

COORDINATION

COORDINATION PART 2

10.3

Hormones in Mammals

10.4

Photoperiodism



LEARNING OUTCOMES 10.3 – HORMONES IN MAMMALS



State the types of hormones

a.



State the types of mechanism of hormone action

b.



Explain the mechanism of hormone action

c.



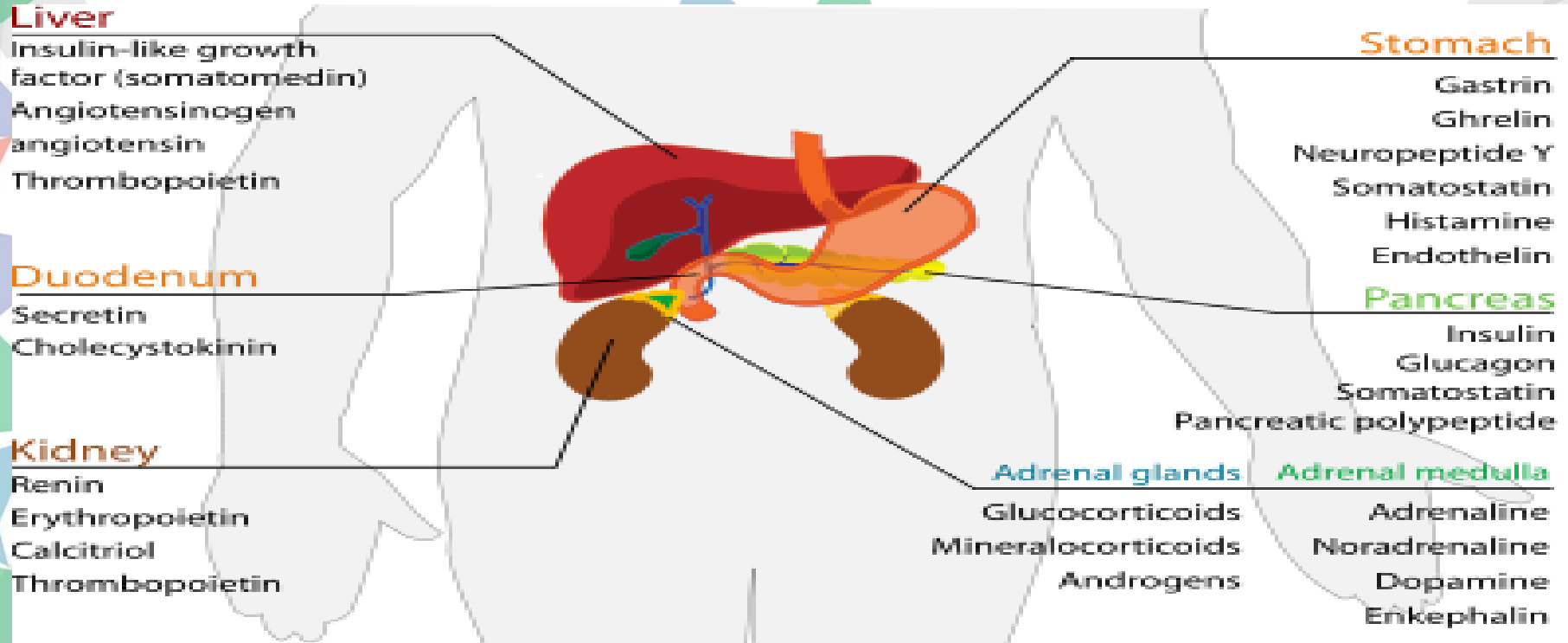
Learning Outcomes 10.4 - PHOTOPERIODISM

01

**Explain the role of phytochrome in
the regulation of flowering**



10.3 Hormone in Mammals

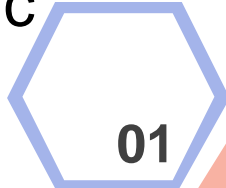


- **A collection of glands that produce chemical messenger (hormone).**

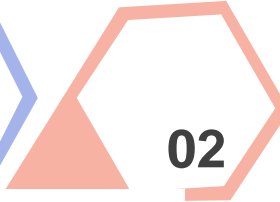
PROPERTIES OF HORMONES



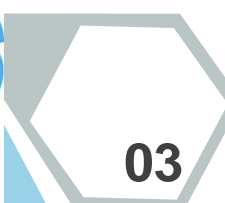
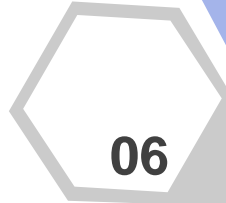
Small soluble organic molecule



Travels in the blood.

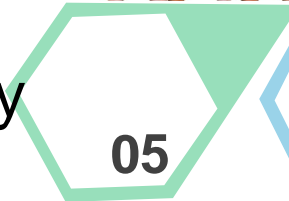


Chemical messenger

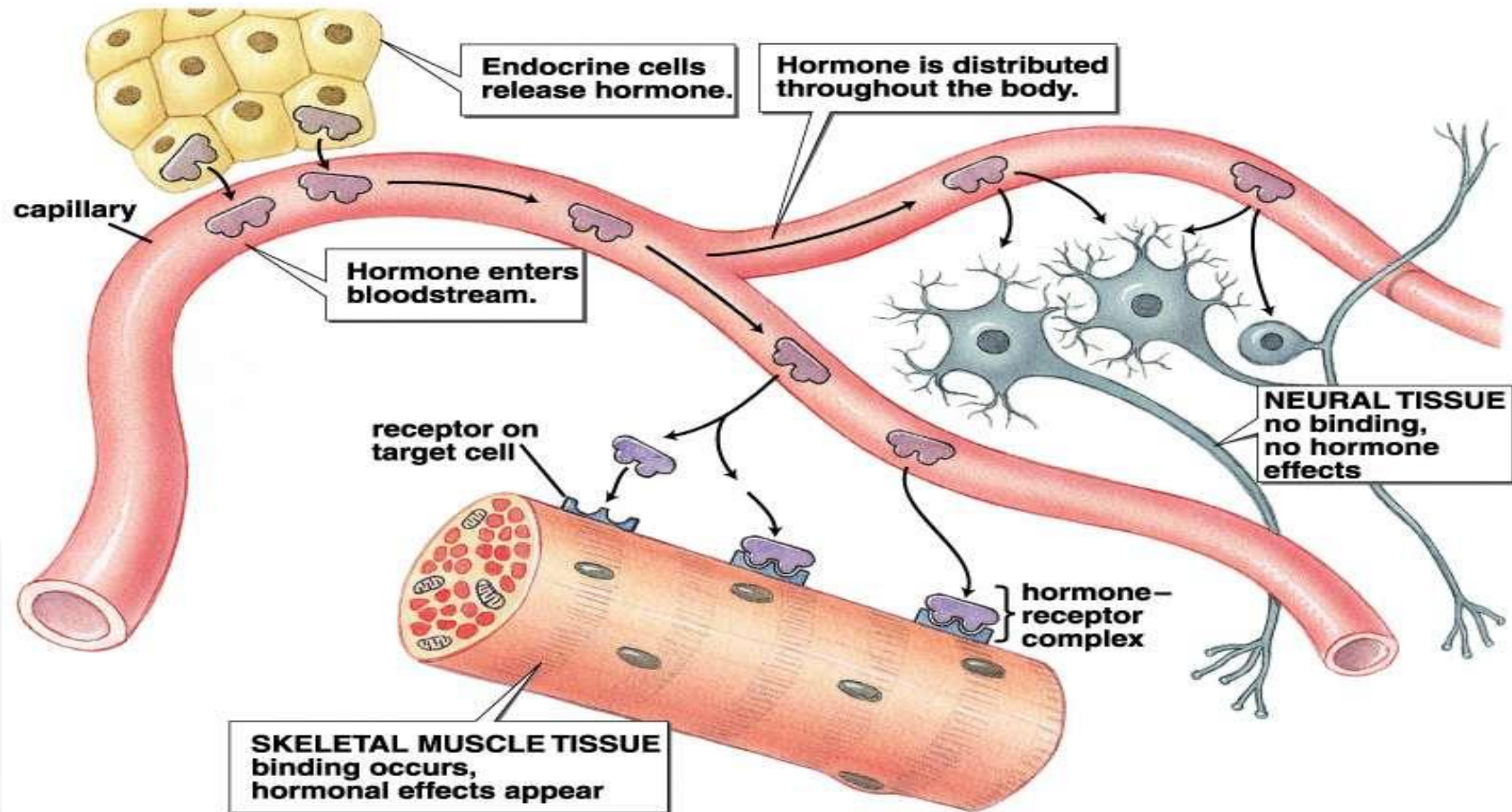


Effective in low concentrations.

Produces response only when they reach target cells.



Specific for a particular target cells



Endocrine gland and hormone	Target tissue	Principal actions
Hypothalamus Releasing and inhibiting hormones	Anterior lobe of anterior	Regulate secretion of hormones by the anterior pituitary
Hypothalamus (production) Posterior lobe of pituitary (storage and release) Oxytocin	Uterus Mammary glands	Stimulates contraction Stimulate ejection of milk into ducts Stimulates reabsorption of water; conserves water
Antidiuretic hormone (ADH)	Kidneys (collecting ducts)	
Anterior lobe of pituitary Growth hormone	General	Stimulates production of insulin-like growth factors; stimulates growth by promoting protein synthesis Stimulates milk production
Prolactin Thyroid stimulating hormone (TSH)	Mammary glands Thyroid gland	Stimulates secretion of thyroid hormones; stimulates increase in size of thyroid gland

Endocrine gland and hormone	Target tissue	Principal actions
Adrenocorticotrophic hormone (ACTH)	Adrenal cortex	Stimulates secretion of adrenal corticol hormones
Gonadotropic hormones (follicle-stimulating hormones[FSH]; luteinizing hormone[LH])	Gonads	Stimulates gonad function and growth
Thyroid gland Thyroxine	General	Stimulate metabolic rate; essential to normal growth and development
Islets of Langerhans of Pancreas Insulin	General	Regulates glucose concentration in blood; stimulates glycogen production; stimulates fat storage and protein synthesis
Glucagon	Liver; adipose tissue	Regulates glucose concentration in blood; stimulates glycogen breakown; mobilizes fat
Adrenal medulla Epinephrine and norepinephrine	Skeletal muscle; cardiac muscle; blood vessels; liver; adipose tissue	Help body cope with stress, increase heart rate, blood pressure

Endocrine gland and hormone	Target tissue	Principal actions
Adrenal cortex		
Aldosterone	Kidney tubules	Maintain sodium and potassium balance; increase sodium reabsorption; increase potassium excretion
Cortisol	General	Help body cope with long term stress ; raise blood glucose level; mobilize fat
Ovary		
Estrogens (estradiol)	General; uterus	Develop and maintain sex characteristics in female; stimulate growth of uterine lining Stimulates development of uterine lining
Progesterone	Uterus; breast	
Testis		
Testosterone	General; reproductive structures	Develop and maintain sex characteristics in male; promotes spermatogenesis
Inhibin	Pituitary (anterior)	Inhibits FSH release in male

10.3 (a)- State the types of hormones



Type of Hormone	Hormone Class	Components	Example(s)
Non steroid	AMINE	Amino acids with modified groups.	Norepinephrine
	PEPTIDE/ PROTEIN	Short chains of linked amino acids/ long chains of linked of amino acids.	Oxytocin, Human Growth Hormone
Steroid	STEROID	Derived from the lipid (cholesterol).	Testosterone, Progesterone

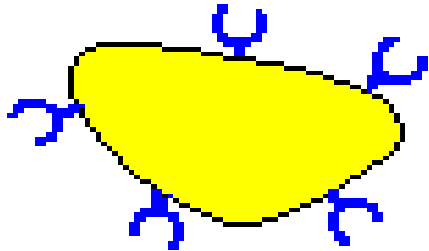


10.3 (a)- State the types of hormones

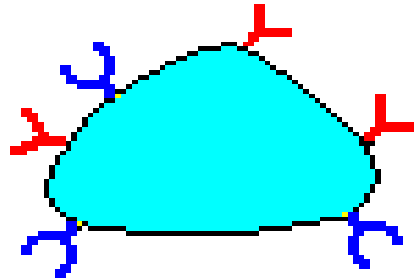
TYPE OF HORMONES	STEROID	NON STEROID
Size	Large	Small
Solubility	Lipid soluble molecule	Water soluble molecule
Permeability	Enable to permeate the cell membrane easily	Unable to permeate the cell membrane
Synthesized from	Synthesized from cholesterol	Amino acid/ peptides/proteins
Example:	Cortisol, aldosterone, testosterone, progesterone, estrogen etc.	Adrenaline, glucagon, insulin etc.

10.3 (b) – State the types of mechanism of hormone action.

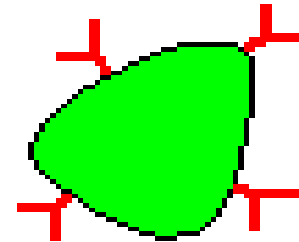
Target Cell for hormone A



Target Cell for both hormones A and B



Target Cell for hormone B

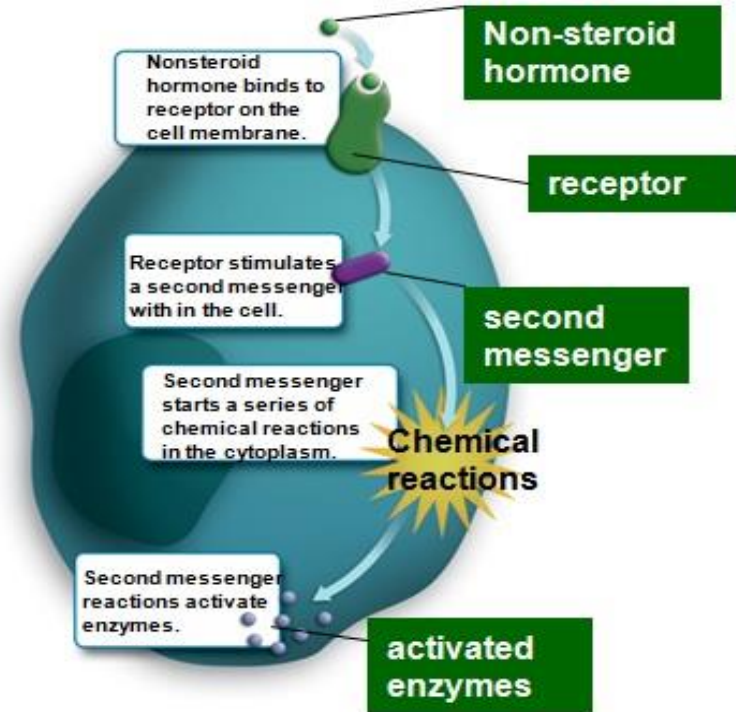
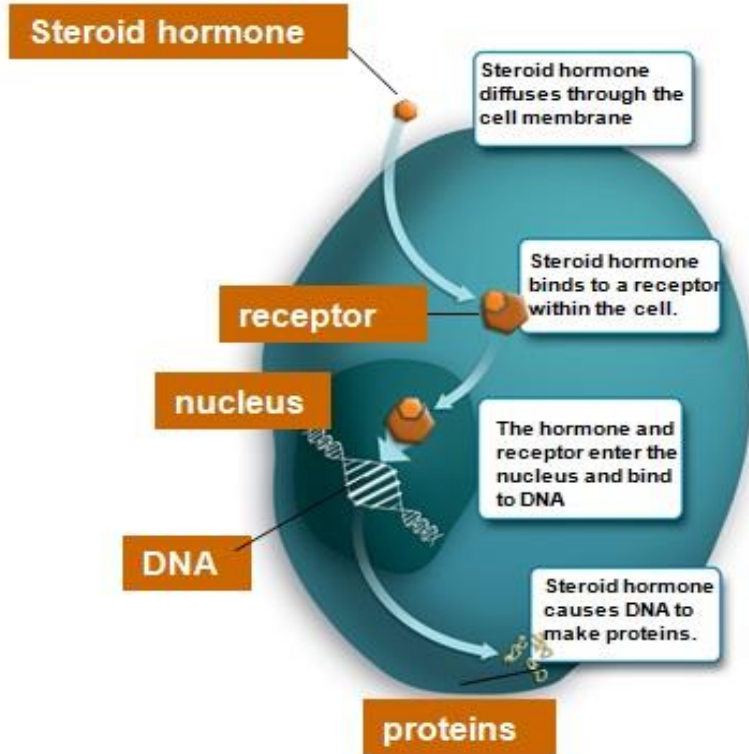


● Hormone A

▲ Hormone B

- ❖ Hormones are very specific.
- ❖ Only target cells that possess -receptor that recognize the hormone will show the response.

10.3 (b) – State the types of mechanism of hormone action.



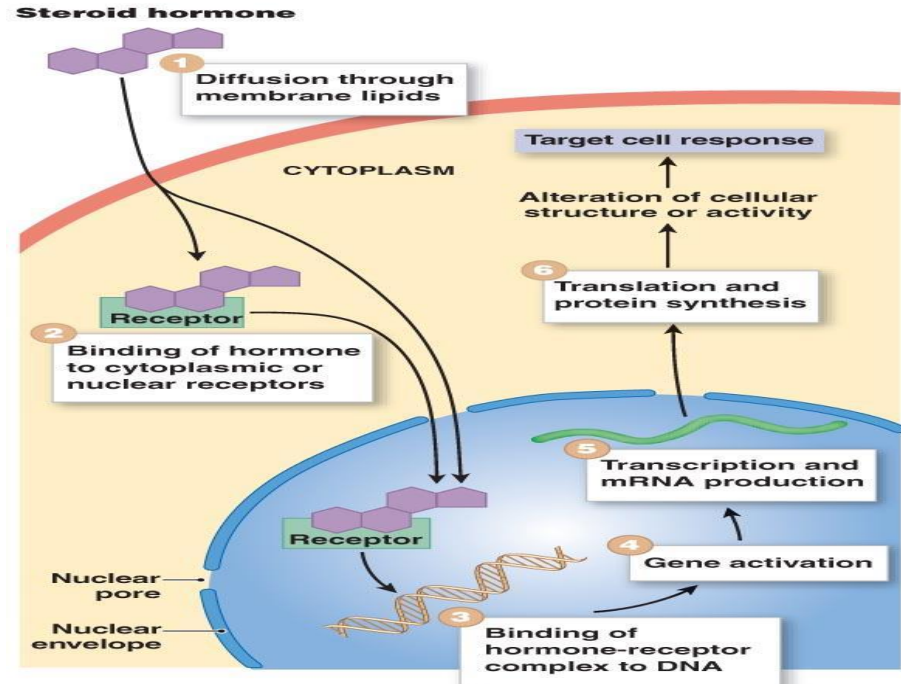
10.3(c) – Explain the mechanism of hormone action

1) Steroid hormone freely passes through the plasma membrane of target cell.

2) Steroid hormone binds to a receptor protein in the cytoplasm.

3) Steroid hormone-receptor complex enter the nucleus and binds to specific genes.

The events associated with the binding of a steroid hormone to receptors in the cytoplasm or nucleus



GENE ACTIVATION

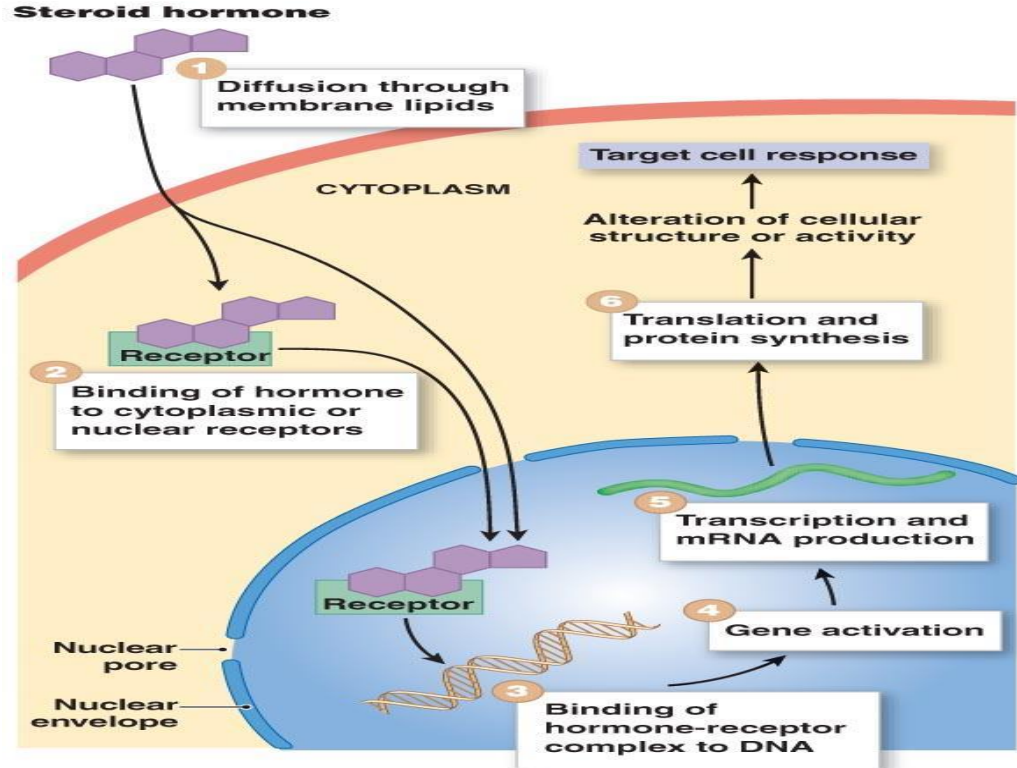
The events associated with the binding of a steroid hormone to receptors in the cytoplasm or nucleus

4) Activate specific gene.

5) Leads to transcription of gene into mRNA.

6) mRNA is translated into specific protein in cytoplasm.

7) Specific protein will alter the cellular structure and metabolic activity.



GENE ACTIVATION

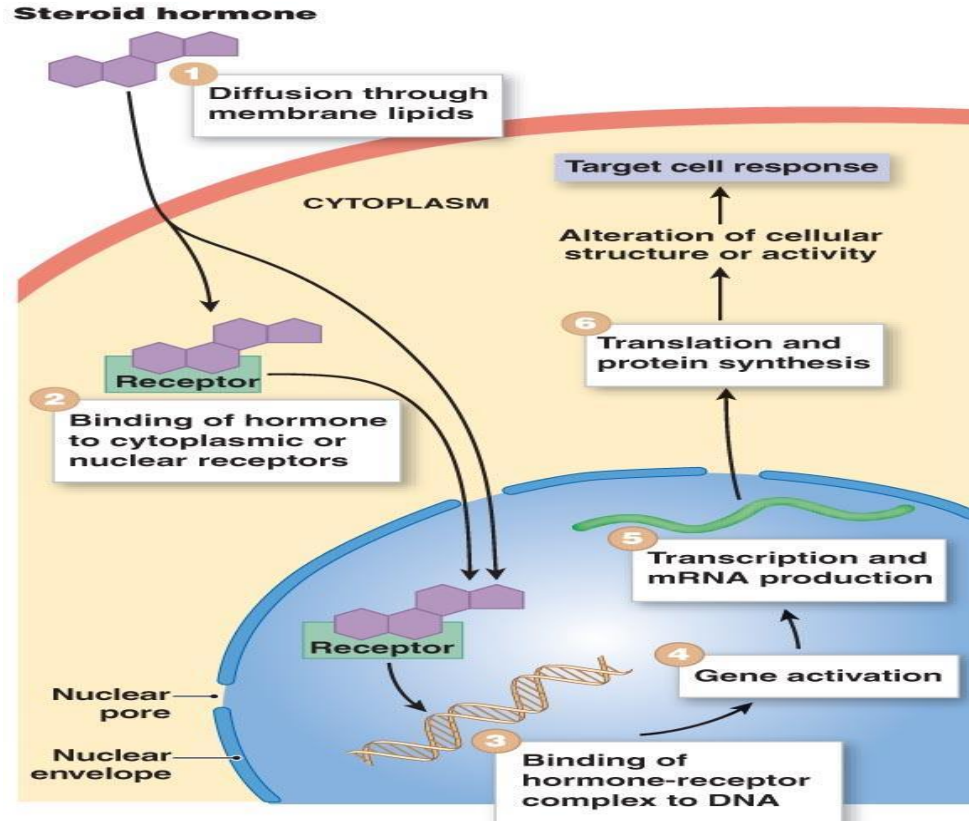
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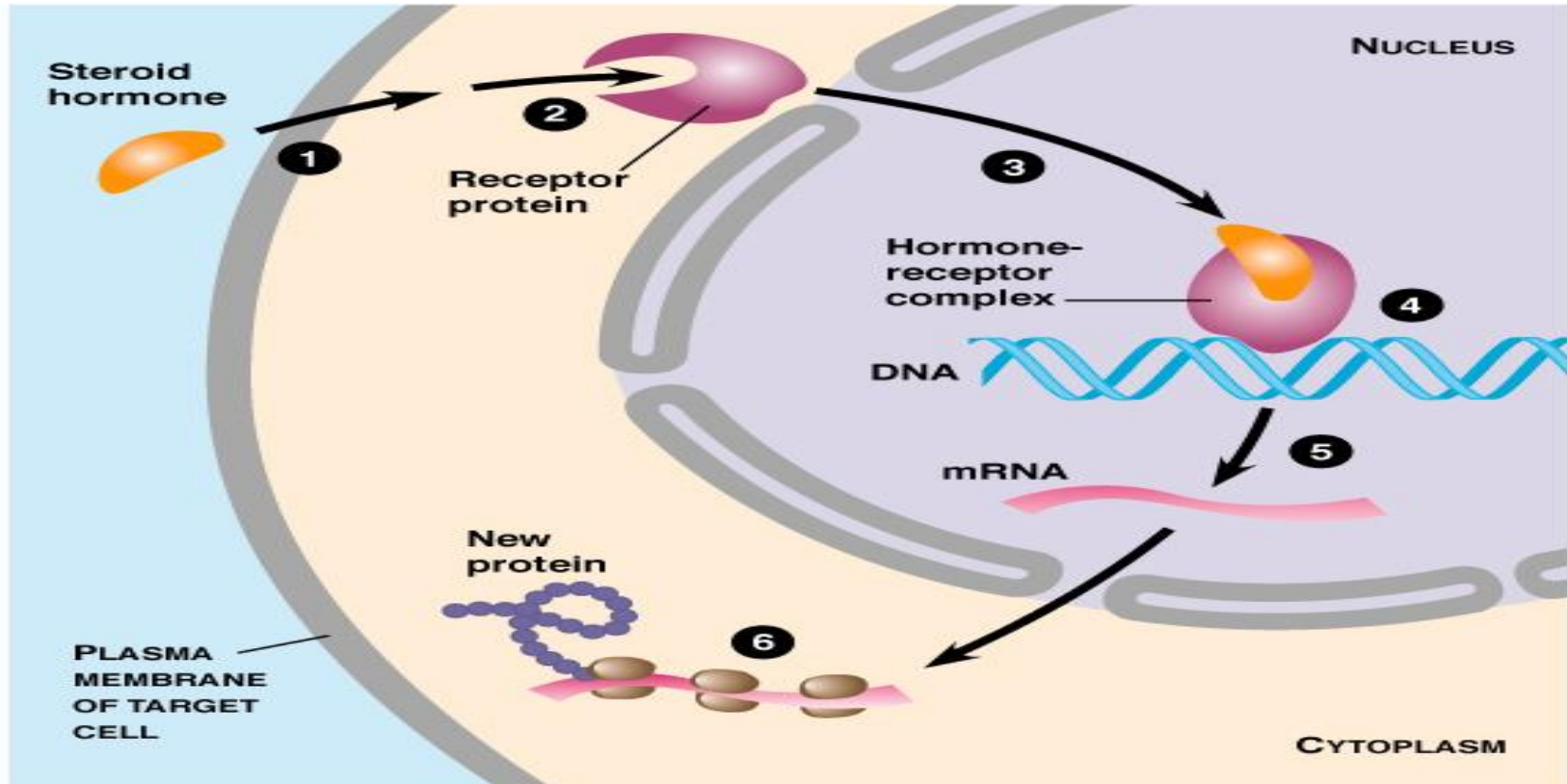
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GENE ACTIVATION

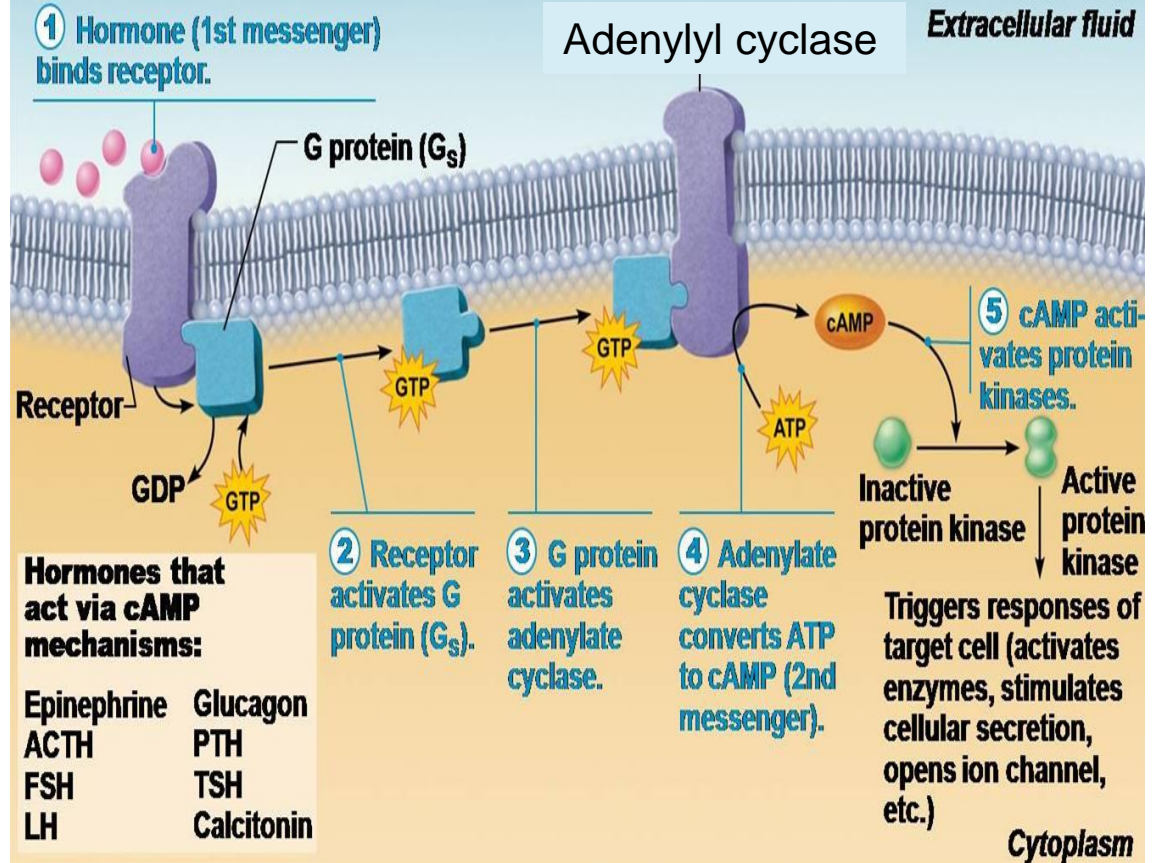


CYCLIC AMP ACTIVATION

1) Non steroid hormone binds to the receptor present on the surface of target cell.

2) Hormone binding activate G protein.

3) G protein activate adenylate cyclase.



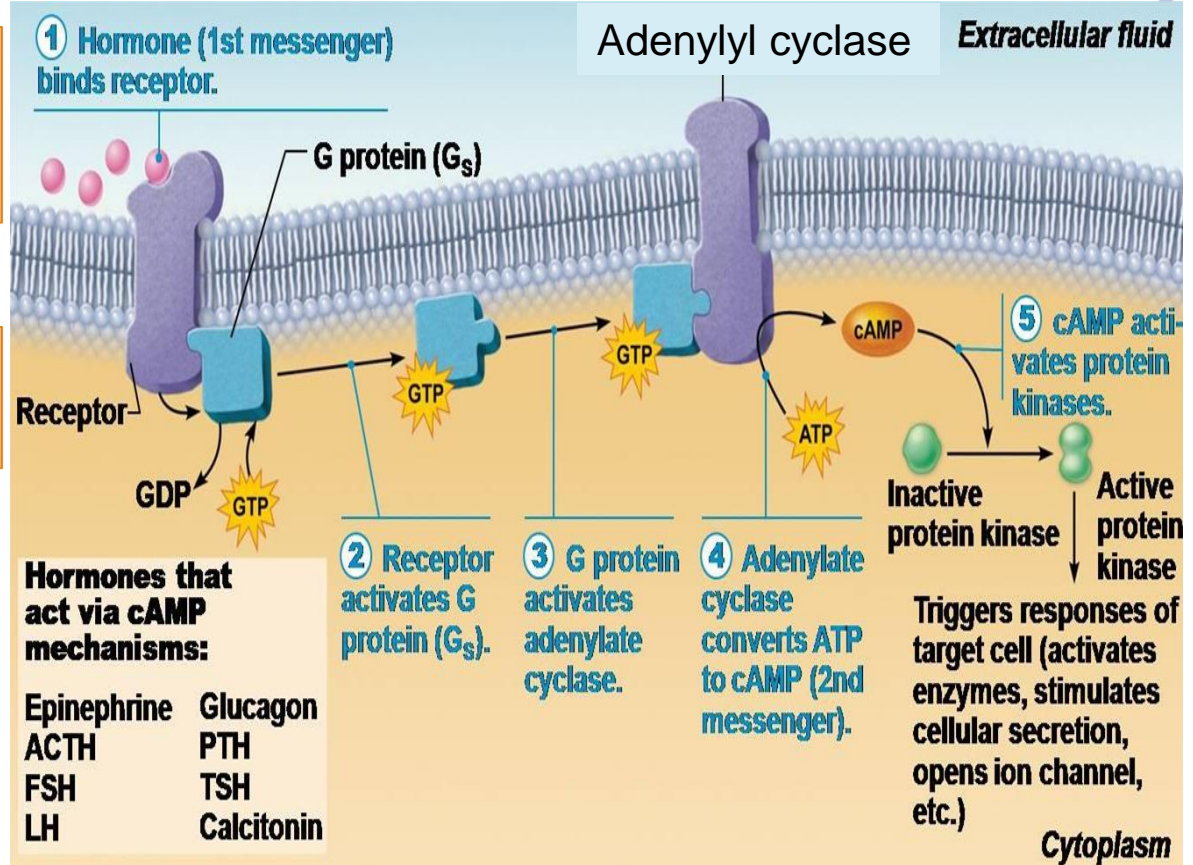
Triggers responses of target cell (activates enzymes, stimulates cellular secretion, opens ion channel, etc.)

Cytoplasm

CYCLIC AMP ACTIVATION

4) Adenylate cyclase converts ATP to cAMP (second messenger).

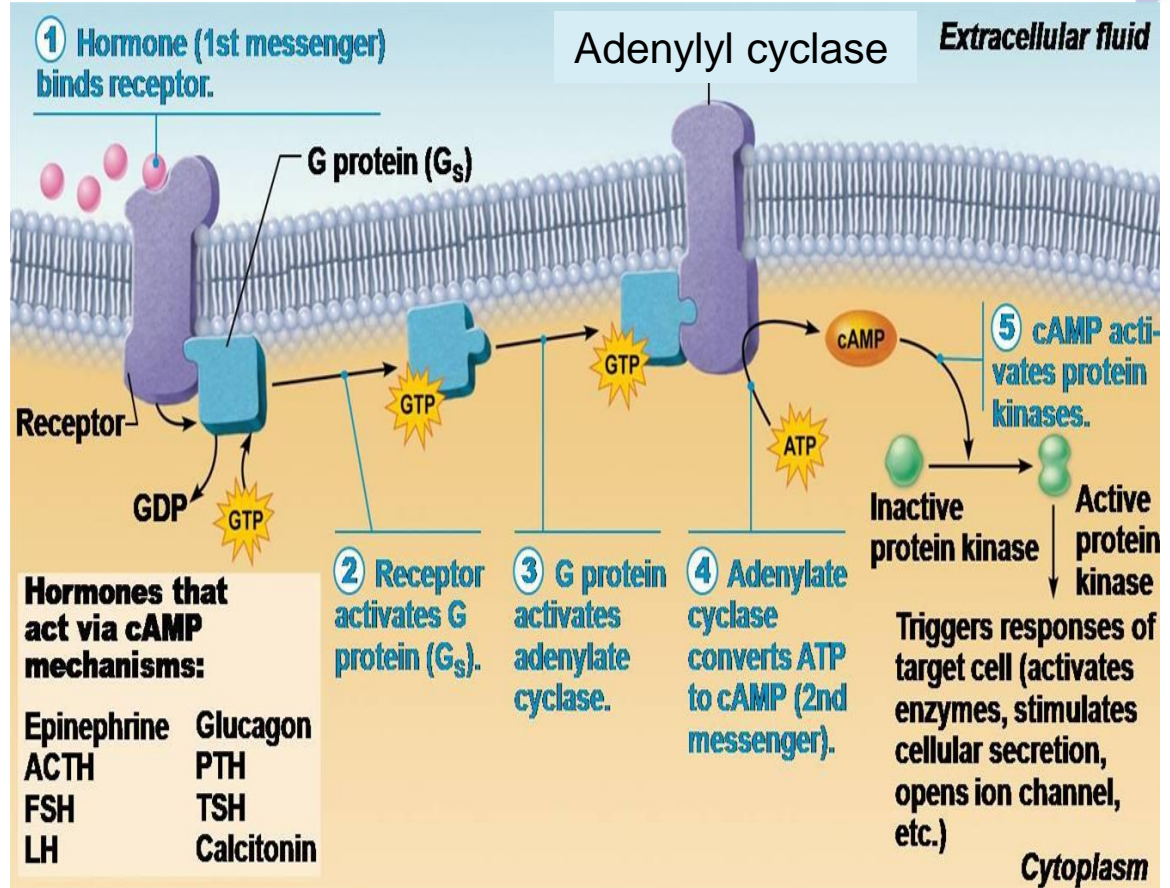
5) cAMP activates a variety of protein kinase in the cell.



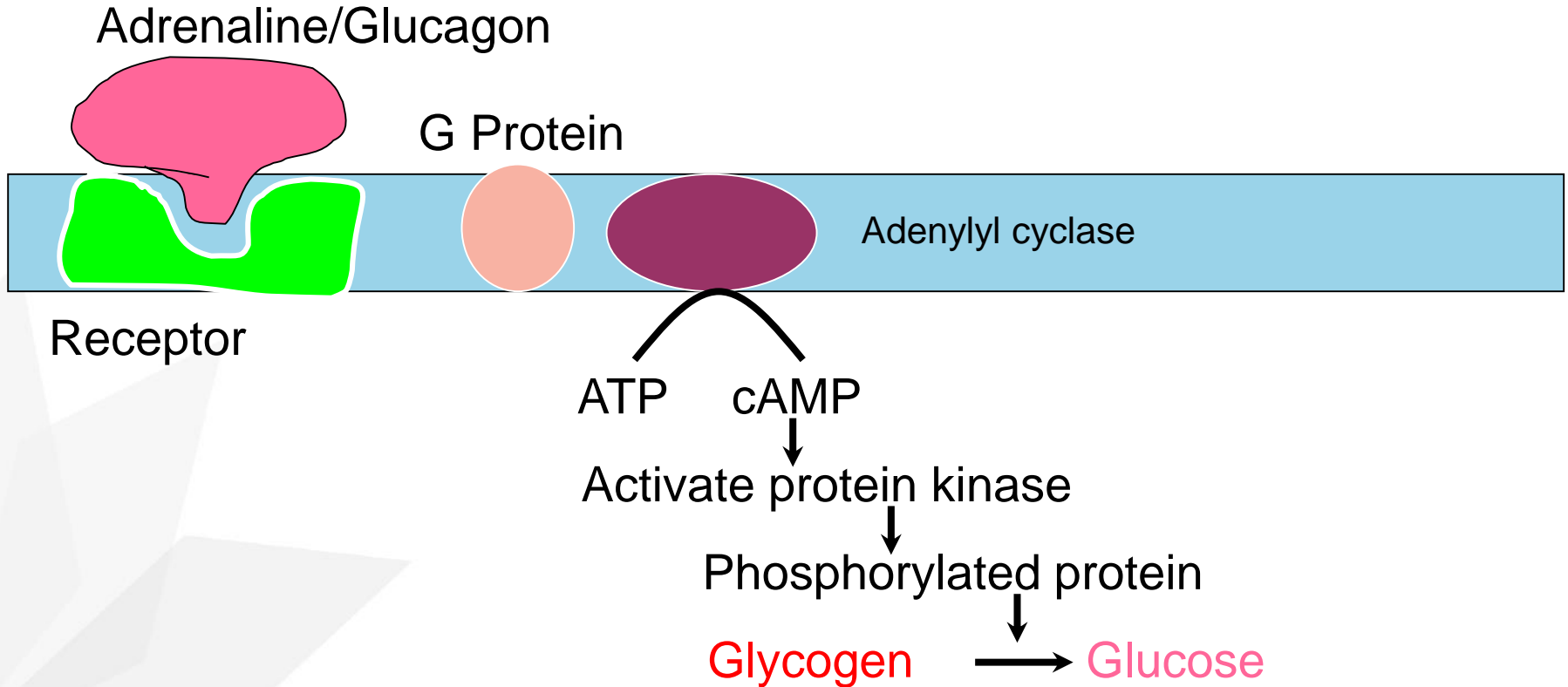
CYCLIC AMP ACTIVATION

6) Each type of protein kinase phosphorylated a specific protein.

7) Phosphorylated proteins trigger responses in target cells.
→ Alter the cellular activities.



CYCLIC AMP ACTIVATION



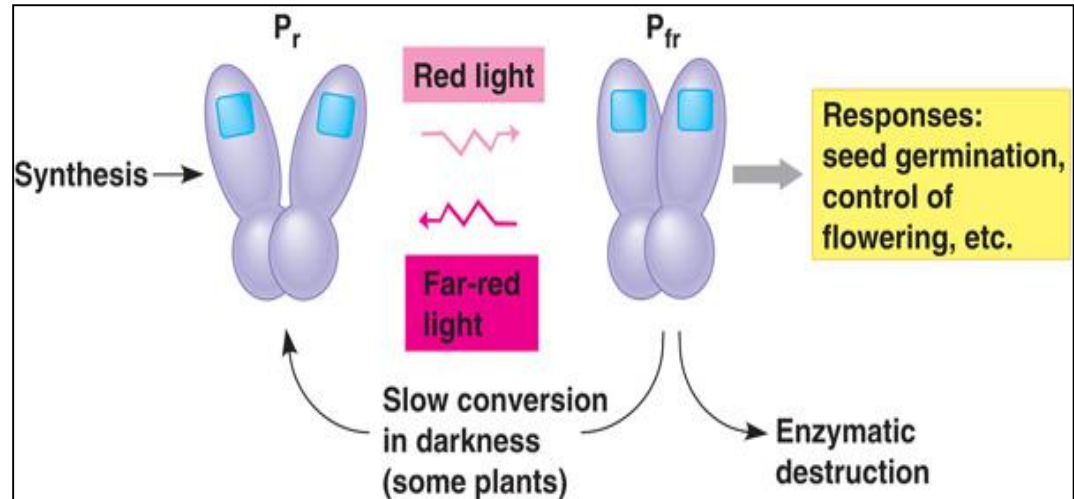
10.4 – Explain the role of phytochrome in the regulation of flowering

Phytochrome is a blue-green pigment existing in two interconvertible forms

PHYTOCHROME	
P_r	P_{fr}
Inactive form	Active form
Absorb red (R:660 nm) light from sunlight	Absorb far red (FR: 730 nm) light from sunlight

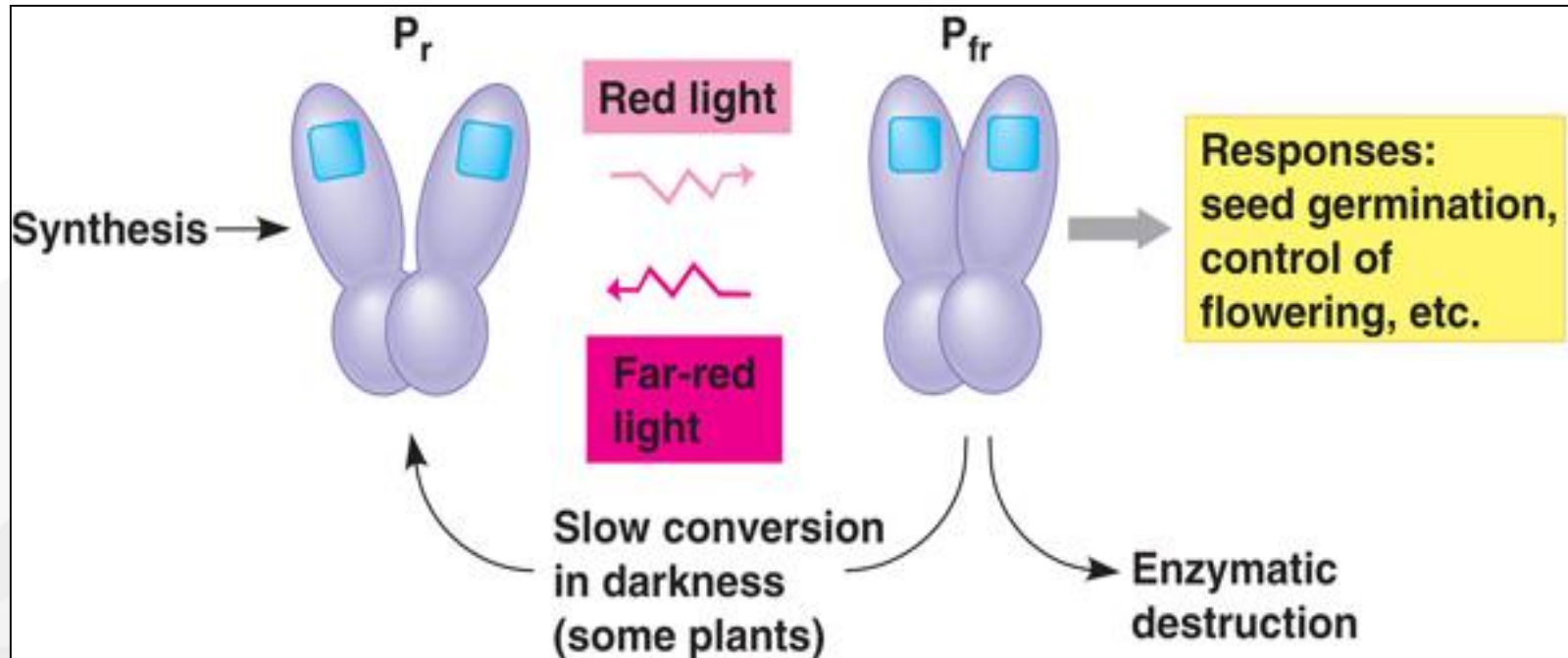
10.4 – Explain the role of phytochrome in the regulation of flowering

- Absorption of light by one form converts it rapidly and reversibly to the other form.
- Sunlight contains **more red light** than far-red light.
 - $P_r \rightarrow P_{fr}$
- During the night,
 - P_{fr} **slowly** $\rightarrow P_r$



10.4 – Explain the role of phytochrome in the regulation of flowering

- In most cases, it is the P_{fr} form of the pigment that switches on physiological and developmental responses in the plant.



PHOTOPERIODISM PHENOMENON

Plants are classified into 3 main groups based on their response to photoperiodism:



Short-day plants

Chrysanthemums,
Poinsettias,
Soybean.



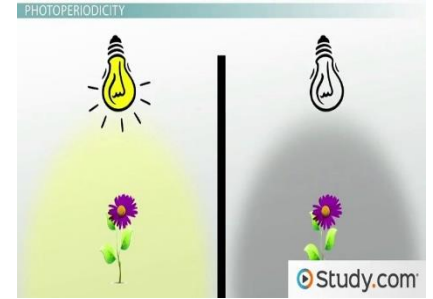
Long-day plants

Spinach, Iris,
Lettuce, radishes



Day-neutral plants

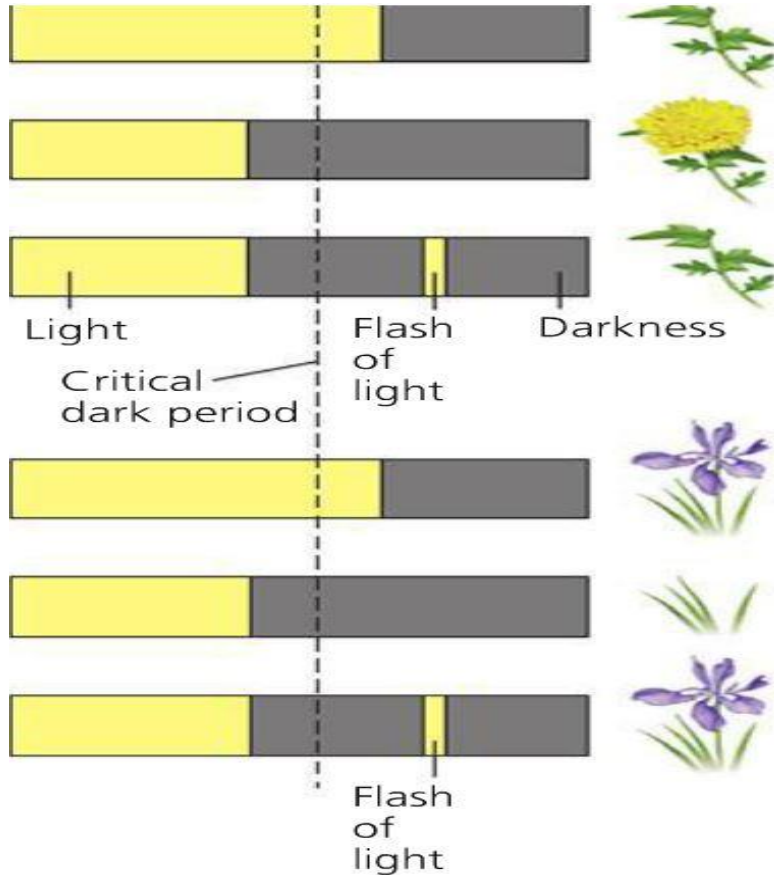
Tomatoes, Rice,
Dandelions.



MAIN GROUPS OF PLANT BASED ON RESPONSES TO PHOTOPERIODISM

	Short-Day plant	Long-Day plant	Day-Neutral plant
	Plants that flower <u>when the night length is equal to or greater than some critical length.</u>	Plants that flower <u>when the night length is equal to or less than some critical length.</u>	Plants that do not initiate flowering in response to the day length but flower in response to some other stimulus. <ul style="list-style-type: none"> - Unaffected by photoperiod. - Flower when they reach a certain stage of maturity. - Does not require a specific day length to flower.
E.g	Chrysanthemums, Poinsettias, Soybean.	Spinach, Iris, Lettuce, Radishes.	Tomatoes, Rice, Dandelions.

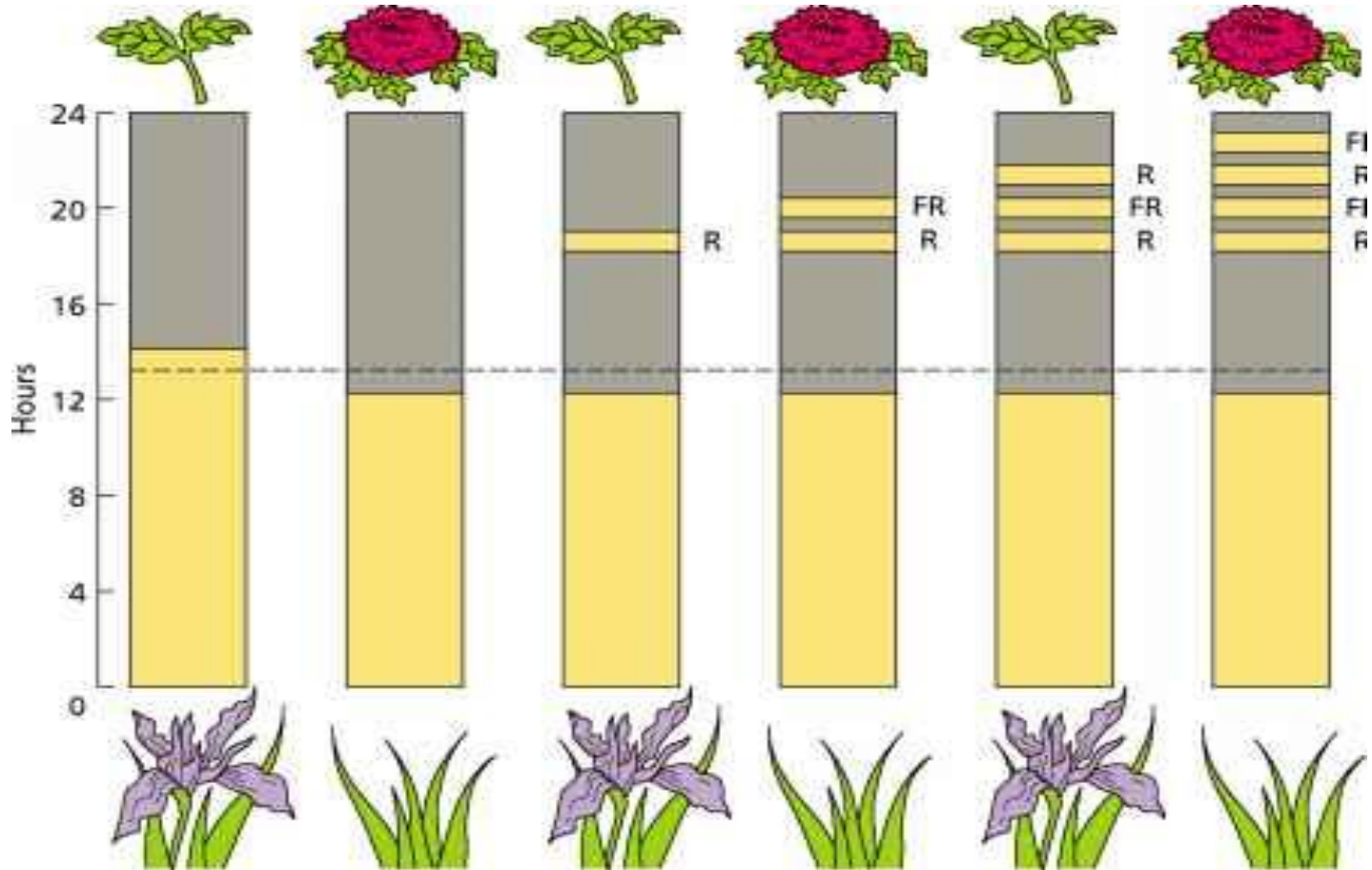
PHOTOPERIODISM PHENOMENON



(a) Short-day (long-night) plant. Flowers when night exceeds a critical dark period. A flash of light interrupting the dark period prevents flowering.

(b) Long-day (short-night) plant. Flowers only if the night is shorter than a critical dark period. A brief flash of light artificially interrupts a long dark period, thereby inducing flowering.

PHOTOPERIODISM PHENOMENON





Thank you



NEXT LECTURE 

IMMUNITY

