retinoid X receptor (RXR), forms heterodimers with VDR, TR, and RARE, and these constitute the functional forms of these transacting factors.

cAMP affects gene transcription through the CRE