

MIND MAP

Hormones And Their Receptors



H O R M O N E S



Hormones are chemical messengers secreted directly in our blood stream from the endocrine glands. Hormones perform various functions from metabolism to growth and development, emotions, mood, sexual function and even sleep.

As hormones circulate in the bloodstream, they molecules encounter receptors in tissues throughout the body.

Hormones can also be classified according to their chemical properties. Chemically, the endocrine hormones fall into four categories: amino acid derivatives, peptides, proteins, and lipid-like hormones such as the steroids.

Steroid hormones directly enters the cytoplasm and interacts with intracellular receptors while non-steroidal hormones (peptide, amino acid, proteins) interact with receptors located on the plasma membrane of cell.

Chemical Classification

Example

Regulated Function

Endocrine Hormones

Amino acid derivatives

Epinephrine (adrenaline) and norepinephrine (both derived from tyrosine)

Stress responses: regulation of heart rate and blood pressure; release of glucose and fatty acids from storage sites

Peptides

Thyroxine (derived from tyrosine)
Antidiuretic hormone (vasopressin)
Hypothalamic hormones (releasing factors)

Regulation of metabolic rate
Regulation of body water and blood pressure
Regulation of tropic hormone release from pituitary gland

Proteins

Anterior pituitary hormones

Regulation of other endocrine systems

Steroids

Sex hormones (androgens and estrogens)

Development and control of reproductive capacity and secondary sexual characteristics

Corticosteroids

Stress responses; control of blood electrolytes

Paracrine Hormones

Amino acid derivative

Histamine

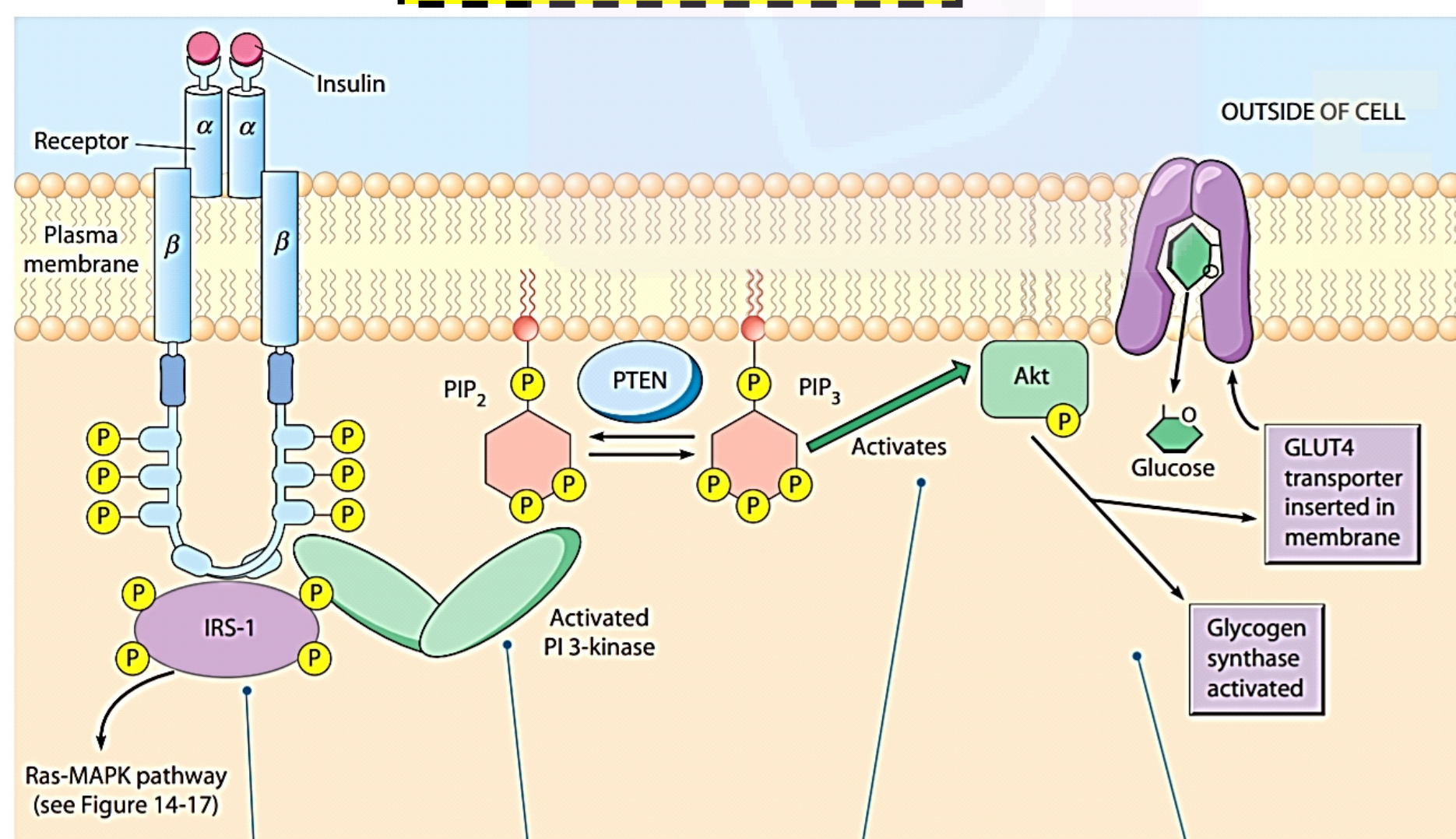
Local responses to stress and injury

Arachidonic acid derivatives

Prostaglandins

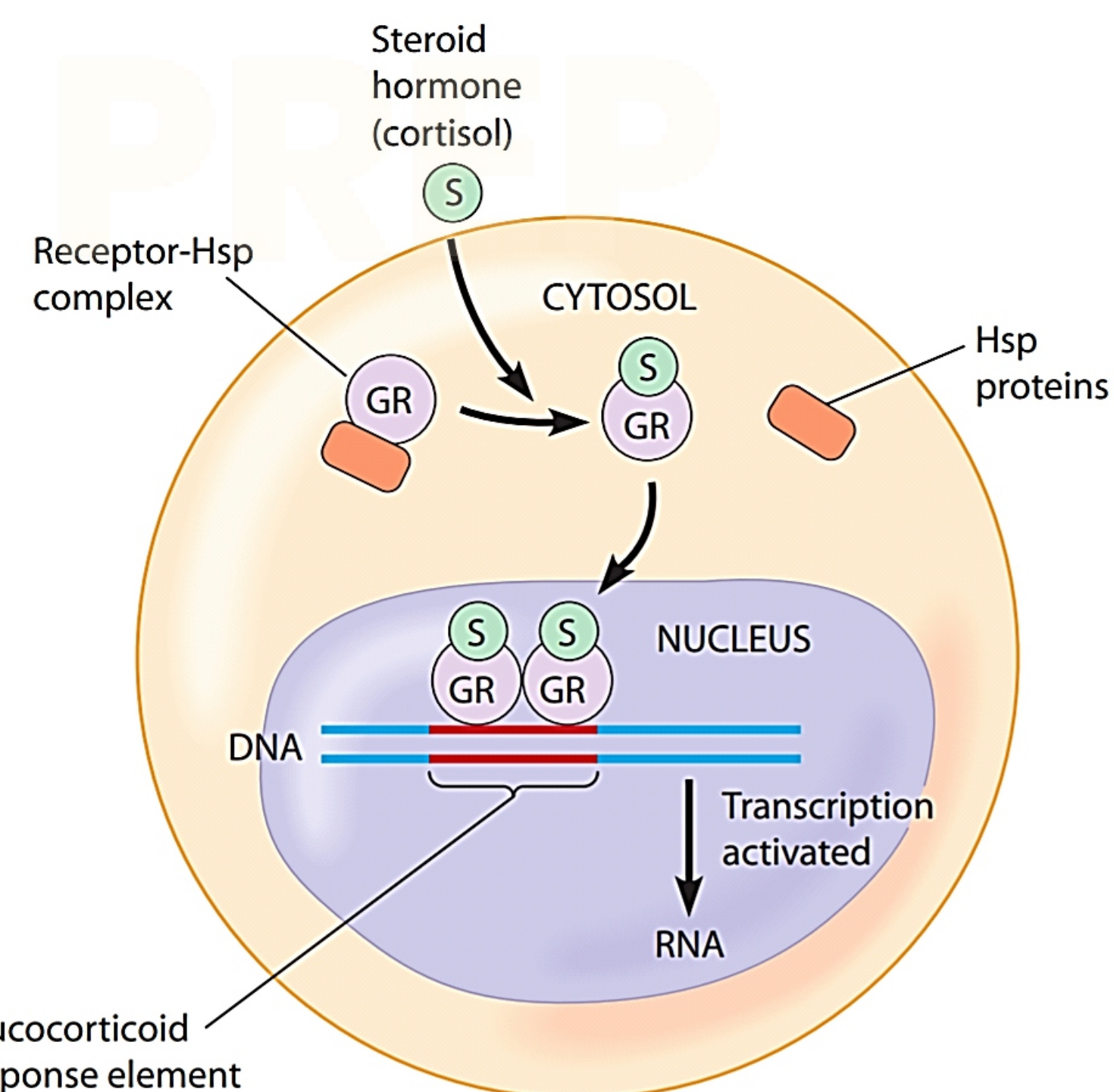
Local responses to stress and injury

NON-STEROIDAL

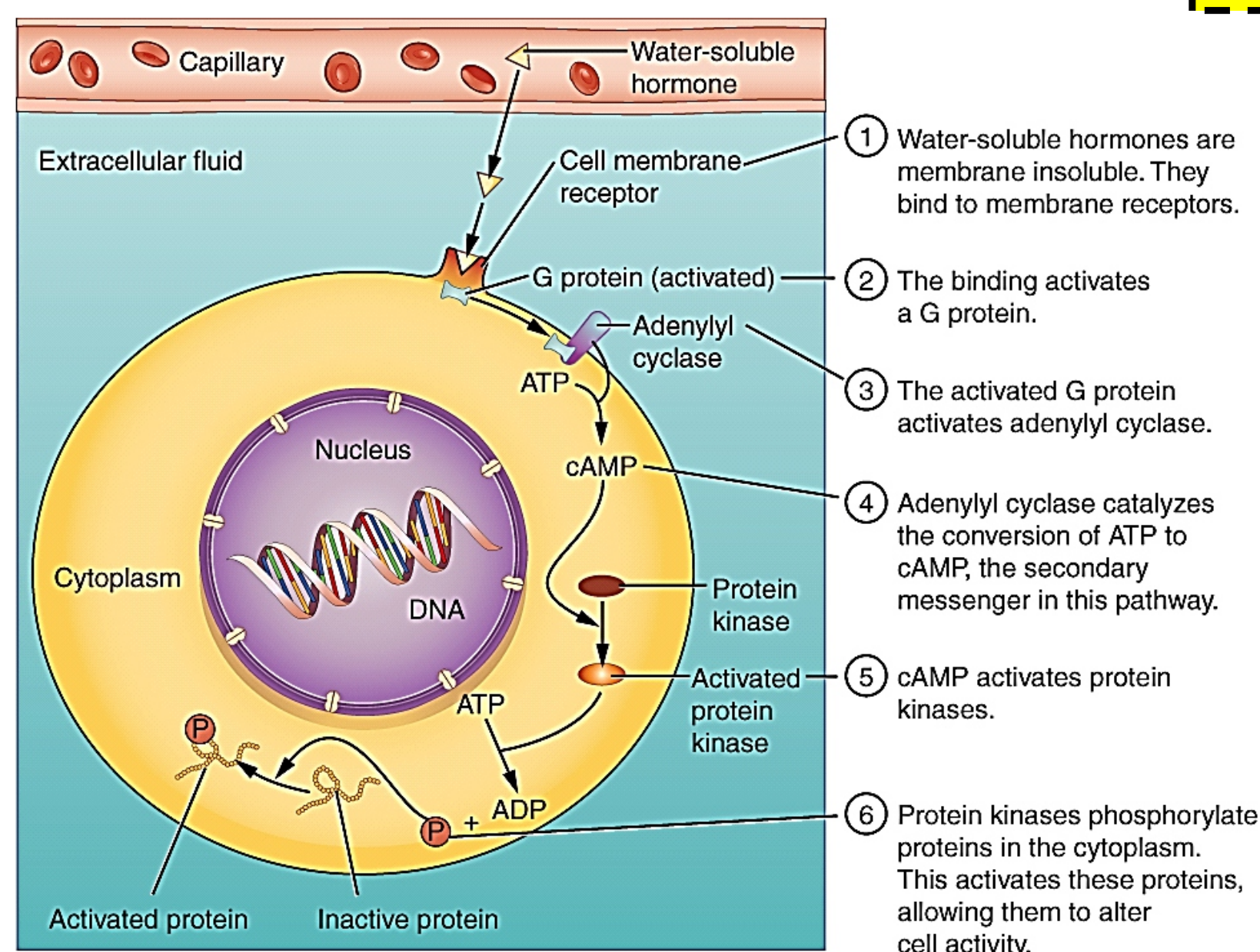


- 1 When the insulin receptor binds insulin, the activated receptor phosphorylates the IRS-1 protein. IRS-1 can lead to recruitment of GRB2, activating the Ras pathway.
- 2 IRS-1 activates PI 3-kinase, which catalyzes the addition of a phosphate group to the membrane lipid PIP₂, thereby converting it to PIP₃. PTEN can convert PIP₃ back to PIP₂.
- 3 PIP₃ binds a protein kinase called Akt, which is activated by other protein kinases.
- 4 Akt catalyzes phosphorylation of key proteins, leading to an increase in glycogen synthase activity and recruitment of the glucose transporter, GLUT4, to the membrane.

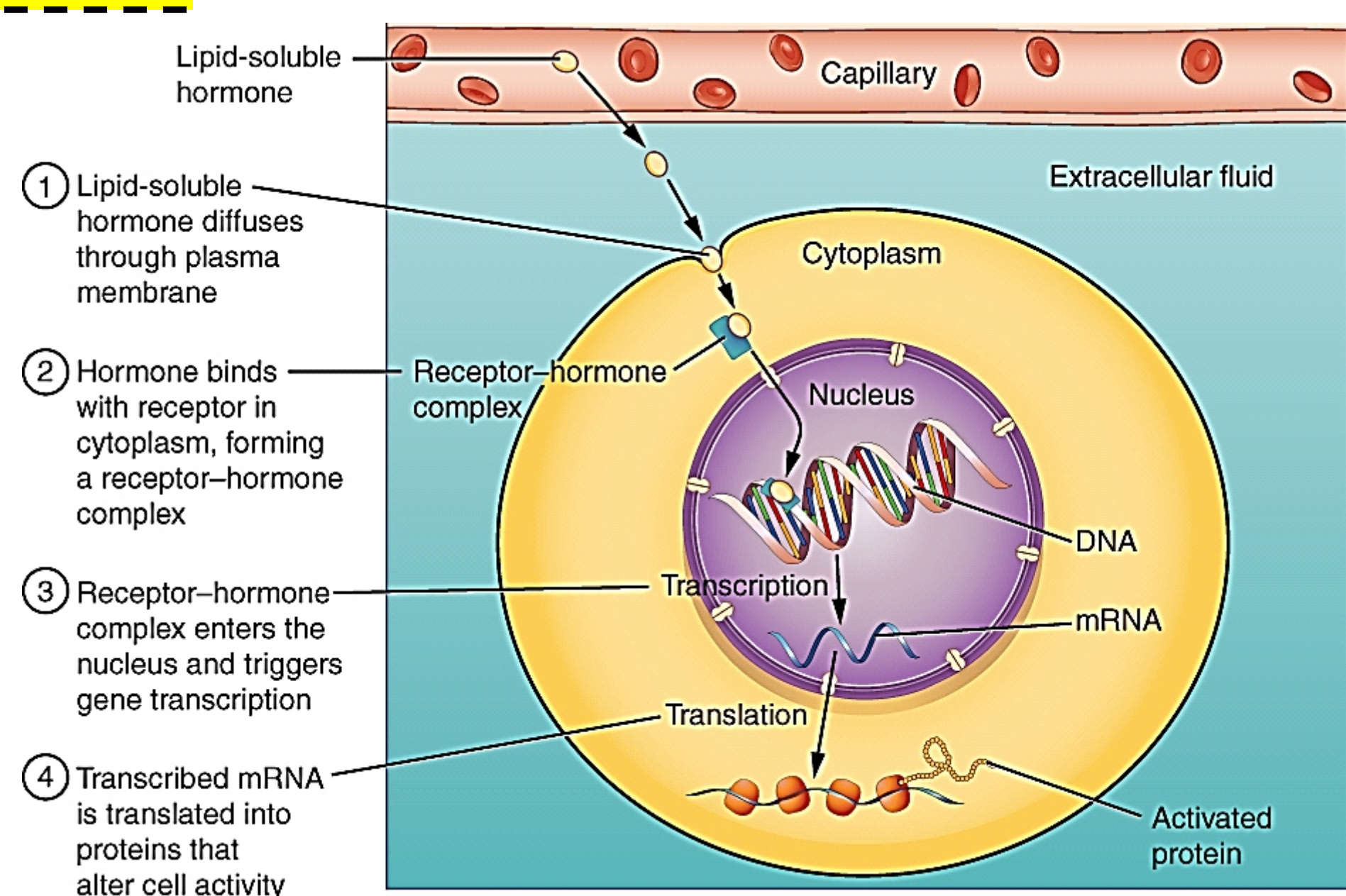
STEROIDAL



HORMONE RECEPTORS



- 1 Water-soluble hormones are membrane insoluble. They bind to membrane receptors.
- 2 The binding activates a G protein.
- 3 The activated G protein activates adenylyl cyclase.
- 4 Adenylyl cyclase catalyzes the conversion of ATP to cAMP, the secondary messenger in this pathway.
- 5 cAMP activates protein kinases.
- 6 Protein kinases phosphorylate proteins in the cytoplasm. This activates these proteins, allowing them to alter cell activity.



- 1 Lipid-soluble hormone diffuses through plasma membrane
- 2 Hormone binds with receptor in cytoplasm, forming a receptor-hormone complex
- 3 Receptor-hormone complex enters the nucleus and triggers gene transcription
- 4 Transcribed mRNA is translated into proteins that alter cell activity

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